United States Department of Agriculture

Gibsonville Healthy Forest Restoration

Environmental Assessment

Forest Service Plumas National Forest Feather River Ranger District October 2017

For More Information Contact:

Daniel Lovato
Plumas Forest Supervisor
159 Lawrence Street
Quincy, CA 95971
Phone: 530 283-2050
Email: dalovato@fs.fed.us
Fax: 530 283-7746

In accordance with Federal civil rights law and U.S. Department of Agriculture (USDA) civil rights regulations and policies, the USDA, its Agencies, offices, and employees, and institutions participating in or administering USDA programs are prohibited from discriminating based on race, color, national origin, religion, sex, gender identity (including gender expression), sexual orientation, disability, age, marital status, family/parental status, income derived from a public assistance program, political beliefs, or reprisal or retaliation for prior civil rights activity, in any program or activity conducted or funded by USDA (not all bases apply to all programs). Remedies and complaint filing deadlines vary by program or incident.

Persons with disabilities who require alternative means of communication for program information (e.g., Braille, large print, audiotape, American Sign Language, etc.) should contact the responsible Agency or USDA's TARGET Center at (202) 720-2600 (voice and TTY) or contact USDA through the Federal Relay Service at (800) 877-8339. Additionally, program information may be made available in languages other than English.

To file a program discrimination complaint, complete the USDA Program Discrimination Complaint Form, AD-3027, found online at http://www.ascr.usda.gov/complaint_filing_cust.html and at any USDA office or write a letter addressed to USDA and provide in the letter all of the information requested in the form. To request a copy of the complaint form, call (866) 632-9992. Submit your completed form or letter to USDA by: (1) mail: U.S. Department of Agriculture, Office of the Assistant Secretary for Civil Rights, 1400 Independence Avenue, SW, Washington, D.C. 20250-9410; (2) fax: (202) 690-7442; or (3) email: program.intake@usda.gov.

USDA is an equal opportunity provider, employer and lender.

Introduction

We are proposing to reduce the risk of insect or disease infestation and wildfire, to protect, restore, and enhance forest ecosystem components, and to restore and protect historic properties on approximately 1,200 acres. These actions are proposed to be implemented on the Feather River Ranger District of the Plumas National Forest.

We prepared this environmental assessment (EA) to determine whether implementation of a combination of vegetation treatment activities and future maintenance involving the removal of excessive regrowth may significantly affect the quality of the human environment and thereby require the preparation of an environmental impact statement (EIS). By preparing this EA we are fulfilling agency policy and direction to comply with the National Environmental Policy Act (NEPA). For more details of the proposed action, see the Proposed Action and Alternatives section of this document.

Proposed Project Location

The project area is located approximately 6-8 miles northeast of La Porte, CA at elevations ranging between 5,200 and 6,400 feet, in and around the historic town site of Gibsonville (Figure 1). County Road 511 (Quincy-La Porte Road) traverses the project area. The legal description of the project area is portions of:

Mount Diablo Meridian, Sierra County, California,
T. 22 N., R 9 E., sections 25, 35 and 36; and
T. 22 N., R 10 E., sections 17, 19, 20, 29 and 30.

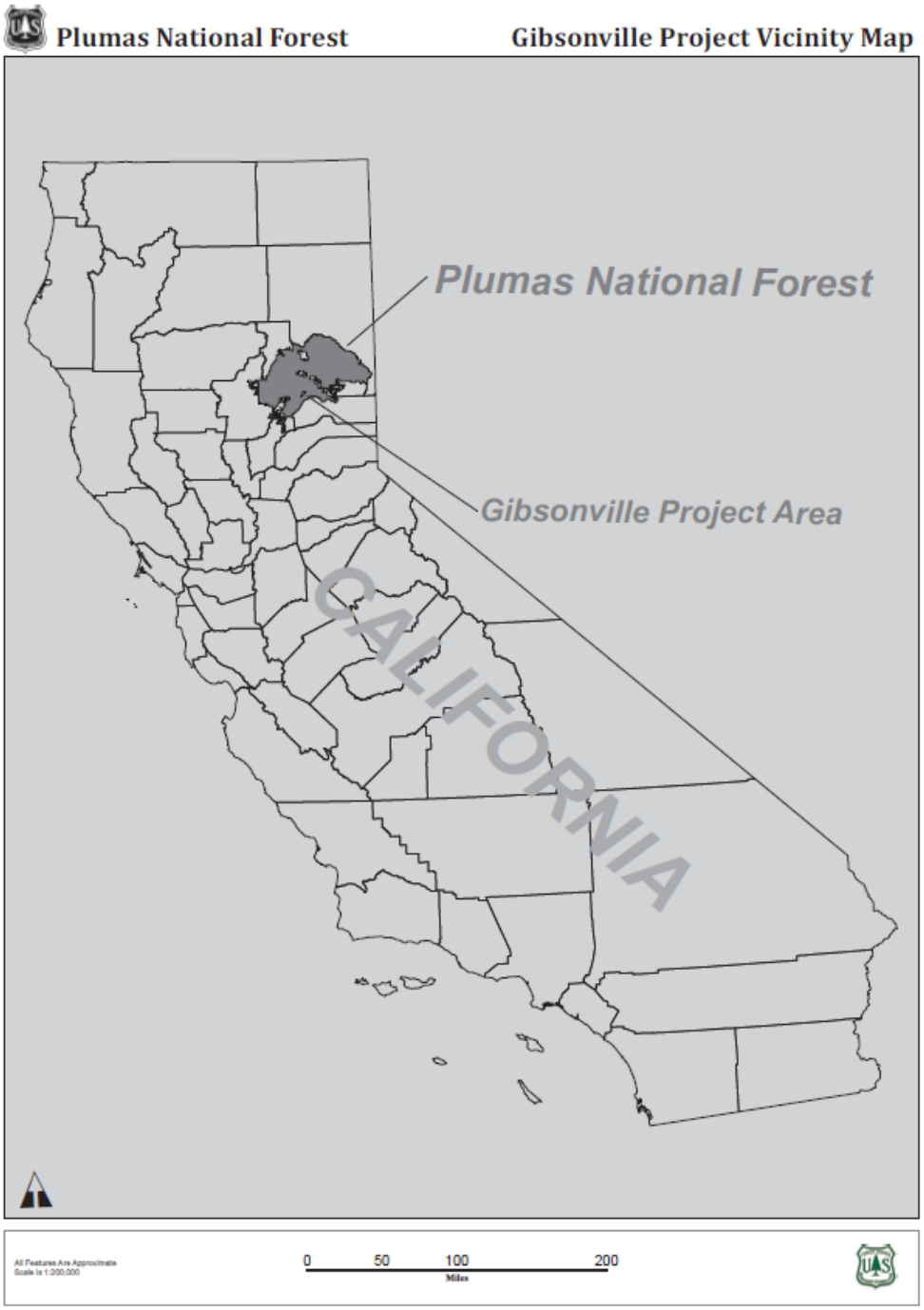
Need for the Proposal

Most of the area is comprised of Sierra mixed conifer consisting of white fir, sugar pine, ponderosa pine and incense cedar. Red fir is mixed with white fir and western white pine at the highest elevations. California black oak is mixed with conifers at lower elevations. Annual precipitation ranges between 60 and 80 inches. Many areas are densely stocked, mostly with white fir and contain evidence of elevated mortality levels during recent periods of drought including bark beetle activity in the form of standing and down dead trees and other insect and disease infestation (Cluck 2014).

Stands were inventoried in the summer of 2013 using the current common stand exam user's guide for the Pacific Southwest Region (USDA Forest Service 2008). For analysis purposes, the stand data was loaded in the Forest Vegetation Simulator, a forest growth model that predicts forest stand development (Dixon 2002). The model was used to quantify existing stand conditions of 760 trees per acre in small tree stands and 620 trees per acre in medium to large tree stands (USDA Forest Service 2016b).

In the absence of frequent understory fire, increases in stand density and tree competition have made many forests more susceptible to bark beetle attack. Reductions in stand density are the most effective treatment for reducing bark beetle-caused tree mortality. Increases in stand- and landscape-level heterogeneity may reduce the occurrence of high levels of bark beetle-caused tree mortality while maintaining endemic (low) levels (Fettig 2012).

Figure 1. Vicinity map



Stands with high densities also increase stresses on larger more desirable retention trees due to increased inter-tree competition for finite site resources – particularly water during extended drought periods – which is interconnected to increases in bark beetle populations and subsequent tree mortality. Therefore, maintaining trees in good health and vigor reduces the risk of high levels of mortality during years of low water supply. Approximately 344,000 dead trees were mapped on the Plumas National Forest in 2016. This is close to 6 times more than what would be considered normal background tree mortality (Cluck 2016).

High fuel loads, consisting of an abundance of dead-down trees and live and dead brush have put some stands at risk to increased fire behavior (Cluck 2014). Forest Vegetation Simulator modeling of existing surface and crown fuel conditions indicate flame lengths of 4.84 to 5.08 feet and fire types of conditional crown fire to active crown fire (USDA Forest Service 2017c).

The stands have high densities of trees, particularly in the 1-11 inches diameter class range, and most stands have moderate densities in the 11-24 inches range. These stands have high accumulations of ladder fuels and vertical continuity with the canopy fuels; in combination with the high surface fuel loads these stands are predicted to have increased susceptibility to higher fire intensity and subsequent tree mortality.

The town of Gibsonville was founded in the 1850's and lasted as a town into the early twentieth century (USDA Forest Service 2017b). Today this town is comprised of 74 archaeological features. The historic town site is still visited and is a popular place for dispersed camping. In recent years especially since 2013 the town of Gibsonville has been repeatedly vandalized and looted by unauthorized excavation. Features and artifact concentrations have been targeted resulting in removal of artifacts and destruction of intact archeological deposits. The persons conducting these actions are picking locations that are hidden due to vegetation.

Aspen forest types and health have declined in their extent compared to historic occurrences (Shepperd et al. 2006). An extensive study done by entomologist Daniel Cluck (2012) shows that 90 percent of aspen stands surveyed in the Sierras are being affected by conifer competition. Of that study, 100 percent of the aspen stands observed on the Plumas National Forest are being suppressed by conifer competition, leaving aspen populations in various states of decline.

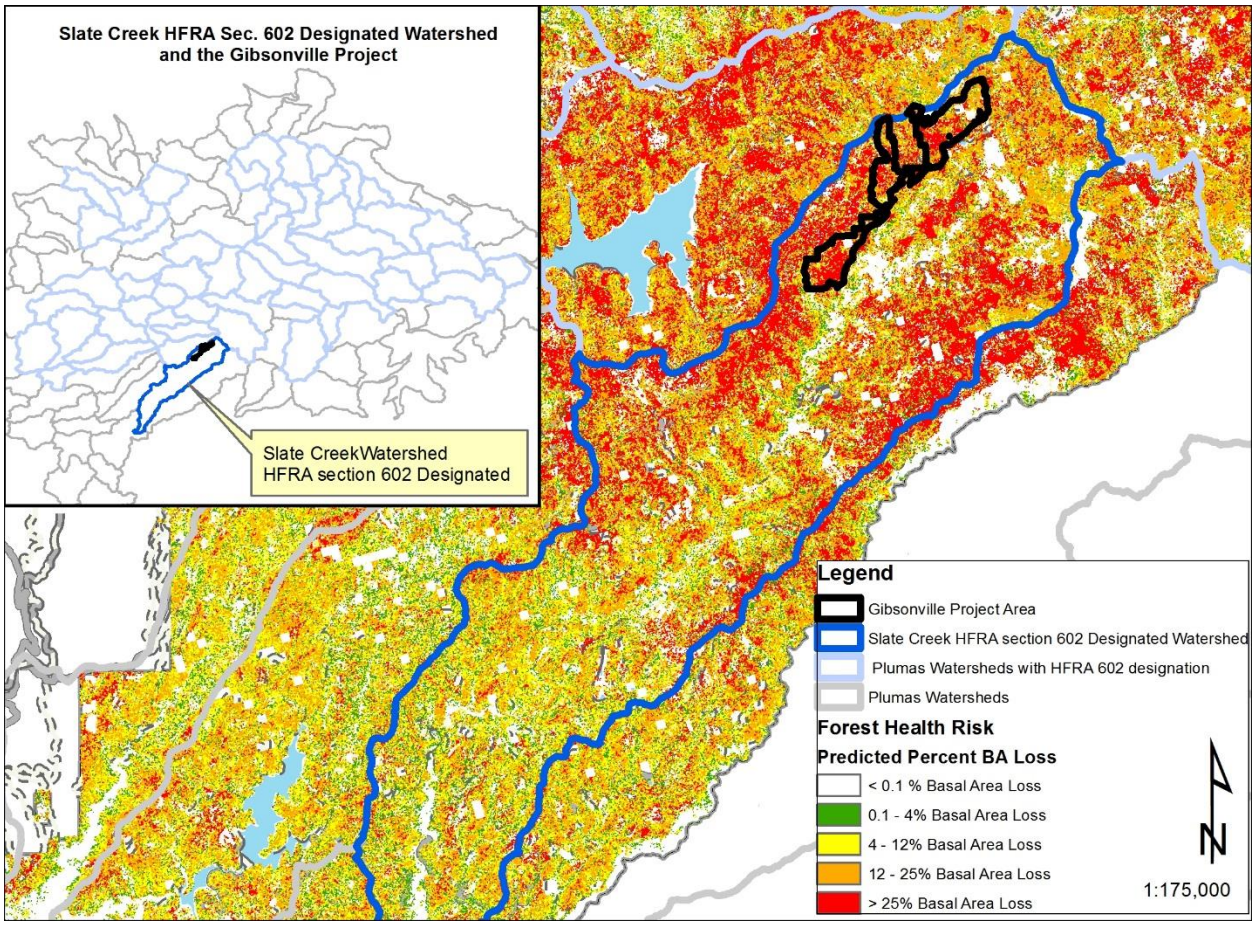
Due to lack of disturbance that would normally remove conifer ingrowth, aspen stands in the Gibsonville project area are being encroached by shade tolerant conifer species. Shading from competition leaves aspen vulnerable to disease and infection and inhibits successful growth and vitality of suckers as well as mature trees. Overtopping conifers in the area are changing hydrologic conditions into systems unfavorable for riparian vegetation, and are creating shaded conditions which slow aspen adult growth. Shade also inhibits successful aspen regeneration by limiting habitat for aspen suckers to grow and by suppressing auxin stimulation to cause suckering (Shepperd 2004). Aspen will sucker in small quantities in partial shade, however the survival of these suckers would be minimal since they cannot compete for canopy space when surrounded by taller conifers species. Maximum suckering requires full sunlight and warm soils (Shepperd et al. 2006). Removing conifer competition would meet the specific requirements needed to initiate aspen regeneration as well as provide an ideal microclimate for viable sucker growth (Doucet 1989; Navratil 1991).

Healthy streams and rare wet meadow plant communities are dependent on the natural balance of functioning hydrological processes featuring clean water and saturated soils. Meadow potential zones are areas that historically were open meadows, but due to the suppression of fire have been encroached upon by conifer trees. Removing conifer competition would meet requirements needed in order to improve and protect meadow habitats.

The Healthy Forest Restoration Act (HFRA) as amended, authorizes the Forest Service to implement hazardous fuel reduction projects to reduce wildfire risk to at-risk public lands; to reduce the risk or extent of, or increase the resilience to, insect or disease infestation; to enhance efforts to protect watersheds; and to protect, restore, and enhance forest ecosystem components, to promote the recovery of threatened and endangered species, improve biological diversity, and enhance productivity and carbon sequestration.

The 2014 Farm Bill amends Title VI of HFRA by adding section 602, Designation of Treatment Areas. Projects to address insect or disease infestation, carried out under this section shall be considered authorized hazardous fuel reduction projects for purposes of the authorities described in subsections (b), (c), and (d) of section 102, and sections 104, 105, and 106 of HFRA (2003). The project area lies wholly within lands designated by the Chief of the Forest Service, under Section 602 of the Healthy Forest Restoration Act in California (Figure 2).

Figure 2. Lands in California Designated Under Section 602.



Under authority of HFRA Section 102(b), projects shall be conducted consistent with the Plumas National Forest Land and Resource Management Plan (Forest Plan) and the Sierra Nevada Forest Plan Amendment (SNFPA). The agency will study, develop, and describe one additional action alternative, if the additional alternative meets the purpose and need of the project (HFRA Section 104). HFRA establishes a predecisional administrative review process (Section 105) and expeditious judicial review (Section 106).

Specific purposes of the project are to:

- Reduce the risk or extent of, or increase the resilience to, insect or disease infestation in the area (HFRA Section 602);
- Implement hazardous fuel reduction treatments to reduce wildfire risk (HFRA Section 102);
- Protect the historic Gibsonville town site (NHPA Section 110);

- Restore ecological integrity, including maintaining or restoring structure, function, composition, and connectivity (HFRA Section 602), by releasing aspen from conifer suppression, restoring meadow potential zones, and mitigating known and encountered non-native invasive plants;
- Manage roadside vegetation involving considerations such as motorist sight distance, clear visibility of road signs, and identification and mitigation of hazards (USDA Forest Service 2011); and
- Retain industry infrastructure by allowing more wood by-products to be generated from fuels treatments and dead and dying trees, thus providing a wood supply for local manufacturers and sustaining a part of the employment base in rural communities. In some cases, these wood by-products will also help to offset the cost of fuels treatments (USDA Forest Service 2004).

Public Involvement and Tribal Consultation

The Gibsonville Healthy Forest Restoration project has been listed on the Plumas National Forest schedule of proposed actions (SOPA) since October, 2015.

The Feather River Ranger District collaborates on Community Wildfire Protection Plans (CWPP) with county and local Fire Safe Councils (FSC) that occupy lands within and bordering the district.

On October 26, 2015 the Feather River Ranger District sent letters to Estom Yumeka Tribe of Enterprise Rancheria, Tyme Maidu Tribe of Berry Creek Rancheria, Concow Maidu Tribe of Mooretown Rancheria, and Mechoopda Indian Tribe of Chico Rancheria. On November 3, the tribal administrator of Estom Yumeka Tribe of Enterprise Rancheria responded that the proposed project is not within the aboriginal territory of the tribe.

Public scoping letters were sent by email and mail to 84 individuals, organizations, institutions, industry representatives, and government agencies on October 26, 2015.

The Forest Service published a legal notice asking for public input on the plan on November 3, 2015 in the Oroville Mercury-Register, the paper of record of the Feather River Ranger District.

The Forest Service received written comments from:

- USDA-NRCS, Plumas and Sierra Counties – Offer to collaborate
- Sierra Pacific Industries –In their letter, Sierra Pacific Industries (SPI) commented that the project should be economically feasible. The project must have enough volume and value to cover the cost of cutting, skidding, processing, and shipping to the conversion facility. If work such as hand thinning and piling, mastication, road construction or reconstruction, and/or restoration work, is to be completed, that work must also be covered by the value of the product.

No other issues were identified during public scoping.

On August 28, 2016 Forest and District staff hosted a field trip to the Gibsonville project area for industry representatives through the American Forest Resource Council. On September 22, 2016 Bill Wickman, AFRC Consultant for California sent a letter noting the need to “sustain existing infrastructure for the economic viability of implementing restoration projects”.

May 15, 2017, during objection resolution it was determined that the predicted product volume exceeded the District Ranger authority and lay with the Forest Supervisor. The District Ranger withdrew the draft Decision Notice.

May 16, 2017, the Forest Supervisor set aside the objections and announced plans to conduct a second public comment period and objection period in the near future after reviewing the project.

Proposed Action and Alternatives

The proposed action (Alternative B) and action alternative (Alternative C) were developed using management strategies set out in PSW-GTR-220 *An Ecosystem Management Strategy for Sierran Mixed-Conifer Forests*; PSW-GTR-237 *Managing Sierra Nevada Forests*; RMRS-GTR-292 *A Comprehensive Guide to Fuel Management Practices for Dry Mixed Conifer Forests in the Northwestern United States*; and RMRS-GTR-178 *Ecology, Biodiversity, Management, and Restoration of Aspen in the Sierra Nevada*. These technical reports summarize the best available science for managing Sierra Nevada mixed conifer forests.

Mechanical treatments use power tools or heavy equipment to remove or rearrange tree and shrub structures to reduce stand densities and reduce fire hazards. These treatments can cover numerous steps including: felling, cutting and spreading, skidding, and processing. Mechanical fuel treatments can alter or remove surface fuels, increase the height to the base of live crowns, and open canopy by removing trees.

Mixed-conifer forests under an active fire regime, had a naturally clumped distribution containing a variety of size and age classes (North et al. 2009). Variable density thinning (VDT), is a method of mechanical thinning of saw-timber sized trees (10 – 29.9 inches diameter base height (DBH)), using individual tree selection to increase within-stand variability while meeting needs to reduce stand densities. These prescriptions mimic naturally clumped distribution containing a variety of size and age classes.

In general, stem density and canopy cover would be highest in drainages and riparian areas, and then decrease over the midslope and become lowest near and on ridgetops. VDT focuses on retention of suitable structures for wildlife nest, den, and rest sites including large trees (> 30 inches DBH) and trees with broken tops, cavities, or platforms. Prescriptions that differ by species retain hardwoods, which are important for wildlife, and favor pines that can increase the forest's fire resilience. Thinning would focus predominantly on firs and incense-cedar.

Thinning from below is a method of mechanical thinning of saw-timber sized trees starting with removing small and medium sized trees first until a desired condition (trees per acre, height to base of live crowns, percent canopy cover) is reached, generally retaining the largest healthiest trees.

Individual tree selection would be used to mechanically thin vegetation between the 74 archaeological features and artifact concentrations located in the historic Gibsonville town site. Vegetation within the archaeological features would be removed by using equipment that fully suspends vegetation so that no ground disturbance will occur. Resulting biomass and slash would be removed to landing away from the archaeological features to be piled and burned. Fire would not be used inside the Gibsonville townsite.

Mechanical removal of conifers by prescription and individual leave tree selection would be used to release aspen stands. Select ponderosa and Jeffrey pine trees greater than 30 inches DBH would be retained for wildlife purposes, structure, and species diversity as well as retention of exceptionally large conifers for aesthetic value. Species such as lodgepole pine and white fir will not be retained because of their vigor in encroaching as well as the prolific seeding that is common for white fir. In some stands mechanical root separation will be used to provide hormonal stimulation to produce increased suckering. In other stands prescribed fire will be use to stimulate the same hormonal response. Post treatment monitoring will be used to assess sucker responses.

Mechanical removal of conifers by individual tree selection would be used within meadows and alder stands to restore function and release from encroachment.

Biomass removal (mechanical removal of trees 3.0 – 9.9 inches DBH) would be used to reduce stand densities resulting in reduced risks of insect and disease infestation, risk of wildfire, and other tree mortality events. In dense overstocked stands of small and medium trees within the project area the highest numbers of trees per acre fall into this size range as do many ladder fuels. Biomass removal allows the option for these trees to be sold for small log uses rather than be cut, piled, and burned on site.

Mastication is the rearrangement of woody shrubs and trees using mechanical ground-based equipment to grind harvest residue or thin small trees. Shrubs and trees less than 10 inches DBH can be masticated although most masticated trees would be less than 6 inches DBH. Mastication reduces stand densities and converts ladder fuels to surface fuels that biodegrade over a period of years.

As opposed to mechanical treatments, hand cutting removes shrubs and trees by manually cutting using chainsaws.

Hazard tree removal would abate trees deemed hazardous or dangerous based on Forest Service handbook standards for identifying such trees (USDA Forest Service 2011, Angwin et al. 2012). This would be done within 200 feet (generally two tree heights) from roads or structures.

Removal of shrubs and trees up to 10 inches DBH by manually cutting using chainsaws reduces stand densities and removes surface and ladder fuels from beneath overstory trees or thins aggregations of small-diameter conifers or plantation trees. The spacing of residual trees would be generally 18-24 feet to allow retention of the healthiest, largest, tallest and most desirable species of conifers and hardwoods to avoid creating openings where future regrowth would be likely. The cut trees, shrubs, and existing slash would be manually pile and burned.

In meadow units where hand cut pile burn is proposed, conifers up to 16 inches in DBH inside meadows and out to 75 feet from meadows edge will be felled. Conifers less than 10 inches in DBH will be piled and burned. Conifers between 10 to 16 inches in DBH will be lopped and scattered or simply felled. The objective of these treatments is to remove the seed source that is encroaching and enhance their health while making them more fire resilient.

The main effect of low-intensity prescribed fire on the ground is its reduction of natural and activity fuels, litter, shrub cover, and small trees. These reductions open growing space, provide a flush of soil nutrients, and increase the diversity of plants and invertebrates (Apigian et al. 2006, Knapp et al. 2007, Moghaddas and Stephens 2007, Murphy et al. 2006, Wayman and North 2007).

To prevent the spread of heterobasidion root disease, the use of sodium tetraborate decahydrate (a fungicide treatment such as Cellu-treat) is proposed for use in areas with evidence of root rot. Fungicide treatments would be applied to stumps of trees 14 inches in diameter and greater where they are within 200 feet of striking roads and other main travel routes. The application of fungicide would not be allowed within any riparian conservation areas or streamside management zones.

The project would be implemented as soon as is feasible after a decision is reached and should take one to three years to complete. Future maintenance involving the removal of excessive

regrowth, generally brush and small trees, (mastication, hand cutting, and or burning) in the project area would likely be necessary to retain the desired condition of this landscape and is considered in the scope of this project.

The project will not include the establishment of permanent roads. Additionally, temporary roads will be decommissioned no later than three years after the date the project is completed. Necessary maintenance and repair of existing permanent roads would occur. Improvements to permanent roads would include installing critical dips, rolling dips, and work to improve stream crossings.

Proposed Action – Alternative B

There is a need for ensuring the sustainability of the benefits provided by natural resources on NFS lands that support human wellbeing through the generation of income and employment opportunities for residents of the immediate area, and through production of goods (timber, biomass) and services in local and regional markets. Sustaining existing infrastructure ensures the economic viability of implementing restoration projects. Receipts from sale of forest products can provide partial funding for noncommercial thinning and burning of fuel treatments that are crucially needed but largely unfunded.

The Sierra Nevada Forest Plan Amendment (SNFPA) generally prohibits mechanical treatments in California spotted owl protected activity centers PACs when located outside of the wildland urban interface defense zone.

The following activities are proposed (Figure 3):

- Treat 202.0 acres by removing conifers less than 30 inches DBH by individual tree selection using a variable density thinning (VDT) as well as biomass conifers 3 inches to 9.9 inches DBH, resulting in densities of 74-122 trees per acre;
- Treat 59.8 acres by thinning from below conifers less than 30 inches DBH by individual tree selection as well as biomass conifer 3 inches to 9.9 inches DBH, resulting in densities of 122-186 trees per acre while retaining 50% or greater canopy cover;
- Treat approximately 41.3 acres of historic Gibsonville town site by removing hazard trees, conifers less than 30 inches DBH by individual tree selection as well as biomass and/or hand cut conifers 3 inches to 9.9 inches DBH to protect archeological features from looting, damage from standing dead tree fall, and wildfire;
- Treat 22.8 acres of aspen release by removing conifers by individual tree selection including saw logs 10 inches in diameter at breast height (DBH) and greater, as well as biomass conifers 3 inches to 9.9 inches DBH;
- Treat 24.7 acres of meadow, alder, and riparian restoration stands by removing conifers by individual tree selection within including saw logs 10 inches in diameter at breast height (DBH) up to 16 inches DBH, as well as biomass and/or hand cut conifers 3 inches to 9.9 inches DBH;
- Treat 171.1 acres by mastication or biomassing conifers up to 9.9 inches DBH, resulting in densities of 122-186 trees per acre;

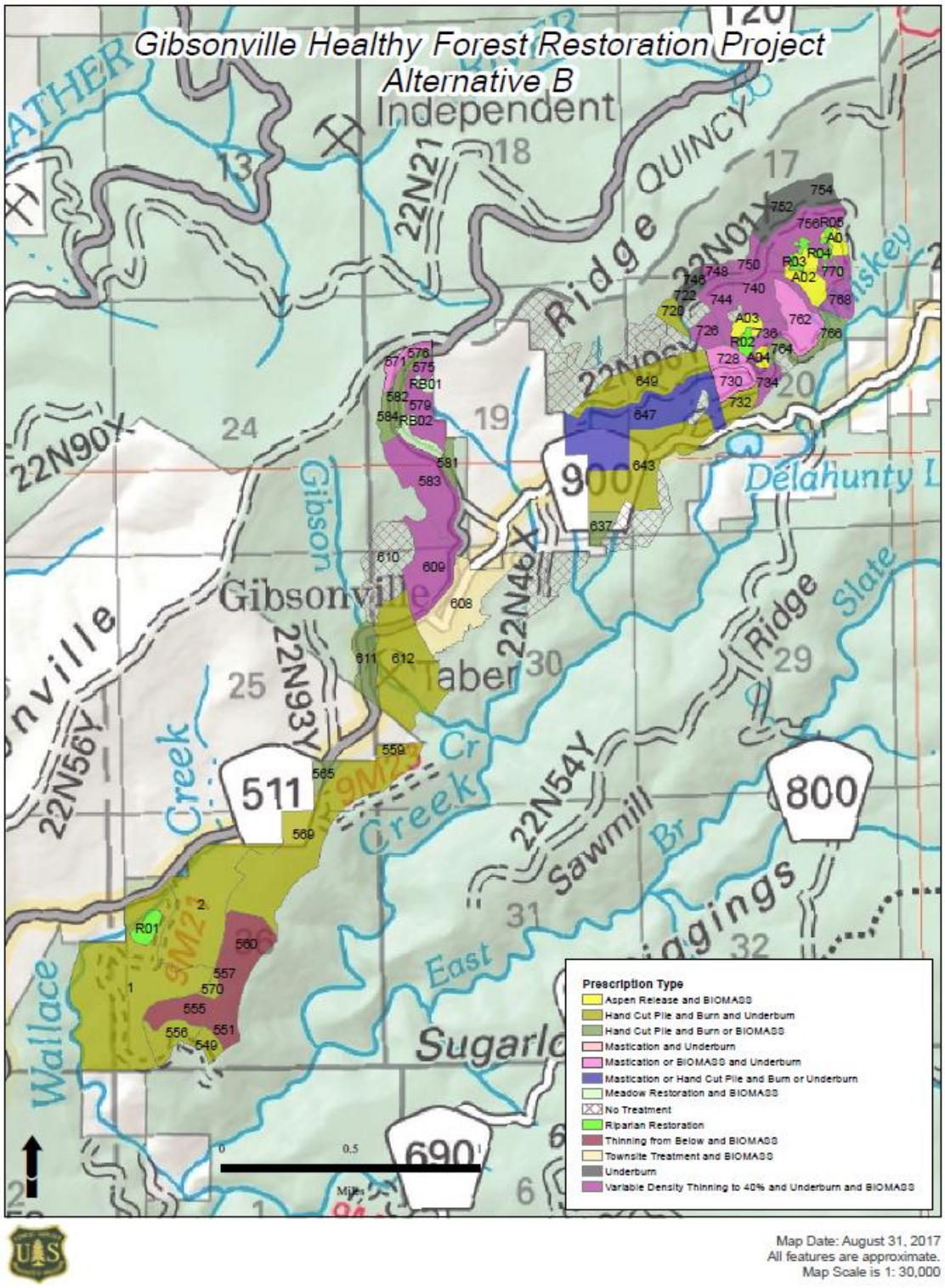


Figure 3. Project Area Map of Alternative B (the Proposed Action)

- Treating 472.8 acres by hand cutting, piling, and pile burning conifers up to 9.9 inches DBH, resulting in densities of 186-298 trees per acre;
- Treat 32.2 acres by underburn only;
- In 173.7 acres no treatment is proposed;
- Mitigate risk within 5.5 miles by removing hazard trees within 200 feet of roads and structures;
- Mitigate known and encountered non-native invasive plants throughout the project area by hand pulling and removing or burning;
- Commercial-sized timber resulting from the thinning would be offered for sale;
- Smaller material would be offered for sale as biomass, firewood or other small-log uses;
- Resulting slash and other woody debris would be piled and burned; and
- To maintain desired conditions these units need to have multiple entries over the next 15 to 20 years for hand thinning, mastication, and/or prescribed burning.

Alternative C: California Spotted Owl Interim Recommendations for Management

Significant challenges and uncertainty face the management of habitat to support viable populations of the California spotted owl – the risk of high intensity fire, loss of habitat from stand-replacing fire, impacts of mechanical treatments to habitat suitability, and declining populations.

Fuels reduction treatments are designed to reduce the surface (0-6”dbh) and ladder (10-16” dbh) fuels which if left in dense conditions lead to increased risk of catastrophic wildfires. These wildfires could pose a threat to California spotted owl habitat. Large scale changes in owl habitat as a result of past wildfires and anticipated future fires in spotted owl habitat has been identified as a potential threat affecting spotted owl distribution (USDI Fish and Wildlife Service 2005, USDI Fish and Wildlife Service 2006). Habitat effects from wildfires cannot be fully measured immediately following wildfire, because direct and indirect tree mortality may not become evident for several years. It is unknown, therefore, how much burning of PACs results in sufficient loss of live mature trees and changed stand structure to eliminate or significantly diminish habitat suitability for spotted owls.

Under the terms of the settlement agreement for the Sierra Nevada Forests Plan Amendment (SNFPA) litigation, we will include and analyze an alternative consistent with the *Draft Interim Recommendation for the Management of California Spotted Owl Habitat on National Forest System Lands 29 May 2015* (USDA Forest Service 2015).

Interim Recommendations (IR) for the California Spotted Owl (CSO) include a 300 acre Protected Activity Center (PAC), a 1,000 acre Territory (which includes the 300 acre PAC) and a 4,400 acre Home Range. This is similar to the current guidelines for the owl with the following changes (Table 3, USDA Forest Service 2015):

- The PAC is a minimum of 300 acres of high quality nesting and roosting habitat (≥ 70% canopy cover or best available) as close to the activity center as possible;

- The Territory is measured as a 0.7 mile radius circle (1,000 acres) around the activity center containing a minimum of 400 acres (including the PAC) of ≥ 70% canopy cover or best available plus at least 300 acres of suitable foraging habitat ≥ 50% canopy cover; and
- The remaining 300 Territory acres should represent fine-scale mosaic (gaps and patches of 0.03-2.0 acres) of low, moderate, and high canopy cover that create heterogeneous conditions, that are in turn conducive to supporting suitable foraging habitat and an abundance of prey.
- The remaining 300 acres of designated (≥ 50% canopy cover) habitat within the Home Range be located as close to the habitat within the Territory as possible.

The Gibsonville Project area overlaps with parts of four California spotted owl home ranges and two territories (as defined by the interim recommendations for management) including a large portion of one PAC (Figure 4). All habitat that is designated as meeting the minimum habitat requirements to support and owl territory are located on National Forest System lands (USDA Forest Service 2015).

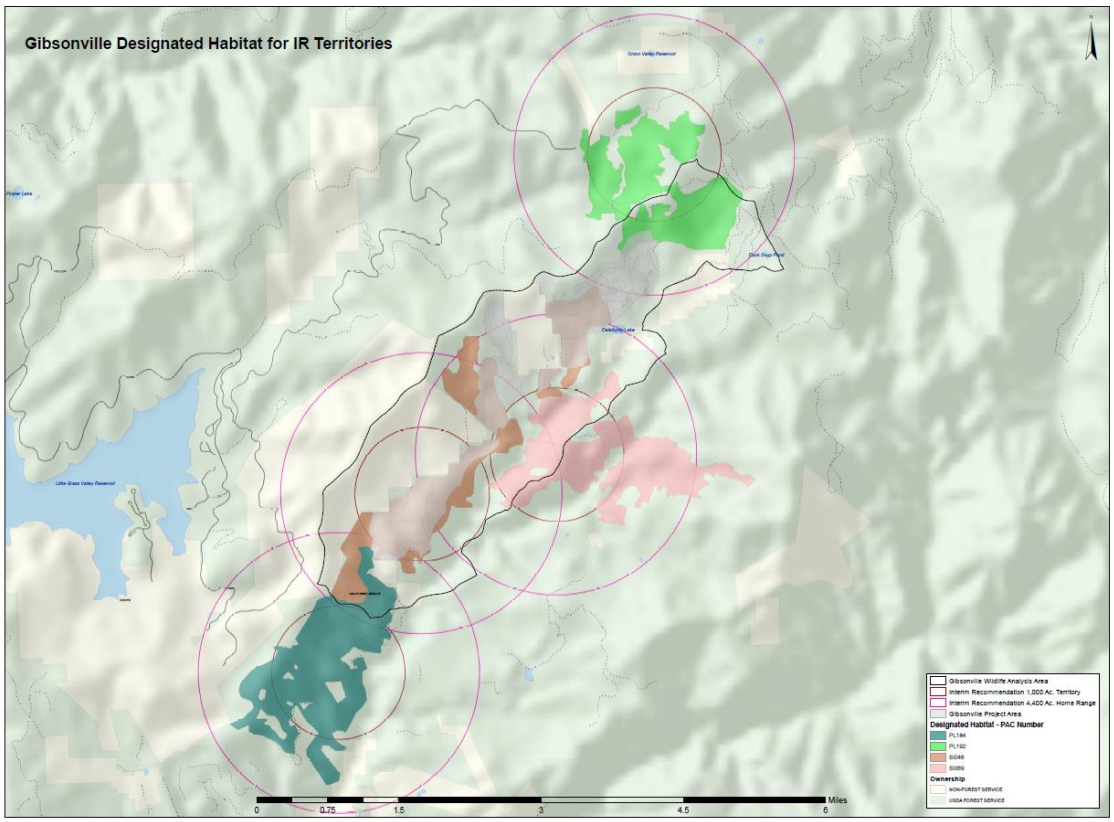


Figure 4. Designated Habitat for Interim Recommendations for CSO Management Territories

Fuel reduction treatments that are consistent with habitat enhancement are likely to be very modest (e.g., removal of smaller diameter trees in dense stands, prescribed fires), given that the highest priority for these acres in the short term is to maintain or enhance habitat quality for spotted owls (USDA Forest Service 2015, page 16). The interim recommendations include no mechanical treatment within the designated habitat acres unless it is intended to maintain or improve habitat conditions for the spotted owl in the short-term (1-5 years) (USDA Forest Service 2015, page 17).

The Gibsonville Project California spotted owl interim recommendations alternative (Alternative C) proposes to treat approximately 1,200 acres (Figure 5). Alternative C does not propose any mechanical treatments in California spotted owl designated habitat.

- Treat 202.0 acres by removing conifers less than 30 inches DBH by individual tree selection using a variable density thinning (VDT) as well as biomass conifers 3 inches to 9.9 inches DBH, resulting in densities of 74-122 trees per acre;

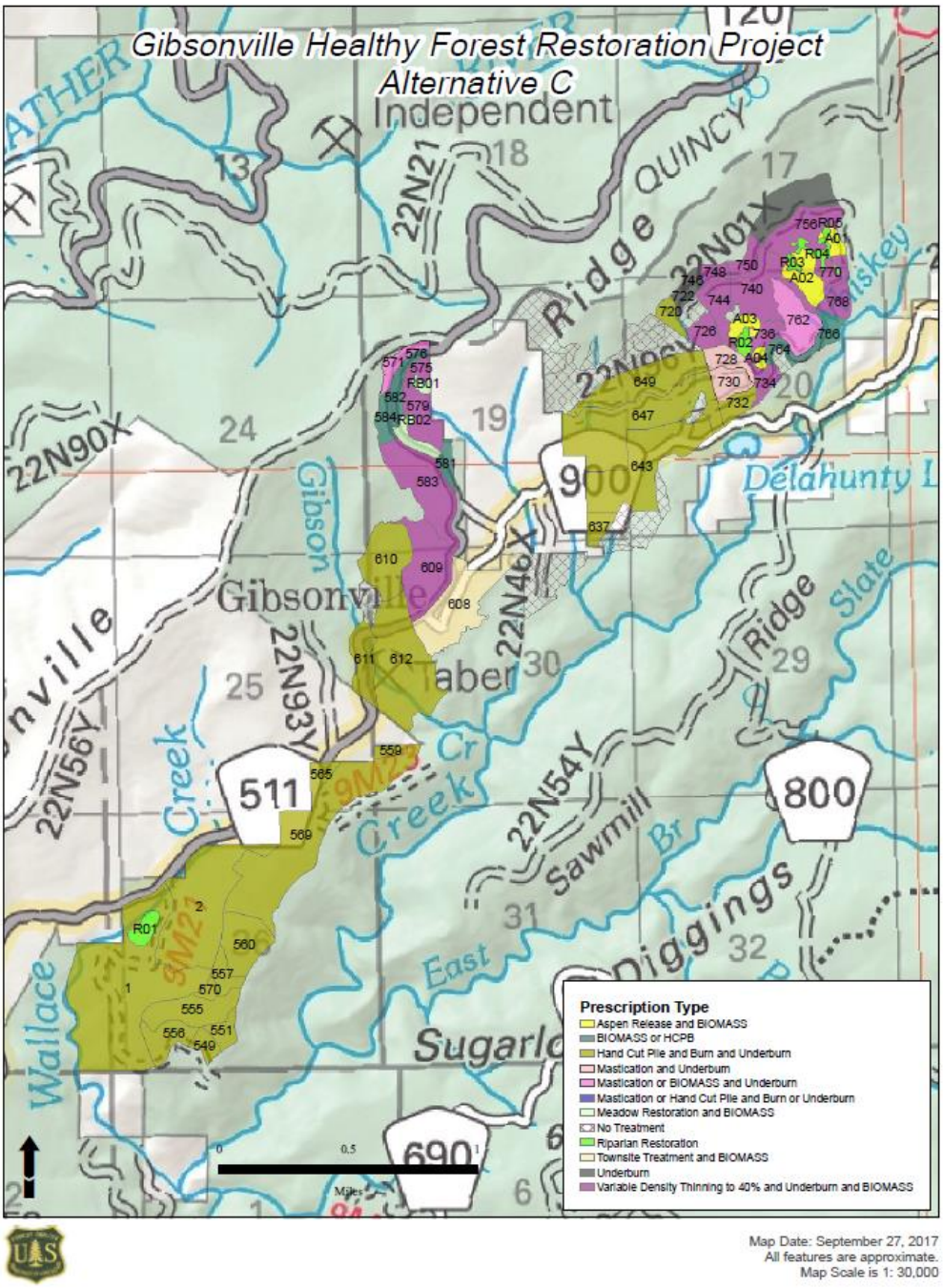


Figure 5. Project Area Map of the California Spotted Owl Interim Recommendations for Management Alternative

- Treat approximately 41.3 acres of historic Gibsonville town site by removing hazard trees, conifers less than 30 inches DBH by individual tree selection as well as biomass and/or hand cut conifers 3 inches to 9.9 inches DBH to protect archeological features from looting, damage from standing dead tree fall, and wildfire;
- Treat 22.8 acres of aspen release by removing conifers by individual tree selection including saw logs 10 inches in diameter at breast height (DBH) and greater, as well as biomass conifers 3 inches to 9.9 inches DBH;
- Treat 24.7 acres of meadow, alder, and riparian restoration stands by removing conifers by individual tree selection within including saw logs 10 inches in diameter at breast height (DBH) up to 16 inches DBH, as well as biomass and/or hand cut conifers 3 inches to 9.9 inches DBH;
- Treat 77.7 acres by mastication or biomassing conifers up to 9.9 inches DBH, resulting in densities of 122-186 trees per acre;
- Treating 653.7 acres by hand cutting, piling, and pile burning conifers up to 9.9 inches DBH, resulting in densities of 186-298 trees per acre;
- Treat 32.2 acres by underburn only;
- In 146.0 acres no treatment is proposed;
- Mitigate risk within 5.5 miles by removing hazard trees within 200 feet of roads and structures, hazard trees felled along approximately 1.75 miles of road within designated habitat would be left in place;
- Mitigate known and encountered non-native invasive plants throughout the project area by hand pulling and removing or burning;
- Commercial-sized timber resulting from the thinning would be offered for sale;
- Smaller material would be offered for sale as biomass, firewood or other small-log uses;
- Resulting slash and other woody debris would be piled and burned; and
- To maintain desired conditions these units need to have multiple entries over the next 15 to 20 years for hand thinning, mastication, and/or prescribed burning.

Table 1. Comparison of Treatment Activities and Sum of Acres Treated by Alternative

Treatment	**Sum of Acres**	
	Alternative B	Alternative C
Variable Density Thinning and Biomass and Underburn	202.0	202.0
Thinning from Below and Biomass and Underburn	59.8	0
Townsite Treatment and Biomass and/or hand-cut (no burning)	41.3	41.3
Aspen Release and Biomass	22.8	22.8
Meadow, Alder, and Riparian Restoration	24.7	24.7
Mastication or Biomass	171.1	77.7
Hand Cutting, Piling, and Pile Burning and Underburn	472.8	653.7
Prescribed Fire (Underburning) Only	32.2	32.2
No Treatment	173.7	146.0
Grand Total	1,200.4	1,200.4

Environmental Impacts of the Proposed Action and Alternative

This section summarizes the potential impacts of the proposed action and alternative for each impacted resource. These resources identified no issues for further impact and the resource report is incorporated by reference: Air Quality (USDA Forest Service 2016a), Botany (USDA Forest Service 2016g), Hydrology (USDA Forest Service 2016d), Soils (USDA Forest Service 2016e), Minerals (USDA Forest Service 2016c), Recreation & Scenery (USDA Forest Service 2017a).

Aquatic Species

The Sierra Nevada yellow-legged frog (SNYLF) is listed as endangered by the U.S. Fish and Wildlife Service (USFWS) and USFWS has designated critical habitat for the species (USDI Fish and Wildlife Service 2008, USDI Fish and Wildlife Service 2016). The results of surveys and habitat analysis suggest there is potentially suitable habitat to support individuals if not a population, however no SNYLF have been found within the project area. A detailed description of potential habitat in the project area can be found in the Gibsonville Healthy Forest Restoration Project: Biological Assessment for Threatened, Endangered, and Proposed Aquatic Species and Biological Evaluation for Forest Service Sensitive Aquatic Species (USDA Forest Service 2016f).

Direct and indirect effects of both Alternative B and Alternative C are expected to be minimal, if at all, with full application of all USFWS conservation measures and Forest Service design features. However, effects to individuals are possible due to proposed non-mechanical treatments within suitable habitat within 82 feet of perennial and intermittent streams.

All treatments from either action alternative would benefit habitat in the short- and long-term. Habitat improvement activities such as removing encroaching conifers from meadows and aspen stands which could be lost due to conifer conversion, or reducing surface and ladder fuels which could lead to habitat loss due to high intensity and severity wildfires.

Not performing treatments would decrease the opportunities for opening up overcrowded areas with dense surface and ladder fuels, thereby leaving existing fuel-loadings which could lead to high intensity and severity wildfires, and not increasing water availability to creeks. This would be an adverse effect to frogs and their habitat.

Economics

The management of natural resources on the Plumas National Forest (PNF) has the potential to affect local economies. People and economies are an important part of the ecosystem. For example use of resources on the national forests generate employment and income in the surrounding communities and counties, and generates revenues returned to the Federal treasury or used to fund additional on-the-ground activities to accomplish resource management objectives. Logging companies contracted to harvest timber will likely employ local workers and provide a source of income. Merchantable timber could serve as an important input to production for local mills or generate investment in new infrastructure. These activities may also generate additional economic stimulus through expenditures made by the contracted companies for work associated and not associated with the timber sale, but covered under this Environmental Assessment.

During the scoping period for this project multiple comments were received from industry touching on subjects such as project feasibility, socio-economic benefits, supply of timber to the local industry, contract provisions, product specifications, and varying treatment types. Contract

provisions are in place to provide resource protection and adherence to best management practices (BMPs). Most are standard in Forest Service contracts and will not be changed. As long as requirements for resource protection are met, no restrictions are made on type of equipment used to get the work done.

To understand the potential impact of proposed land management practices, it is important to grasp the relative size of the timber industry, its components, and how these have changed over time. Some important issues to consider are whether a proposed management action would stimulate growth or decline in the industry. In some geographies the timber industry can be a significant driver in the economy. If it is, other sectors of the economy, as well as total employment and total personal income, will likely follow trends in the timber industry. It is important to know whether this is the case because if employment in other sectors fluctuate with the timber industry, then management actions on public lands may affect more than the timber industry itself. If, on the other hand, jobs in the rest of the economy are growing independent of trends in the timber industry, then management actions that potentially affect the timber industry may have impacts that are limited to that industry. The former has proven to be true in the analysis area for the proposed action. From 1998 to 2013, timber employment shrank from 620 to 461 jobs, a 25.6 percent decrease. At the same time non-timber employment shrank from 3,831 to 3,134 jobs, an 18.2 percent decrease (Economic Profile System 2017).

Environmental Consequences

Methodology

This economic analysis focuses on those revenues and treatment costs associated with implementing forest health activities and fuel reduction treatments in the Gibsonville Healthy Forest Restoration Project area. The purpose of this economic analysis is to present the potential revenues and costs associated with each of the alternatives for comparison purposes. This analysis does not include monetary values assigned to resource outputs such as wildlife, watersheds, soils, recreation, visual quality, or fisheries. It is intended only as a relative measure of differences between alternatives based on direct costs and values used.

Revenue Cost Analysis: The project is self-sufficient if the timber value is close to or exceeds the project costs. If the analysis indicates that the project costs far exceed the revenues, the project may need to be modified. There is increased risk that the project may not be implemented, or may require large amounts of supplemental funding. The amount of timber harvested is a critical component of the analysis. This is expressed in terms of volume and the unit of measure used for this analysis is thousand board foot (MBF). Costs or values associated with the timber harvest are expressed in terms of dollars per MBF of sawtimber ($/MBF). For example, the base rate value for this sale is $6.00/MBF for red fir and white fir, $10.00/MBF for Ponderosa pine and sugar pine, and $10.00/MBF for Incense cedar.

Economic Impacts (Jobs and labor income): Employment opportunities can have direct, indirect, or induced effects on the local economy. Direct effects are associated with the primary producer. For example, the manufacturing of lumber from the Gibsonville Healthy Forest Restoration Project would have a direct effect on employment opportunities. Indirect effects account for employment in service industries that serve the lumber manufacturer. These industries may include logging, trucking, and fuel suppliers. Induced effects are driven by wages, and are circulated through the local economy for food, housing, transportation, and other living expenses. The sum of direct, indirect, and induced effects is the total economic impact in terms of jobs and monetary outputs. This report assumes that 10 – 15 direct jobs are created per million board feet of timber harvested. The restoration and fuel work would support additional direct and indirect

employment. There are an additional estimated 1.4 indirect jobs for every full time field job. All jobs are equivalent to year-around employment.

Action Alternatives: Alternative B (Proposed Action) and Alternative C

Revenue Cost Analysis: The analysis (table 2) was based on the Region 5 sale feasibility analysis spreadsheet, which is a residual value timber appraisal. This approach takes into account stump-to-mill costs, other logging costs, and non-harvest project costs. The volume of timber harvested is directly related to the number of acres harvested and the treatments proposed in each cutting unit.

Table 2. Revenue Cost Analysis Report

	Alt B (Proposed Action)		Alt C (Owl Action)		Difference
	Volume mbf	Value $	Volume mbf	Value $	$ +/-
Timber value	3,703	944,064	2,932	745,756	-198,308
Total harvest cost		-429,457		-343,252	+86,205
Net harvest value		514,607		402,503	-112,104
Total Non-harvest cost (service work)		-583,300		-680,875	-97,575
Revenue Versus Cost		-68,693		-278,372	-209,679

Economic Impacts (Jobs and Labor Income) The analysis calculated the jobs and labor income associated with the processing of timber products harvested and conducting required design criteria, as well as all project activities. If the Alternative B is implemented an estimated 84 new full time jobs would be available during the projects lifetime. Assuming an average income of $43,000 the total employee-related income entering the local economy would be $3,599,005. Under Alternative C an estimated 79 jobs would be produced with $3,381,468 entering the economy. This assumes all work items will be performed under each action, but since the projects are higher costs than revenues, some jobs may be lost due to the dropping of service work.

No-action would result in a negative effect on the local industries that depend on service contracts or a steady supply of timber, as well as counties that use timber yield taxes to fund county programs. Local industries would have notably reduced opportunities related to forest management activities such as timber harvesting and forest health projects. Additionally, the local economy would not receive benefits from associated employment, such as in food, lodging, and transportation businesses. The unemployment rate could potentially stay constant through the year, at double the national unemployment rate. The income loss for families would trickle through the local economy affecting many of the local industries in a negative way.

Fire and Fuels

Environmental Indicators and Measures

The Measurement indicators for potential treatment effects on potential fire behavior and severity include flame length, fire type, and canopy base height.

Flame length (feet): The length of flame measured in feet. Increased flame lengths can increase fire intensity and likelihood of torching events and crown fires. Flame length is influenced in part by fuel type and weather conditions. The upper limit for direct action taken by hand crews is generally considered to be 4 feet, and 6 feet is considered the upper limit for direct action by mechanized equipment (dozers). Flame lengths in excess of these limits usually result in indirect action taken to contain the fire. Desired flame length post treatment is 4 feet or less.

Fire type (surface, passive crown, or active crown fires): Fire type is described in four ways. The first type is a surface fire, which burns only the fuels at or near the surface without torching the trees above. This is the desired condition. The second type is the passive crown fire, which torches out individual or small groups of trees as the surface fuels burning under them provide the convective heat to ignite the above-ground fuels. The third is the active crown fire in which fire is spread from tree to tree in conjunction with the convective heat of the surface fuels burning under them. The fourth is the independent or running crown fire. This is a very rare occurrence in which the fire is spread from tree to tree independent of the burning surface fuels. This type of crown fire requires extreme weather conditions and contiguous canopy.

Canopy base height (feet): For the purpose of this analysis, canopy base height is the lowest height above the ground at which there is sufficient canopy fuel to propagate fire vertically through the canopy (Scott and Reinhardt 2001). Desired canopy base heights are greater than 15 feet.

Table 3. Effects analysis of fire and fuels indicators and measures by prescription

Prescription	Treatment Type	Flame Lengths (feet)	Fire Type	Canopy Base Height (feet)
Variable Density Thinning	No Treatment	4.85	Conditional Crown Fire	27.33
	Thin and biomass and underburn	2.94	Surface Fire	54.29
Townsite Treatment (no burning)	No Treatment	4.85	Conditional Crown Fire	27.33
	Thin and biomass to landings	2.94	Surface Fire	69.90
Thinning from Below	No Treatment	4.85	Conditional Crown Fire	27.33
	Thin and biomass and underburn	3.41	Surface Fire	44.71
Masticate or Biomass and Underburn	No Treatment	4.84	Active Crown Fire	19.50
	Biomass and UB	3.51	Surface Fire	33.00
	Masticate and UB	2.82	Surface Fire	54.00
Hand Cut Pile Burn and Underburn	No Treatment	4.82	Conditional Crown Fire	16.83
	Hand Cut Pile Burn and Underburn	3.93	Surface Fire	56.25
Prescribed Fire	No Treatment	3.88	Surface Fire	73.00
	Underburning Only	1.14	Surface Fire	73.00

The effects of all treatment prescriptions (except no treatment) is to achieve desired conditions for fire behavior. The combined effects of fuels treatments (e.g. thin and biomass and underburn, hand cut pile burn and underburn) have the greatest effect on fire behavior. Strategic location of treatments increase the likelihood that wildland fires occurring in the treatment units would be successfully suppressed by initial attack and provides safer space for fire suppression resources.

The cumulative effects of past management practices, and fire exclusion have largely shaped the forest that exists in the project area today. These factors have influenced vast areas of the Sierra Nevada mountain range and are well documented in the scientific literature. These activities along with other project activities across the district will help reintroduce fire into the ecosystem.

Heritage

This work would follow the approved standard protection measures (Appendix E, 1.2 and 2.0) of the *Programmatic Agreement among the USDA Forest Service, Pacific Southwest Region (Region 5), the California State Historic Preservation Officer, the Nevada State Historic Preservation Officer, and the Advisory Council on Historic Preservation Regarding Processes for Compliance with Section 106 of the National Historic Preservation Act for Management of Historic Properties by the National Forest of the Pacific Southwest Region* (Regional PA 2013).

Under either alternative the direct effects to the archaeological site will be the same. Vegetation will be thinned to create an open forest so that it is possible to see across the site. Since the people performing the looting at Gibsonville appear to be targeting locations they believe they will not be seen it is believed that increased visibility across the site will lead to a decrease in unauthorized excavation. After completion of the project the site will be monitored to measure its effectiveness to detour looting. Monitoring will be carried out at minimum once a year.

Another effect will be the removal of standing dead trees which pose a hazard to visitors and people camping on the site. The controlled felling of the standing dead trees will have less impact on the archaeological deposits of Gibsonville than if the trees were allowed to naturally fall. Controlled falling will directionally fall the trees away from archaeological features to prevent damage. When trees fall naturally the root-ball of the tree can be pulled out of the ground, pulling with it artifacts out of their associated deposit and damaging features; controlled falling of the standing dead trees will prevent this from happening.

Studies have shown that fire can damage cultural resources; obsidian artifacts can lose hydration rings and can even melt, bone and wood artifacts can burn, glass and ceramic artifacts can explode or melt, metal artifacts can melt or fall apart (Solomon 2000, Solomon 2002). The reduction of fuel loads on and around the archaeological site of Gibsonville will have a positive effect for archaeological resources through a reduced risk of high intensity wildfire.

Under either alternative the cultural resources of Gibsonville will move towards the desired condition of reduced damage due to looting, standing dead tree fall, and wildfire. Also the public safety will be increased for visitors to the site by removal of standing dead trees.

Safety

There are approximately 5.5 miles of roads in the Gibsonville project area accessible to the public and forest workers. These individuals are at risk from dead and dying trees located along roads, because they deteriorate, become unstable, and eventually fall. Falling trees may hit individuals, their cars, or trap people in the area. In addition to roadside hazards, dead trees pose hazards to hikers, hunters, other recreationists, loggers, slash crews, and workers conducting future prescribed burns or other projects. There is also the risk to heritage resources as discussed above in that section.

In both alternatives danger to the public would be reduced along roads by felling hazard trees. Of the approximate 5.5 miles of roads about 1.75 miles are within California spotted owl designated habitat. In Alternative C, trees inside designated habitat would be felled to abate hazards and left on the ground. All other merchantable hazard trees would still be removed for commercial value.

In both action alternatives the risk is abated. In Alternative B more value is captured as revenues to accomplish other service work. Otherwise in Alternative C these trees would contribute to project costs as additional service items in the contract.

In Alternative C, some felled hazard trees would contribute to increase large down wood, contributing to wildlife habitat values. These same trees contribute to surface fuel loads and their location along roadsides would continue to increase risk to firefighter safety during direct attack.

Silviculture

Environmental Indicators and Measures

Environmental indicators and measures are used to describe the effects of the action alternatives on the vegetative resource. Environmental indicators that will be analyzed in this section are:

1) Stand density metrics, including trees per acre, basal area, and stand density index, and relative density, are well established indicators of forest health and forest stand resilience to insects, disease, and drought (Fettig et al 2007).

2) Trees per acre, tree size and species, and canopy cover by diameter size class serve as useful metrics to measure fire resistant stand structure at the stand and landscape level. These metrics are the basis for quantifying landscape structure (i.e., California Wildlife Habitat Relationship (CWHR) vegetation types, size classes, and density classes) and landscape diversity. California Wildlife Habitat Relationship (CWHR) classifies existing vegetation types important to wildlife. The CWHR system has three elements: major tree-dominated vegetation associations (see Table 4), tree size, and canopy cover

    a) Size class: 3 – pole-sized tree (6-11” dbh), 4 – small tree (11-24” dbh), 5 – medium/large tree (> 24” dbh).

    b) Density class: S – sparse (10-24%), P – open (25-39%), M – moderate (40-60%), D – dense (> 60%).

Affected Environment

Currently, shade-tolerant species dominate most of the analysis area stands; however conditions range stand by stand which have varying levels of shade-tolerant versus shade-intolerant species. Those stands on lower elevation south and west facing slopes have greater amounts of shade-intolerant species, yet many mixed species stands have very high proportions of shade-tolerant species. Currently, shade-tolerant species including white fir, red fir, and incense cedar account for 91 to 97 percent of tree species present in project area stands. Desired shade-intolerant tree species such as black oak, ponderosa pine, Jeffrey pine, and sugar pine only account for 3 to 9 percent of the trees species present in project area stands.

Elevation affects the forest types that are present. The forest types in the analysis area range from ponderosa pine and Sierra mixed conifers at lower elevations to true fir (white and red fir) at higher elevations (Table 4).

There are fewer large (greater than 30 inches DBH) Jeffrey pines, sugar pines, and Douglas-fir trees as a result of past harvesting. Mortality of sugar pine from white pine blister rust (*Cronartium ribicola*) has also contributed to reduced numbers of these species, especially the smaller trees. Past disturbance has favored germination of new shrub, hardwood, and conifer seedlings and, along with fire exclusion, a higher density of small, mostly shade-tolerant trees (incense-cedar, red fir, and white fir) in the understory.

Table 4. Description of forest types found in the project area.

Forest Type	Major Species	Other Species Present
Ponderosa pine (PPN)	Ponderosa pine (*Pinus ponderosa*)	Incense-cedar (*Calocedrus decurrens*), Douglas-fir (*Pseudotsuga menziesii),* and sugar pine (*Pinus lambertiana*)
Sierran mixed conifer (SMC)	Jeffrey pine (*Pinus jeffreyi*), sugar pine, incense-cedar, *and* white fir (*Abies concolor*)	Douglas-fir and black oak (*Quercus kelloggi*)
True fir (WFR, RFR)	White fir and red fir (*Abies magnifica*)	Incense-cedar, Douglas-fir, sugar pine, and black oak

The typical mixed conifer type includes shade-tolerant species that can germinate and grow in the shade of the overstory trees. Without any disturbance, these shade-tolerant species can develop into multiple layers of vegetation or ladder fuels. When low-severity fires are allowed to burn through these stands at frequent intervals (every 5 to 15 years), shade-tolerant vegetation can be kept below the lower reaches of the overstory foliage, preventing the development of a fuel ladder

Forest Health

Tree mortality is a natural ongoing occurrence in forest ecosystems and insects and disease have contributed to vegetation composition in the analysis area. Insects will remain at endemic levels as long as precipitation levels are near or above normal. However, when precipitation is below normal for several consecutive years, trees become moisture-stressed and susceptible to insect attacks. Due to the interaction of past management activities (such as fire exclusion, unnaturally high stocking levels of shade-tolerant species, and drought) as well as climate change trends, populations of insects and disease increase beyond endemic levels associated with forest health.

Stands with high densities also increase stresses on larger more desirable retention trees due to increased inter-tree competition for finite site resources – particularly water during extended drought periods – which is interconnected to increases in bark beetle populations and subsequent tree mortality. Therefore, maintaining trees in good health and vigor reduces the risk of high levels of mortality during years of low water supply. Approximately 344,000 dead trees were mapped on the Plumas National Forest in 2016. This is close to 6 times more than what would be considered normal background tree mortality (Cluck 2016).

Bark beetles and defoliators are the primary insects of concern found in the analysis area and are associated primarily with ponderosa and Jeffrey pines and true fir. A forest health field evaluation conducted in the summer of 2013 observed the following insects within and adjacent to the Gibsonville Project area: fir engraver bark beetle (*Scolytus ventralis*), mountain pine beetle (*Dendroctonus ponderosae),* Douglas-fir tussock moth (O*rgyia pseudotsugata*), and the white fir sawfly (*Neodiprion abietis*) (Cluck 2014).

Ponderosa and Jeffrey pines are susceptible to the mountain pine beetle (*Dendroctonus ponderosae),* and *Ips* species. The mountain pine beetle is the most aggressive and contributes to direct tree mortality, particularly in moisture-stressed trees within high-density stands where density driven competition is greatest. The primary prevention measure for this species is to maintain healthy vigorous trees in low stand densities where competition for water, light, and nutrients is minimized. The *Ips* species breed in activity slash and may grow beyond endemic

levels in areas where logging slash is not properly treated. When populations build to sufficient numbers, the *Ips* beetle can attack mature trees.

The fir engraver bark beetle (*Scolytus ventralis*), also occurs within the analysis area. The fir engraver bark beetle attacks true fir species and is associated with direct and indirect tree mortality, in combination with drought and disease occurrences in high-density stands (Ferrell 1996).

Defoliators like the Douglas-fir tussock moth (O*rgyia pseudotsugata*) and the white fir sawfly (*Neodiprion abietis*) has caused moderate to high levels of white fir defoliation within and adjacent to the project area. The Douglas-fir tussock moth is an important defoliator of true firs, primarily white fir. Defoliation by the tussock moth kills or top-kills many trees, weakens additional trees that can be eventually killed by bark beetles, and may retard tree growth for several years. The white fir sawfly is also a defoliator of white fir. White fir sawfly outbreaks are usually short in duration due to natural causes.

Although diseased trees are found throughout the project area, they are most common in overcrowded stands. A forest health field evaluation conducted in the summer of 2013 observed the following diseases within and adjacent to the Gibsonville Project area: fir type Heterobasidion (*Heterobasidion occidentale)* root disease, white pine blister rust (*Cronartium ribicola*), red fir dwarf mistletoe (*Arceuthobium abietinum* f. sp. *magnificae*.), and Cytospora canker *(Cytospora abietis)* (Cluck 2014).

Heterobasidion root disease is known to occur throughout the forests of northern California and southern Oregon (Schmitt et al. 2000). Overcrowded stands containing a large percentage of white fir almost always contain some amount of Heterobasidion root disease, which decays tree roots. When the roots die faster than they can regenerate, the tree will fall over or die. Incense-cedar, ponderosa pine, and sugar pine are resistant to the strain that infects white and red fir. Historically, the forest contained more of these resistant species.

White pine blister rust is present in the project area. This disease is specific to the five-needle pines like sugar and western white pine. Infections are scattered throughout the area and occur in all tree diameter sizes. This disease has killed some younger trees, and older infected trees show reduced growth and vigor.

Dwarf mistletoe is also present in these forest types. Dwarf mistletoes are parasitic, flowering plants that can only survive on living conifers. Tree growth and vigor are reduced on infected trees with moderate to high dwarf mistletoe ratings.

Cytospora canker has also been observed in trees infected with dwarf mistletoe. Cytospora canker is a damaging, canker-inducing fungus that commonly occurs on true firs. Cytospora canker is a weak parasite that attacks trees that have been debilitated by other disease-causing agents, drought, fire, insects, and human activities.

Alternative B (Proposed Action) – Direct and Indirect Effects

Mechanical thinning

Variable density thinning would remove poor vigor, diseased, and damaged trees. In addition, thinning the suppressed, intermediate, and codominant tree classes would reduce stand densities and promote the growth and vigor of codominant and dominant conifers—that is, the older, mature, larger trees would be retained longer in the overstory. Stand health would be improved,

and individual tree mortality would be reduced. The overstocked stands or aggregations within stands would be thinned in order to reduce stress due to inter-tree competition. Stand growth and vigor would be maintained or improved, making stands and aggregations less susceptible to insect attacks (Koehler et al. 1978; DeMars and Roettgering 1982, Fettig et al. 2007).

Insect risk thinning guidelines for the Plumas NF state that the Westside zone should be thinned to 200 square feet of basal area now and then let the stand grow to 260 square feet per acre (400 stand density index) in 20 years (Landrum 2004). As can be seen from Tables 2 and 3, variable density thinning to canopy covers ranging between 30-50% with an treatment unit average effectively reduces stocking (in terms of trees per acre) and density (in terms of relative density) closer to desired levels for forest health. However, prescriptions that retain more canopy cover (50% canopy cover and greater) continue to leave forested stands overstocked and subject to potential insect and disease attacks and subsequent mortality and higher fire risk.

This alternative would meet the requirements of the 2004 SNFPA ROD pages 50-51 (USDA 2004) with regards to retaining 30 percent of the existing basal area for CWHR 4 stands (Table 5) and 40 percent of existing basal area for CWHR 5 stands (Table 6).

Hand cutting and hand piling

Thinning (hand cutting) would occur in pole size (CWHR 3) to large tree size (CWHR 4 & 5) stands and would re-arrange brush and conifer tree ladder fuels less than 10 inches in diameter. Post-treatment residual conifer tree spacing would range from 18 to 22 feet, on average. Trees per acre and basal area per acre would be reduced as well.

Hand thinning would reduce the number of trees per acre in the suppressed and intermediate diameter classes. The removal of small tress (less than 10 inches dbh) however, does not reduce the density effectively enough and stands may still be vulnerable to “density induced mortality” as indicated by relative densities greater than 55-60%.

Table 5. After thinning stand attributes for CWHR 4D/M Stands for various residual canopy cover.

CWHR 4D/M	After Thin Stand Attributes						
	Canopy Cover (%)	Trees Per Acre	Basal Area (Sq. Ft.)	Basal Area Retained (%)	Stand Density Index (SDI)	Max SDI	% of Max SDI
Existing	52%	760	335	NA	598	818	73%
30% CC (Along Roads)	34%	53	213	63%	253	813	31%
40% CC (Stand Average)	40%	91	249	71%	311	814	38%
50% CC (Away from roads)	47%	122	299	85%	389	815	48%
60% CC	51%	186	324	83%	446	815	55%

No Treatment

Problems with diseases (dwarf mistletoe, stem rot, blister rusts), insects (bark beetles), and damage (broken tops, basal wounds) have been observed in ponderosa pine, sugar pine, incense-cedar, Douglas-fir, and white fir trees within the project area.

Table 6. After thinning stand attributes for CWHR 5D/M Stands for various residual canopy cover.

CWHR 5D/M	After Thin Stand Attributes						
	Canopy Cover (%)	Trees Per Acre	Basal Area (Sq. Ft.)	Basal Area Retained (%)	Stand Density Index (SDI)	Max SDI	% of Max SDI
Existing	55%	620	348	NA	615	792	78%
30% CC (Along Roads)	32%	52	193	55%	238	793	30%
40% CC (Stand Average)	40%	74	246	71%	312	791	39%
50% CC (Away from roads)	50%	113	315	90%	416	792	53%
60% CC	55%	298	348	100%	532	792	67%

In no treatment stands, existing conditions would persist and develop unaltered by active management, with the exception of continued fire suppression activities. Wildfire, drought, disease, and insect-related mortality and recruitment would continue to occur. Table 7 displays the stand attributes by CWHR size and density classes. Stands would remain dense, particularly in the smaller diameter classes in terms of trees per acre, basal area and stand density index.

Table 7. Stand attributes by CWHR size and density classes before thinning.

CWHR Size & Density Classes	Before Thin Stand Attributes					
	Canopy Cover (%)	Trees per Acre	Basal Area (Sq. Ft.)	Stand Density Index (SDI)	Max SDI	% of Max SDI
4D/M	52	760	335	598	818	73%
5D/M	55	620	348	615	792	77%

Oliver (1995) observed that northern California even-aged ponderosa pine stands whose densities exceeded Sartwell's (1971) basal area threshold of 150 square feet per acre were susceptible to *Dendroctonus* bark beetle attack. The basal area threshold for western Sierra Nevada mixed conifer is 200 square feet per acre (Landram 2004). The stands that are over this basal area threshold and which contain pine species within these stands are at elevated risk of bark beetle mortality (Fiddler et al. 1989; Oliver 1995). True fir species (white and red fir) may exist at higher stand densities. However, at high stand densities, root disease and drought increase the susceptibility of true fir species to mortality caused by the Scolytus fir-engraver beetle (Oliver and Larson 1996; Guarin and Taylor 2005; Ferrell 1996; Macomber and Woodcock 1994).

These high tree densities would persist without treatment, thereby reducing growth rates and tree vigor, and increasing risk of mortality due to inter-tree competition and increased incidence of insect activity (Ferrell 1996; Oliver and Larson 1996; Oliver 1995). High densities of small trees may cause competition for soil moisture and nutrients, which could contribute to increased stress on larger, older trees (Dolph et al. 1995).

These areas would continue to be at a high risk for insect and disease infestations as stand growth and vigor continue to decline. As Ferrell (1996) summarizes: "Currently, Sierra Nevada forests have high levels of mortality caused by bark beetles infesting trees stressed by drought, fire, overly dense stands, and pathogens. Fuel loads and fire hazard are high …Mitigative restoration

requires thinning overly dense stands, primarily by controlled burning in parks and wilderness areas, combined with mechanical thinning and other selective tree-cutting practices elsewhere..."

Dwarf mistletoe-infested trees in the overstory would continue to infect understory trees and adjacent stands. The rate of spread of dwarf mistletoe would be more rapid through a multistoried stand with many horizontal layers of foliage than through a single-storied stand (Parmeter 1978; Hadfield and Russell 1978). Stand health would continue to decline in overstocked aggregations of trees within moderately stocked and densely stocked stands, eventually resulting in individual tree mortality. Mortality would increase the fuel loading, but endemic mortality would keep a continuous supply of dead trees for wildlife foraging and nesting.

The increasing stand density and consequent mortality due to inter-tree competition and increased incidence of insect activity may have a major adverse effect on forest health by decreasing tree vigor and growth; increasing susceptibility to insects, disease, and drought; and increasing susceptibility to intense fire behavior. The resulting stand structure would be characterized by a dense understory and mid-story with interlocking crowns.

Alternative C – Direct and Indirect Effects

Mechanical thinning

Alternative C would have similar, but less affect to forest health and stand attributes (i.e., basal area, trees per acre) as the proposed action due to the reduction in scale (acres). This alternative would treat 59.8 fewer acres (5 percent of the total project acres) by thinning from below (Table 8). Pre-commercial thinning (thinning only trees less than 10" DBH) alone would not be as effective in reducing overall basal area and trees per acre when compared to commercial thinning (trees greater than 10" DBH). This alternative would also treat 93.4 fewer acres (7.8 percent of the total project acres) by biomassing or mastication.

Table 8. Comparison of treatment acres by alternative.

Treatment	Alternative B (Acres)	Alternative C (Acres)	Difference (Acres)
Variable Density Thinning and Biomass and Underburn	202.0	202.0	0
Thinning from Below and Biomass and Underburn	59.8	0	-59.8
Townsite Treatment and Biomass and/or hand-cut	41.3	41.3	0
Aspen Release and Biomass	22.8	22.8	0
Meadow, Alder, and Riparian Restoration	24.7	24.7	0
Mastication or Biomass	171.1	77.7	-93.4
Hand Cutting, Piling, and Pile Burning and Underburn	472.8	653.7	+180.9
Prescribed Fire (Underburning) Only	32.2	32.2	0
No Treatment	173.7	146.0	-27.7
Grand Total	1,200.4	1,200.4	0

Hand cutting, and hand piling

This alternative would have affects to forest health similar to the proposed action. This alternative would treat an additional 180.9 acres (15.1 percent of the total project acres) under hand cutting and piling than the other (Table 8). This is the most expensive treatment prescription per acre; averaging about double the price per acre for mastication.

No treatment

This alternative would have similar affects to forest health as the proposed action. This alternative would leave 27.7 fewer acres (2.3 percent of the total project acres) untreated (Table 8).

Fire Resistant & Resilient Structure

Existing conditions of forested stands within the project area range depending on factors such as ownership, past management activities, and CWHR size class and density. In general, forested stands proposed for thinning treatments within the project area are primarily CWHR 4 and CWHR 5 size class stands. The average existing conditions in terms of trees per acre and canopy cover percent by CWHR diameter classes are shown in Table 9.

Stand Structure (diameter class distribution): The stands have high densities of trees, particularly in trees less than 24 inches in diameter. These stands have high accumulations of ladder fuels and vertical continuity with the canopy fuels; in combination with the high surface fuel loads these stands are predicted to have increased susceptibility to higher fire intensity and subsequent tree mortality. These high stand densities also increase stress on larger more desirable retention trees due to increased tree competition for water during extended drought periods.

Table 9. Existing stand structure for CWHR 4D/M and 5D/M stands by trees per acre and canopy cover percent.

CLASS CWHR	Trees per acre stand structure by DBH size classes for CWHR 4D/M and 5D/M stands					
	0-6”	6-11”	11-24”	24-30”	>30”	Total
4D/M	630	41	50	15	24	760
5D/M	470	44	68	18	19	620
CLASS CWHR	**Canopy Cover stand structure by DBH size classes for CWHR 4D/M and 5D/M stands**					
	0-6”	6-11”	11-24”	24-30”	>30”	Total
4D/M	14	9	19	11	26	52
5D/M	14	9	25	13	22	55

Note: Sums of canopy cover by size do not sum to “Total” because of overlapping canopy.

The existing stand structure based upon canopy cover and trees per acre promotes a low light environment, favoring the regeneration, growth, and development of shade-tolerant species such as white fir and incense-cedar. Lack of disturbance, such as frequent low severity fire, has contributed to a species composition shift from shade intolerant species (such as pine species, black oak, and aspen) to shade tolerant species (most notably white fir). Species composition conversion to white fir may increase vulnerability of stands to higher severity stand replacing fire events (Collins and Stephens 2010), contributes to conditions wherein there is little opportunity for shade intolerant species to reestablish and regenerate, consequently reduces species extent and

diversity of fire adapted shade intolerant species (McKelvey and Johnston 1992, McKelvey et al. 1996) thereby reducing landscape level diversity and heterogeneity which contributes to fire resilience (Millar et al. 2007, Collins and Stephens 2010).

Landscape Structure: As a result of past management activities described above, conditions across the Sierra Nevada have been described as "generally younger, denser, smaller in diameter, and more homogeneous" (McKelvey et al. 1996); this condition is typical of forests in the analysis area. Such conditions are best characterized by California Wildlife Habitat Relationship (CWHR) size class 4 where diameter at breast height (DBH) ranges between 11 and 24 inches and size class 5 where diameter at breast height (DBH) is greater than 24 inches. Analysis of CWHR size class distribution for forest types in the analysis area shows a relative overabundance of CWHR size class 4 and 5, indicating a departure from desired distribution of size classes. Because such stand structure has increased vulnerability to high-severity fires, insect outbreaks, and landscape level drought-induced mortality, a homogenous (same species or structure) occurrence of this seral stage across the landscape is unstable (McKelvey and Johnston 1992, Millar et al. 2007). A more diverse distribution of seral stages, characterized by heterogeneous stand structures, may be more resilient to disturbance events such as fire, drought, and insect and disease infestations and more characteristic of desired conditions (Stephens and Fule 2005, Millar et al. 2007, Collins and Stephens 2010).

On a landscape scale, Table 10 shows existing CWHR vegetation types, size class distribution, and canopy cover distribution for the sub-watersheds within the project area. Over 65 percent of the acres in the analysis area are in the moderate to dense canopy cover classes, which indicates multiple canopy layers and interlocking crowns. In addition, over 68 percent of the analysis area is in the poles to small tree size classes, which also indicate an increased fire hazard risk potential.

Table 10. Summary of vegetation types, size class distribution, and canopy closure distribution within the Gibsonville project area sub-watersheds.

CWHR	Forest Vegetation Data	Forest Service Sub-Watershed Acres	Percent of Acres
Vegetation type diversity	Barren (includes water and wet meadow)	123	3.1%
	Shrub Types (montane chaparral)	514	13.0%
	Sierra mixed conifer	1,629	41.2%
	True fir (White and Red)	1,683	42.6%
	Pine (ponderosa, Jeffrey)	3	0.1%
	TOTALS	**3,952**	**100%**
Size Class Distribution	Miscellaneous (barren, water, grassland, shrubs)	631	16.0%
	2) Sapling (1–6 inches DBH)	9	0.2%
	3) Pole (6–11 inches DBH)	565	14.3%
	4) Small Tree (11–24 inches DBH)	2,094	53.0%
	5) Medium/Large Tree (> 24 inches DBH)	653	16.5%
	6) Multi Layered (Size 5 over 4 or 3; Canopy >60%)		
	TOTALS	**3,952**	**100%**
Canopy Closure Distribution	NA (0–9%) (barren, water, grassland, shrubs)	631	16.0%
	S) Sparse (10–24%)	162	4.1%
	P) Open (25–39%)	588	14.9%
	M) Moderate (40–59%)	895	22.7%
	D) Dense (60–100%)	1,676	42.4%
	TOTALS	**3,952**	**100%**

Alternative B (Proposed Action) – Direct and Indirect Effects

Mechanical thinning

The most effective strategies for reducing crown fire occurrences and severity are to: 1) reduce surface fuels, 2) increase height to live crown, 3) reduce canopy bulk density, and 4) reduce continuity and density of the forest canopy (Graham et al. 2004; Peterson et al. 2005; Agee and Skinner 2005). Mechanical thinning treatments would utilize species preference guidelines to enhance species composition of the residual stand. Prescriptions that generally retain trees greater than 24 inches DBH would allow for the removal of undesirable trees such as, a shade-tolerant white fir, up to 29.9 inches DBH if it is competing with a desired tree such as shade-intolerant pine or a hardwood tree greater than 30 inches DBH. Shade-tolerant species, like white fir, red fir, and incense-cedar, would be targeted, but not enough large shade-tolerant trees would be removed to promote regeneration of many more shade-intolerant species (Table 11).

Table 11. Species composition in percent (based on basal area) for CWHR 4D/M and 5D/M stands that are thinned to various residual canopy cover percent.

4D/M Stands	PP	SP	JP	DF	IC	WF	RF	BO
No Thin	2%	5%	1%	1%	8%	62%	22%	1%
30% CC	2%	5%	2%	0%	5%	56%	29%	1%
40% CC	2%	5%	2%	0%	6%	57%	27%	0%
50% CC	2%	5%	2%	1%	7%	60%	24%	0%
60% CC	2%	5%	2%	1%	7%	62%	23%	1%
5D/M Stands	PP	SP	JP	DF	IC	WF	RF	BO
No Thin	1%	0%	0%	2%	11%	78%	8%	0%
30% CC	2%	0%	0%	3%	11%	73%	10%	0%
40% CC	1%	0%	0%	2%	13%	73%	9%	0%
50% CC	1%	0%	0%	2%	13%	76%	8%	0%
60% CC	1%	0%	0%	2%	11%	78%	8%	0%

Notes: CC = canopy cover; PP= ponderosa pine, SP = sugar pine; JP = Jeffrey pine; DF = Douglas-fir; IC = incense cedar; WF = white fir; RF = red fir; and BO = black oak.

Stand Structure: Mechanical treatments would reduce stand density through thinning and removal of conifers up to 29.9 inches DBH. The Gibsonville Project incorporates the concepts of GTR-220, which allows intermediate to larger diameter trees (up to 29.9 inches DBH) to be harvested (i.e., overtopping black oaks or aspen, reducing tree density and promoting crown separation near roads and upper slopes). Trees per acre would be reduced by variable density thinning, removing sapling and pole size trees and some co-dominant trees, creating 1/10 acre to ½ acre gaps, and skipping other areas by leaving moderate to high density areas.

Trees per acre and canopy cover would be reduced through mechanical treatments. Some CWHR 4 and 5 stands adjacent to roads would receive heavier thinning (below 71 trees per acre) to create open canopy stands and enhance diameter growth of residual trees. Some CWHR 4 and 5 stands that are farther away from roads would receive lighter thinning (less removal of trees and subsequently less reduction to canopy cover) to maintain closed-canopy stand conditions of later seral stands while reducing ladder fuels and stand density to reduce negative impacts of future fires, drought, and insect and disease occurrences. Canopy cover within RCAs would be maintained.

Tree stocking and density would be reduced to desirable levels that reduce predicted fire behavior and reduce vulnerability to drought, insect, and disease. Variable density thinning also promotes stand and landscape level heterogeneity which enhances landscape resiliency to large disturbance events (Collins and Stephens 2010).

All mechanical thinning treatments would employ species preference guidelines to generally retain shade intolerant species and remove shade tolerant species with a goal of retaining a species composition representative of a mesic sierra mixed conifer forest. Aspen treatments would be designed to retain all mature aspen and remove encroaching conifers to improve aspen regeneration.

The field surveys indicate that the existing aspen stands are in decline and at risk of extirpation from the site if conifer encroachment persists. A portion of the "mature" individuals of the clone are already dead, and suckers- while currently present – are overtopped/encroached by mature conifers and are also being affected by herbivory. The importance of these aspen communities, the threat of encroaching conifers particularly white fir, (Shepperd et al. 2006; Pierce and Taylor 2010; McCullough et al 2013), and the effectiveness of differing levels of conifer removal and effects of conifer and aspen regeneration (Shepperd et al 2006; Krasnow and Stephens 2015; Berill, Dagley and Coppeto 2016) are well-documented in the literature.

In addition, Gordon's (1970, 1979) research on true fir natural regeneration in northern California suggest that as low as 5-10 retained codominant/dominant trees per acre are sufficient to naturally regenerate an opening with white fir.

While studies such as Krasnow and Stephens (2015) indicate that high severity wildfire effectively promote aspen regeneration, this is difficult to achieve on such small and disparate treatment units. However, many studies (Jones et al 2013; Krasnow et al 2012, Krasnow and Stephens 2015; Berrill and Dagley 2014; Berrill, Dagley and Coppeto 2016) show that conifer removal, coupled with prescribed fire can effectively promote aspen regeneration within smaller and more discrete management units. Conifer removal also allows for more complete management of undesirable seed sources, which is more imprecise when using prescribed fire.

Hand cutting, and piling

Hand cutting would change the structure (by reducing ladder fuels), density, and size of fuels in the stand, piling and pile burning would change the total fuel loading.

Hand cutting would occur in pole sized stands and would re-arrange brush and conifer tree ladder fuels less than 10 inches in diameter. Hand cutting would also occur in some CWHR 4 and 5 stands. Post-treatment residual conifer tree spacing would range from 18 to 22 feet, on average thereby reducing trees per acre to the upper threshold of desired conditions. Hand thinning would reduce the number of trees per acre in the suppressed and intermediate diameter classes which serve as ladder fuels in each stand. Removing ladder fuels through hand thinning improves fires resistant structure by reducing the probability of torching which is the common vector of transitioning surface fires into passive crown fires.

Hand cutting treatments would employ species preferences to retain species native to the forest stand ecological type. Desired shade-intolerant species such as black oak, ponderosa and Jeffrey pine, rust-resistant sugar pine, and Douglas-fir would typically receive preference for retention while allowing for a diverse mix of species occupying the site.

Hand cutting treatments would create open canopy stands within plantations and naturally occurring pole sized (less than 11 inches DBH) stands. These treatments would enhance the development of CWHR 2 sized stands into CWHR 3 sized stands with Open (P) and Sparse (S) canopy cover (less than 39 percent canopy cover).

No treatment

Historically, stands in the Gibsonville Project area had a higher component of shade-intolerant species such as Jeffrey pine, Douglas-fir, and sugar pine in the overstory. Maintaining the existing stand structure would favor shade-tolerant species such as white fir, red fir, and incense-cedar. There would be little opportunity for the naturally dominant pine species to reestablish and regenerate themselves, except what may occur through natural large-scale disturbance events such as wildfire

With no treatment, areas would continue to be dominated by closed-canopy mid-seral forested stands. These stands, best characterized by CWHR size class 4 and 5 and canopy density classes of moderate (M) and dense (D), contribute to landscape homogeneity due to its abundance and connected arrangement. Because such stand structure has increased vulnerability to high-severity fires, insect outbreaks, and landscape level drought-induced mortality, a homogenous (same species or structure) occurrence of these closed-canopy, mid-seral stages across the landscape is unstable and less resilient to the aforementioned forest disturbances (McKelvey and Johnston 1992).

Past harvest activities described in the previous section have resulted in 1) the reduction of large dominant and codominant overstory trees, 2) the retention of smaller diameter intermediate and suppressed trees and 3) a shift in species composition from shade-intolerant pine dominated stands to shade-tolerant, white fir dominated stands; all of which have largely decreased landscape level forest heterogeneity (diversity) (McKelvey and Johnston 1992). In addition, a near absence of landscape level, low-intensity surface fires has contributed to increased stand densities in smaller diameter classes, particularly in shade-tolerant species (Skinner and Chang 1996).

Stand Structure: At the stand level, similar to what has occurred at the landscape level, the combination of past management activities, fire exclusion, and extensive drought-related mortality has created relatively homogeneous areas typified by small even-aged trees existing at high densities (Oliver and Larson1996). High-density stands are also more susceptible to density-dependent mortality driven by drought and insect and disease infestations (Cochran et al.1994; Guarin and Taylor 2005; Macomber and Woodcock 1994, Powell 1999). Extensive drought in the late 1980s and early 1990s, combined with high stand density, resulted in extensive mortality of white fir (Guarin and Taylor 2005; Ferrell 1996; Macomber and Woodcock 1994). Much of this material has fallen over in the last 20 years and become dead and down fuel. The high densities of small trees and high fuel loads contribute to:

- overstocked stand conditions in which trees become stressed due to competition for water, light, and nutrients; this can lead to a higher potential for mortality due to drought, insects, or disease (Powell 1999; Ferrell 1996; Guarin and Taylor 2005; Fettig et al. 2007);
- conditions that favor the recruitment of shade-tolerant species, which promotes a shift in species composition from pine-dominated to fir-dominated forests (Oliver and Larson 1996; McKelvey and Johnston 1992); and

- large accumulations of ground fuels, ladder fuels, and canopy fuels which increase the potential for stand-replacing, high-severity fire events (Weatherspoon and Skinner 1996).

Without treatment, trees in the suppressed and intermediate crown classes would continue to provide ladder fuels into the overstory crown canopy. Existing conditions, including multiple size classes, high trees per acre, and dense canopy indicate high fuel ladder potential and interlocking crowns capable of sustaining crown fires.

Alternative C – Direct and Indirect Effects

Mechanical thinning

Alternative C would treat 59.8 fewer acres under thinning from below. Due to the reduction in scale (acres), this alternative would have similar, but less effective desirable impacts to stand structure and landscape structure (i.e., trees per acre and canopy cover by DBH size classes) as Alternative B. Alternative C would treat 93.4 fewer acres using biomass or mastication.

Hand cutting, and piling

This alternative would have similar affects to stand and landscape structure as the proposed action. Alternative C would treat an additional 180.9 acres under hand cutting and piling than Alternative B. Pre-commercial thinning (less than 10” DBH) alone would not be quite as effective in reducing overall stand structure when compared to commercial thinning (greater than 10” DBH).

No treatment

This alternative would have similar affects to forest health as the other. It would leave 27.7 fewer acres untreated.

Wildlife

Environmental Indicators and Measures

California Wildlife Habitat Relationship (CWHR) classifies existing vegetation types important to wildlife. The CWHR system has three elements:

- major tree-dominated vegetation associations (forest types);
- tree size (size class); and
- canopy cover.

These classifications include characterizing tree size classes of small tree (4 = dbh 11 – 24 inches), medium/large tree (5 = dbh greater than 24 inches), and multilayered (6 = size 5 over size 3 or 4) and tree canopy closure classes of moderate (M = 40 – 59%) and dense (D = 60 – 100%). CWHR size and density classes 6, 5D, 5M, 4D, and 4M can be used to approximate suitable habitat for California spotted owl.

Definitions of suitable habitat are derived from those listed in Verner et al. (1992), USDA Forest Service (2004), and USDI Fish and Wildlife Service (2005). Based on these definitions the following CWHR types in the analysis area provide:

- suitable nesting habitat – Sierran Mixed Conifer, White Fir, and Ponderosa Pine forest types, size class 5 (trees > 24 inch DBH), and canopy cover that is Moderate (40-59 percent) to Dense (60-100 percent);

- suitable foraging habitat is found in the same forest types listed above for nesting habitat (CWHR 5D, 5M) as well as CWHR 4D, 4M: size class 4 (trees 11-24 inch DBH) and canopy cover Moderate to Dense.

Affected Environment

There is habitat within the Gibsonville analysis area, including the treatment units, that is suitable for owls to nest and forage (USDA Forest Service 2016h). These CWHR types have the highest probability of providing stand structure associated with preferred nesting, roosting and foraging. Stands considered to be suitable for foraging have at least two canopy layers, dominant and co-dominant trees in the canopy averaging at least 12 inches in dbh, at least 40 percent canopy closure, and higher than average levels of snags and downed woody material. Too dense an understory makes it difficult for California spotted owls (CSO) to hunt; on the other hand, some amount of understory vegetation provides cover for a diversity of prey for the CSO. Ridge-tops are usually not suitable for nesting or roosting habitat but is utilized for foraging.

The analysis area (Figure 4) is comprised of 5 subwatersheds totaling 5,330 acres of which 3,952 acres are National Forest System lands. Of the 3,952 acres there are 2,364 acres CWHR classified as suitable habitat: 567 acres as suitable nesting habitat (5M, 5D) and 1,797 acres as suitable foraging habitat (4M, 4D). There is also approximately 1,588 acres of unsuitable habitat within the analysis area.

Of the 2,364 acres of suitable CSO habitat within the analysis area there are 750 acres (32%) within the project area.

Alternative B (Proposed Action) – Direct and Indirect Effects

Variable Density Thin, Townsite Treatment, Thinning from Below, Aspen Release

Alternative B would reduce 243.3 acres to minimal suitability by mechanical thinning for variable density thin and townsite treatment. This alternative would also take 22.8 acres below suitability by mechanical thinning for aspen release. Proposed treatments would provide valuable habitat for aspen associated species, including foraging habitat for the CSO. Suitability is maintained for 59.8 acres by mechanical thinning from below.

Acres proposed for reducing habitat suitability are predominantly along the high-use forest road, historic Gibsonville Townsite where the objective is to protect archaeological features and artifact concentrations, surrounding an aspen area where the goal is to restore aspen habitat by raising the water table, reduce shading and reducing the nutrient competition, and reducing the tree density within forest surrounding the aspen habitat for forest health, fire resilience and fuels reduction.

The CWHR classifications would not change as a result of the thinning from below treatment of 59.8 acres. The main objective is stand density, to reduce dense surface and ladder fuels, thereby reducing the risk of wildfire, reducing competition and nutrients for trees, and increasing surface water for flow into creeks.

Meadow and Riparian Restoration Biomass or Masticate, Hand Cut Pile Burn (HCPB), and Underburn

Alternative B would treat 700.8 acres meadow and riparian restoration, biomass or mastication, hand cut pile burn and underburning. Alternative B would not reduce CWHR classifications as a result of these proposed treatments. Biomassing or masticating, HCPB, and underburning would

reduce stand densities, remove (or rearrange) surface and ladder fuels up to 10” dbh. Overstory canopy cover would not be reduced and layering would be retained.

Hazard Tree Removal

There are approximately 5.5 miles of roadside hazard tree abatement proposed for the project. Treating hazard trees within a 200 feet buffer off both sides of the road would create approximately 266.7 acres of roadside treatments overlaying the 1200.4 acres of treatment prescriptions. There is no roadside hazard tree abatement proposed within PAC.

All Treatment Prescriptions

There could be short-term disturbance for owls utilizing the area for foraging. These treatments would be removing surface fuels (ground fuels, shrubs, and small trees) which could have some short-term effects on prey species but would benefit habitat in the long-term. These treatments are designed to retain large pieces of down wood and maintain adequate ground cover to reduce erosion and sedimentation into streams. The retention of snags and large down wood would also aid in minimizing effects on the spotted owl foraging habitat and their prey species. The reduction of shrub cover may increase the availability of prey species to owls. However, it could also result in a reduction of prey species due to the loss of cover.

The prescriptions within riparian conservation areas are more restrictive and would remove some of the dense ground cover by removing surface fuels. Limited operation periods would be applied to any nesting or roosting owls. Proposed treatments would result in a short-term disturbance to species within the area due to temporary road reconstruction for mastication, activities to remove vegetation and increased road use.

No Treatment

No action would not provide for the long-term protection of California spotted owl habitat from loss due to potential wildfires, insect and disease infestation, and drought (low water and high temperature) conditions. . Alternative B moves project acres towards the desired condition. However 173.7 acres are prescribed no treatments.

Alternative C – Direct and Indirect Effects

Variable Density Thin, Townsite Treatment, Thinning from Below, Aspen Release

Alternative C would treat the same 243.3 acres for variable density thin and townsite treatment and 22.8 acres for aspen release with the same effects. None of these treatments are proposed within CSO designated habitat. The 59.8 acres by mechanical thinning from below would be replaced with additional HCPB.

Meadow and Riparian Restoration Biomass or Masticate, Hand Cut Pile Burn (HCPB), and Underburn

Alternative C would treat 788.3 acres meadow and riparian restoration, biomass or mastication, hand cut pile burn and underburning. The differences being 93.4 fewer acres being treated with biomass or mastication and 180.9 acres more being treated with HCPB.

Hazard Tree Removal

Of the approximately 5.5 miles of roadside hazard tree abatement proposed for the project, about 1.75 miles cross CSO designated habitat. Within those approximately 181.8, acres hazard trees would be felled and left in place, contributing to large down wood.

All Treatment Prescriptions

The CSO is not expected to be directly affected and indirect effects are expected to be low based on direction, standards and guidelines, design features and protection measures. Both alternatives may affect the CSO but are not likely to lead to a trend toward listing or loss of viability for the species based on the amount and intensity of the proposed treatments.

No Treatment

Because of the increase prescriptions of HCPB, Alternative C would have 27.7 fewer acres as no treatment.

CUMULATIVE EFFECTS:

***Wildfires and Fuels Treatments*:** In 1999 the Devil's Gap Fire occurred which was about 1500 acres, burned at 90% high-intensity, and was about 10 miles southwest of the Gibsonville area (USDA Forest Service 2017c). Multiple smaller fires have occurred throughout the analysis area, small fires either ignited by lightning or human caused means, which were contained and controlled during the initial attack phase. There has not been any recent large high-intensity wildfires in the analysis area. However, due to climate change and drying conditions the possibility of large high-intensity fires is of concern aggravated by the lack of natural fire in the area due to suppression.

***Barred Owl*:** The potential for the barred owl to become established and compete with CSO within the Gibsonville project area is a possible additional cumulative effect, but at this point, it is unknown as to what the extent this effect might be. The Gibsonville area lies between a heavier treated private land and unsuitable steep, rocky Slate Creek drainages which could make the area more desirable to the barred owl. To date barred owls have not been located in the Gibsonville area which is in the northernmost portion of the Slate Creek watershed, however, there are a number of barred and sparred (California spotted owls mated to Barred owls) owl in the lower to middle of the watershed.

***Roadside Hazard Tree*:** Projects have been determined to have no cumulative effects to vegetation attributes (i.e., tree density, canopy cover, species composition, stand structure, etc.) since they would remove approximately two to six trees per acre along a road corridor. Roadside hazard tree projects also would not change seral stage diversity classes.

***Botanical (i.e., aspen restoration, noxious weed control), watershed (i.e., meadow or stream restoration*:** projects are generally not implemented at a scale (*i.e., less than 70 acres) or location to influence vegetation attributes on a project or landscape-level analysis area. Christmas trees and fuel wood cutting have a negligible effect on vegetation attributes at a project and landscape-lev el analysis area due to limited access (i.e., adjacent to roads) and to the seasonal and dispersed nature of these activities.

Finding of No Significant Impact

As the responsible official, I am responsible for evaluating the effects of the project relative to the definition of significance established by the CEQ Regulations (40 CFR 1508.13). I have reviewed and considered the EA and documentation included in the project record, and I have determined that the proposed action and the CSO alternative will not have a significant effect on the quality of the human environment. As a result, no environmental impact statement will be prepared. My rationale for this finding is as follows, organized by sub-section of the CEQ definition of significance cited above.

Context

For the proposed action and alternative the context of the environmental effects is based on the environmental analysis in this EA.

The proposed action and the CSO alternative address the purpose and need for the project. The Healthy Forests Restoration Act (HFRA) of 2003, as amended, authorizes the Forest Service to implement hazardous fuel reduction projects to reduce wildfire risk; to reduce the risk or extent of, or increase the resilience to, insect or disease infestation; to enhance efforts to protect watersheds; and to protect, restore, and enhance forest ecosystem components, to promote the recovery of threatened and endangered species, improve biological diversity, and enhance productivity and carbon sequestration.

Tree mortality throughout northeastern California is generally elevated but has not reached the extremely high levels observed in the central and south Sierra Nevada range. However, some forested areas have experienced substantial mortality resulting in increases in the number of hazard trees along roadways and powerlines and increases in fuel loads that can lead to more damaging wildfires. The 2016 tree mortality survey numbers mapped approximately 344,000 dead trees on the Plumas National Forest. This is close to 6 times more than what would be considered normal background tree mortality.

Intensity

Intensity is a measure of the severity, extent, or quantity of effects, and is based on information from the effects analysis of this EA and the references in the project record. The effects of this project have been appropriately and thoroughly considered with an analysis that is responsive to concerns and issues raised by the public. The agency has taken a hard look at the environmental effects using relevant scientific information and knowledge of site-specific conditions gained from field visits. My finding of no significant impact is based on the context of the project and intensity of effects using the ten factors identified in 40 CFR 1508.27(b).

1. Impacts that may be both beneficial and adverse. A significant effect may exist even if the Federal agency believes that on balance the effect will be beneficial.

Based on the scoping process, a limited number of issues were identified and fully analyzed in the environmental analysis to ensure consideration of the intensity of environmental effects is not biased by any potential beneficial effects of the action.

2. The degree to which the proposed action affects public health or safety.

The project was developed to include addressing public health and safety by incorporating hazard tree removal along roadways into the purpose and need.

3. Unique characteristics of the geographic area such as the proximity to historical or cultural resources, parklands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas.

The project was developed to include increasing visibility of and protecting the historic Gibsonville townsite, which is the major historical resource within the project area, into the purpose and need.

4. The degree to which the effects on the quality of the human environment are likely to be highly controversial.

We have included and analyzed an alternative consistent with the *Draft Interim Recommendations for the Management of California Spotted Owl Habitat on National Forest System Lands, 29 May 2015*. These recommendations constitute a suite of measures that individually hold promise and support in scientific literature pertaining to owls and forest ecology, but they have not been field tested as a composite set of conservation measures. Thus, we cannot offer any certainty in terms of their benefits, only the potential for benefits based on the best available science.

5. The degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks.

The agency has considerable experience with actions like the ones proposed. The analysis shows the effects are not uncertain, and do not involve unique or unknown risk.

6. The degree to which the action may establish precedent for future actions with significant effects or represents a decision in principle about a future consideration.

The action is not likely to establish a precedent for future actions with significant effects, because it affects a specific project area and routinely addresses a common agency action.

7. Whether the action is related to other actions with individually insignificant but cumulatively significant impacts. Significance exists if it is reasonable to anticipate a cumulatively significant impact on the environment. Significance cannot be avoided by terming an action temporary or by breaking it down into small component parts.

The cumulative impacts are not significant. The effects of the action are limited to the local area other than providing connectivity at the landscape level to other forest health, fire resilient forest projects.

8. The degree to which the action may adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural, or historical resources.

No cultural resources will be impacted by project activities due to following standard resource protection measures as outlined in II(A) of the First Amended Programmatic Agreement among the USDA Forest Service, Pacific Southwest Region, the Advisory Council on Historic Preservation, and the California State Historic Preservation Officer, Regarding the Process for Compliance with Section 106 of the National Historic Preservation Act of Undertakings on the National Forests of the Pacific Southwest Region (Region 5 Programmatic Agreement, 2013).

9. The degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act of 1973.

The proposed activities may affect the federally listed Endangered Sierra Nevada yellow-legged frog, but not likely to adversely affect. The determination is based on the following; current surveys, ongoing surveys, limited operating periods, adhering to standards and guidelines such as Riparian Management Objectives (RMOs), Riparian Habitat Conservation Areas (RCAs), and Best Management Practices (BMPs). Consultation with the U.S Fish & Wildlife Service was necessary and their Biological Opinion was received March 21, 2017. If, during the implementation of this project evidence of an endangered or threatened species is determined, a qualified biologist would be called immediately to make a species determination and mitigations would be developed.

10. Whether the action threatens a violation of Federal, State, or local law or requirements imposed for the protection of the environment.

The proposed action and alternative violates no federal, state, or local environmental protection laws. The alternatives are consistent with the 1988 Plumas National Forest Land and Resource Management Plan, as amended by the 2004 Sierra Nevada Forest Plan Amendment (SNFPA) final supplemental EIS Record of Decision.

References

Agee, J.K. and C.N. Skinner. 2005. Basic principles of forest fuel reduction treatments. Forest Ecology and Management. 211(1-2): 83-96. Online: www.treesearch/pubs/36541

Angwin, P.A., D.R. Cluck, P.J. Zambino, B.W. Oblinger and W.C. Woodruff. 2012. Hazard tree guidelines for Forest Service facilities and roads in the Pacific Southwest Region. Pacific Southwest Region. FHP Report RO-12-01. 40 p.

Apigian, K.O., D.L. Dahlsten, and S.L. Stephens. 2006. Fire and fire surrogate treatment effects on leaf litter arthropods in a western Sierra Nevada mixed-conifer forest. Forest Ecology and Management. 221: 110-122.

Berrill J-P and C.M. Dagley. 2014. Regeneration and recruitment correlate with stand density and composition in long-unburned aspen stands undergoing succession to conifer in the Sierra Nevada, USA. Forest Res 3: 119. doi:10.4172/2168-9776.1000119.

Berrill, J-P., C.M. Dagley, and S.A. Coppeto. 2016. Predicting treatment longevity after successive conifer removals in Sierra Nevada aspen restoration. Ecological Restoration 34(3): 236-244.

Cluck, D.R. 2012. Forest health survey of northeastern California aspen. Forest Health Protection. Pacific Southwest Region. FHP Report NE-SPR-12-01. 33p.

Cluck, D.R. 2014. Insect and disease evaluation of the Sacketts project. Forest Health Protection. Pacific Southwest Region. FHP Report NE 14-03. 13p.

Cluck, D.R. 2016. 2016 tree mortality: aerial detection survey results for northeastern California. Forest Health Protection. Pacific Southwest Region. 21p.

Cochran, P.H., J.M. Geist, D.L. Clemens, R.R. Clausnitzer and D.C. Powell. 1994. Suggested stocking levels for forest stands in northeastern Oregon and southeastern Washington. Res. Note PNW-RN-513. Portland, OR: USDA Forest Service, Pacific Northwest Research Station 21p.

Collins, B.M. and S.L. Stephens. 2010. Stand-replacing patches within a 'mixed severity' fire regime: quantitative characterization using recent fires in a long-established natural fire area. Landscape Ecology 25: 927-939.

DeMars, C.J. and B.H. Roettgering. 1982. Western pine beetle. USDA Forest Service, Forest Insect and Disease Leaflet 1. 8p.

Dixon, G.E. 2002. Essential FVS: a user's guide to the forest vegetation simulator. Internal Rep. Fort Collins, CO: USDA Forest Service, Forest Management Service Center. 240 p. (Revised: September 9, 2010).

Dolph, K.L., S.R. Mori and W.W. Oliver. 1995. Long term response of old-growth stands to varying levels of partial cutting in the eastside pine type. Western Journal of Applied Forestry. Vol 10, No. 3. 101-108.

Doucet, R. 1989. Regeneration Silviculture of aspen. For. Chron. 65: 23-27.

Economic Profile System. 2017. A profile of timber and wood products, selected geographies: Plumas County, CA. Headwaters Economics. www.headwaterseconomics.org

Ferrell, G.T. 1996. The influence of insect pests and pathogens on Sierra Forest. In Sierra Nevada Ecosystem Project (SNEP) – Final report to Congress. Status of the Sierra Nevada: Volume II, Assessments and Scientific Basis for Management Options. University of California, Davis. 1177-1192.

Fettig, C.J. 2012. Forest health and bark beetles. In: North, M., ed. 2012. Managing Sierra Nevada forests. Gen. Tech. Rep. PSW-GTR-237. Albany, CA: USDA Forest Service, Pacific Southwest Research Station: 13-22. Chapter 2.

Fettig, C.J., D.D. Klepzig, R.F. Billings, A.S. Munson, T.E. Nebeker, J.F. Negron and J.T. Nowak. 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: 24-53.

Fiddler, G.O., T.A. Fiddler, D.R. Hart and P.M. McDonald. 1989. Thinning decreases mortality and increases growth of ponderosa pine in northeastern California. Res. Paper. PSW-RP-194. Albany, CA: Pacific Southwest Research Station, USDA Forest Service. 12p.

Gordon, D.T. 1970. Natural regeneration of white and red fir: influence of several factors. Research Paper PSW-58. Pacific Southwest Forest and Range Experiment Station, USDA Forest Service. Berkeley, CA 32 p.

Gordon, D.T. 1979. Successful natural regeneration cuttings in California true firs. Research Paper PSW140. Pacific Southwest Forest and Range Experiment Station, USDA Forest Service. Berkeley, CA 14 p.

Graham, R.T., S. McCaffery and T.B. Jain. 2004. Science basis for changing forest structure to modify wildfire behavior and severity. USDA Forest Service General Technical Report. RMRS-GTR-120.

Guarin, A. and A.H. Taylor. 2005. Drought triggered mortality in mixed conifer forests in Yosemite National Park, California, USA. Forest Ecology and Management. 218: 229-244.

Hadfield J.S. and K.W. Russel. 1978. Dwarf mistletoe management in the Pacific Northwest. In, Proceedings of the Symposium on Dwarf Mistletoe Control Through Forest Management, April 11-13, 1978. Berkley, CA. USDA Forest Service, Pacific Southwest Forest and Range Experiment Station, General Technical Report GTR-PSW-031. 73-81.

Jain, T.B., M.A. Battaglia, H. Han-Sup, R.T. Graham, C.R. Keyes, J.S. Fried, and J.E. Sandquist. 2012. A comprehensive guide to fuel management practices for dry mixed conifer forests in the northwestern United States. Gen. Tech. Rep. RMRS-GTR-292. Fort Collins, CO: USDA Forest Service, Rocky Mountain Research Station. 331 p.

Jones, B.E., M. Krupa, and K.W. Tate. 2013. Aquatic ecosystem response to timber harvesting for the purpose of restoring aspen. PLoS ONE 8(12): e84561. doi:10.1371/journal.pone.0084561.

Knapp, E.E., D.W. Schwilk, J.M. Kane, and J.E. Keeley. 2007. Role of burning season on initial understory vegetation response to prescribed fire in a mixed conifer forest. Canadian Journal of Forest Research. 37: 11-22.

Koehler, C.S., D.L. Wood and A.L. Scarlett. 1978. Bark beetles in California forest trees. University of California, Davis. Division of Agricultural Sciences, Leaflet 21034. 8p.

Krasnow, K.D. and S.L. Stephens. 2015. Evolving paradigms of aspen ecology and management: impacts of stand condition and fire severity on vegetation dynamics. Ecosphere 6(1):12. http://dx.doi.org/10.1890/ES14-00354.1

Krasnow, K.D., A.S. Halford, and S.L. Stephens. 2012. Aspen restoration in the eastern Sierra Nevada: effectiveness of prescribed fire and conifer removal. Fire Ecology 8(3): 104-118.

Landram, M. 2004. Oversight and functional assistance trip report: density management on the Plumas National Forest MAY 18-20, 2004. Region 5 Forest Vegetation Program Manager, USDA Forest Service.

Macomber, S.A. and C.E. Woodcock. 1994. Mapping and monitoring conifer mortality using remote sensing in the Lake Tahoe Basin. Remote Sensing of Environment. 50: 255-266.

McCullough, S.A., A.T. O'Green, M.L. Whiting, D.A. Sarr, and K.W. Tate. 2013. Quantifying the consequences of conifer succession in aspen stands: decline in a biodiversity-supporting community. Environmental Monitoring and Assessment 185(7): 5563-5576. Doi: 10.1007/s10661-012-2967-4.

McKelvey, K.J. and J.D. Johnston. 1992. Historic perspectives on forests of the Sierra Nevada and the Transverse Ranges of southern California: forest conditions at the turn of the century. Gen. Tech. Rep. GTR-PSW-133. USDA Forest Service.

McKelvey, K.S., C.N. Skinner, C. Chang, D. Et-man, S.J. Husari, D.J. Parsons, J.W van Wagtendonk and C.P. Weatherspoon. 1996. An overview of fire in the Sierra Nevada. In Sierra Nevada Ecosystem Project (SNEP) – Final report to Congress. Status of the Sierra Nevada: Volume II, Assessments and Scientific Basis for Management Options. University of California, Davis. 1033-1040.

Millar, C.I., N.L. Stephenson and S.L. Stephens. 2007. Climate change and forests of the future: managing in the face of uncertainty. Ecological Applications 17(8): 2145-2151.

Moghaddas E.E. and S.L. Stephens. 2007. Thinning, burning, and thin-burn fuel treatment effects on soil properties in a Sierra Nevada mixed-conifer forest. Forest Ecology and Management. 250: 156-166.

Murphy D., D. Johnson, W. Miller, R. Walker, and R. Blank. 2006. Prescribed fire effects on forest floor and soil nutrients in a Sierra Nevada forest. Soil Science. 171: 181-199.

Navratil, S. 1991. Regeneration challenges. In: Navratil, S. and P.B. Chapman, editors. Aspen management for the 21st Century. Proceedings of a symposium, November 20-21, 1990, Edmonton, Alberta. Edmonton, Alberta, For. Can., Northwest Reg., North. For. Cent. And Poplar Counc. Can. 15-27.

North, M., P. Stine, K. O'Hara, W. Zielinski, and S. Stephens. 2009. An ecosystem management strategy for Sierran mixed-conifer forests. Gen. Tech. Rep. PSW-GTR-220. Albany, CA: USDA Forest Service, Pacific Southwest Research Station. 49 p.

North, M. ed. 2012. Managing Sierra Nevada forests. Gen. Tech. Rep. PSW-GTR-237. Albany, CA: USDA Forest Service, Pacific Southwest Research Station. 184 p.

Oliver, C. and B. Larson. 1996. Forest stand dynamics. New York: John Wiley & Sons, Inc.

Oliver, W.W. 1995. Is self-thinning in ponderosa pine ruled by dendroetonus bark beetles? Forest Health through Silviculture: Proceedings of the 1995 National Silviculture Workshop: Mescalero, New Mexico, May 8-11, 1995. 213-218.

Parmeter, J.R., Jr. 1978. Forest stand dynamics and ecological factors in relation to dwarf mistletoe spread, impact, and control. In, Proceedings of the Symposium on Dwarf Mistletoe Control Through Forest Management, April 11-13, 1978. Berkley, CA. USDA Forest Service, Pacific Southwest Forest and Range Experiment Station, General Technical Report GTR-PSW-031. 16-30.

Peterson, D.L., M.C. Johnson, J.K. Agee, T.B. Jain, D. McKenzie and E.D. Reinhart. 2005. Forest structure and fire hazard in dry forests of the western United States. USDA Forest Service, General Technical Report. PNW-GTR-628.

Pierce, A.D. and A.H. Taylor. 2010. Competition and regeneraton in quaking aspen-white fir (*Populus tremuloides-Albies concolor*) forests in the Northern Sierra Nevada, USA. Journal of Vegetation Science, 21: 507-519. doi:10.1111/j.1654-1103.2009.01158.x

Powell D.C. 1999. Suggested stocking levels for forest stands in northeastern Oregon and southeastern Washington: an implementation guide of the Umatilla National Forest. USDA Forest Service, Pacific Northwest Region Technical Publication F14-SO-TP-03-99.

Sartwell, C. 1971. Thinning ponderosa pine to prevent outbreaks of mountain pine beetle. In, David M. Baumgartner (ed.) Precommercial thinning of coastal and intermountain forests in the Pacific Northwest. 41-52. Wash. State Univ. Coop Ext. Serv., Pullman.

Schmitt, C.L., J.R. Parmeter and J.T. Kliejunas. 2000. Annosus root disease of western conifers. Forest Insect and Disease Leaflet 172. USDA Forest Service. 9p.

Scott, J.H. and E.D. Reinhardt. 2001. Assessing crown fire potential by linking models of surface and crown fire behavior. Res. Pap. RMRS-RP-29. 59 p. online: www.treesearch/pubs/4623.

Shepperd, W.D. 2004. Techniques to restore aspen forests in the western U.S. Transactions of the Western Section of the Wildlife Society. 40: 52-60.

Shepperd, W.D., P.C. Rogers, D. Burton and D.L. Bartos. 2006. Ecology, biodiversity, management, and restoration of aspen in the Sierra Nevada. USDA Forest Service General Technical Report RMRS-GTR-178. 122p.

Skinner, C.N. and C. Chang. 1996. Fire regimes, past and present. In Sierra Nevada Ecosystem Project (SNEP) – Final report to Congress. Status of the Sierra Nevada: Volume II, Assessments and Scientific Basis for Management Options. University of California, Davis. 1041-1069.

Solomon, M. 2000. An assessment of the potential effects to obsidian hydration bands caused by prescribed fires. CDF Archaeological Reports 26.

Solomon, M. 2002. Fire and glass: effects of prescribed burning on obsidian hydration bands. In: the effects of fire and heat on obsidian. Loyd, J.M., T.M. Origer, and D.A. Fredrickson. Ed. Cultural Resources Publication.

Stephens, S.L. and P.Z. Fule. 2005. Western pine forests with continuing frequent fire regimes: possible reference sites for management. Journal of Forestry, 103: 357-362.

USDA Forest Service. 1988. Plumas Nation Forest land and resource management plan. Pacific Southwest Region, San Francisco, CA.

USDA Forest Service. 2004. Sierra Nevada forest plan amendment, final supplemental environmental impact statement. Pacific Southwest Region, Vallejo, CA.

USDA Forest Service. 2008. Natural resource information system: field sampled vegetation – common stand exam user's guide.

USDA Forest Service. 2011. Road system operations and maintenance handbook, chapter 40 – highway safety program. FSH 7709.59_40. National Headquarters, Washington, DC.

USDA Forest Service. 2015. Draft interim recommendation for the management of California spotted owl habitat on National Forest System lands. May 29, 2015. Unpublished.

USDA Forest Service. 2016a. Air Quality. Unpublished.

USDA Forest Service. 2016b. Gibsonville healthy forest restoration project: silviculture report. Unpublished.

USDA Forest Service. 2016c. Gibsonville healthy forest restoration project minerals report. Unpublished.

USDA Forest Service. 2016d. Gibsonville healthy forest restoration project hydrology report. Unpublished.

USDA Forest Service. 2016e. Gibsonville healthy forest restoration project soils report. Unpublished.

USDA Forest Service. 2016f. Gibsonville healthy forest restoration project: biological assessment for threatened, endangered and proposed aquatic species and biological evaluation for Forest Service sensitive aquatic species. Unpublished.

USDA Forest Service. 2016g. Gibsonville healthy forest restoration project botany biological assessment and biological evaluation. Unpublished.

USDA Forest Service. 2016h. Gibsonville healthy forest restoration project biological evaluation for protected and Forest Service sensitive terrestrial wildlife species. Unpublished.

USDA Forest Service. 2017a. Gibsonville recreation and scenery resources report. Unpublished.

USDA Forest Service. 2017b. Gibsonville project cultural resources report and effects report. Unpublished.

USDA Forest Service. 2017c. Gibsonville project fire and fuels report. Unpublished.

USDI Fish and Wildlife Service. 2005. Endangered and threatened wildlife and plants: 90-day finding on a petition to list the California spotted owl as threatened or endangered. Federal Register. Vol. 70, No. 118.

USDI Fish and Wildlife Service. 2006. Notice of 12-month petition finding for the California spotted owl. Federal Register. Vol. 71, No. 100.

USDI Fish and Wildlife Service. 2008. Quarterly species list for the Plumas National Forest. USFWS Reference No. 1-1-03-SP-1810. Reviewed electronically for updates from USDA-FS District Office on May 2016.

USDI Fish and Wildlife Service. 2016. Endangered and threatened wildlife and plants; designation of critical habitat for the Sierra Nevada yellow-legged frog, the northern distinct population segment of mountain yellow-legged frog, and the Yosemite toad. Federal Register. 81(166): 59046-59119.

Verner, J., K.S. McKelvey, B.R. Noon, R.J. Gutierrez, G.I. Gould and T.W. Beck. 1992. The California spotted owl: a technical assessment of its current status. Pacific Southwest Research Station, USDA Forest Service, Albany, CA.

Wayman, R. and M. North. 2007. Initial response of a mixed-conifer understory plant community to burning and thinning restoration treatments. Forest Ecology and Management. 239: 32-44.

Weatherspoon, C.P. and C.N. Skinner. 1996. Landscape-level strategies for forest fuel management. In Sierra Nevada Ecosystem Project (SNEP) – Final report to Congress. Status of the Sierra Nevada: Volume II, Assessments and Scientific Basis for Management Options. University of California, Davis. 1167-1176.