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Gibsonville Healthy Forest Restoration Project: Silviculture Report

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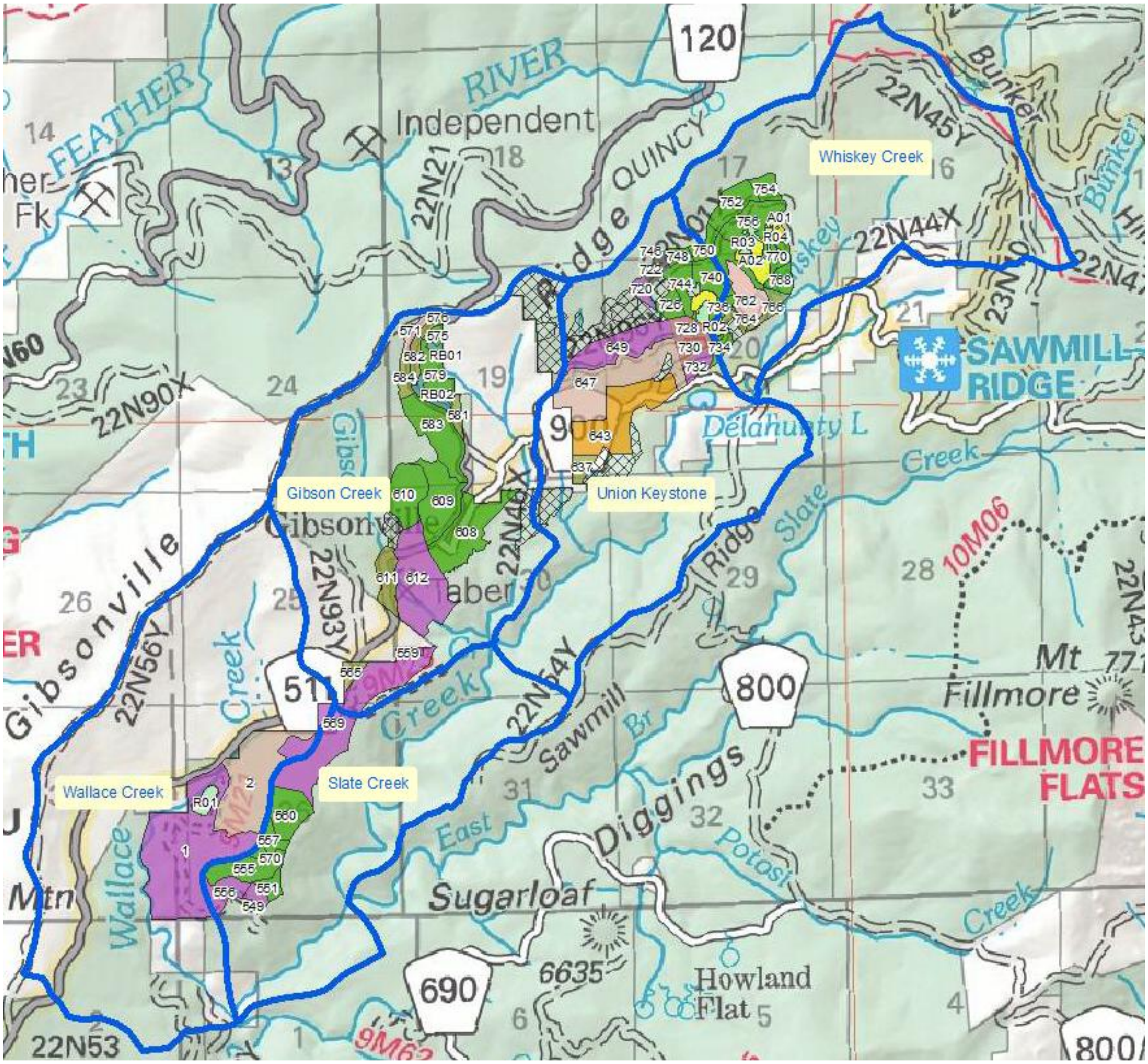

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Introduction

The Forest Service proposes to reduce the risk of wildfire, to protect, restore, and enhance forest ecosystem components (i.e., streams, meadows, aspen areas) in the vicinity of Gibsonville, California. A combination of hazard tree removal, forest health, and fuels reduction treatments are proposed on 1,200 acres of Forest Service system lands. These actions are proposed to be implemented on the Feather River Ranger District of the Plumas National Forest.

Description of Alternatives

The following are brief descriptions of the alternatives analyzed for this proposal.

Alternative A - While this alternative takes no action at this time, on-going activities such as routine road maintenance, fire suppression, and recreation may still occur in this area. This alternative serves as a baseline against which to compare the action alternative. Under Alternative A, no fuels treatments, forest health or restoration treatments would be implemented to accomplish the purpose and need. The intent and the desired condition set forth in the 1988 Plumas National Forest Land and Resource Management Plan (PNF LRMP) (USDA 1988), as amended by the Sierra Nevada Forest Plan Amendment (SNFPA) FSEIS and ROD (USDA 2004a,USDA 2004b), would not be achieved. While no costs would be incurred with the "no" action alternative, hazard tree removal, no fuels reduction, or economic benefit would be extended to the rural communities as a result of this project.

Alternative B - This alternative seeks 1) to protect, enhance and restore riparian, meadows, aspen areas and spotted owl and goshawk protected activity centers and territories; 2) remove hazard trees and reduce fuel ladders along roads, thereby increasing firefighter and transportation safety; 3) enhance forest health, increase tree vigor, reduce tree mortality and susceptibly to insect, disease and drought by reducing tree densities; 4) and provide some economic benefit utilizing sawlogs and biomass.

Proposed treatments would include a combination of variable density thinning, thinning from below, biomass removal, mastication, hand thinning, and prescribed fire. Alternative B is designed to the fullest extent possible incorporating the General Technical Report GTR-220 (North et al. 2009) and GTR-237 (North et al. 2012) and fulfills land management direction and the standards and guidelines for the 2004 SNFPA ROD land allocations (USDA 2004b).

Alternative C - This alternative was developed to analyze an alternative consistent with the *Draft Interim Recommendations for the Management of California Spotted Owl Habitat on National Forest System Lands 29 May 2015*. Alternative C would also have the same goals and objectives as listed in Alternative B above, but to a lesser extent.

Proposed treatments would be similar to Alternative B and would include a combination of variable density thinning, thinning from below, biomass removal, mastication, hand thinning, and prescribed fire. However, there would be less acres of variable density thinning and more acres of hand cutting and piling and no treatment areas. Alternative C is designed to the fullest extent possible incorporating the General Technical Report GTR-220 (North et al. 2009) and GTR-237 (North et al. 2012) and fulfills land management direction and the standards and guidelines for the 2004 SNFPA ROD land allocations (USDA 2004b).

Description of Treatments

The Forest Service would use specific treatment methods to achieve the desired results for the project. The following list briefly describes the treatment methods proposed:

Hazard Tree Removal: Removal of trees deemed hazardous or dangerous based on Forest Services handbook standards for identifying such trees. This is generally done within two tree heights, or approximately 200 feet, from roads or structures.

Mechanical Thinning (timber removal): Removal of saw-timber sized trees (10 - 29.9 inches diameter breast height (DBH)) to thin the stand and remove ladder and canopy fuels. The goal is to increase ground-to-crown height, increase spacing between trees, and increase the spacing between tree crowns. Approximately 40 percent canopy cover would be retained on average over all treatment units, with a 30% canopy cover target near roads transitioning to 50% canopy approximately 200 feet from roads. The purpose of the 30% canopy cover standard near roads is to create safer conditions for firefighters to establish a fireline there. A fire will generally "lay down" to a ground fire when the flames cannot move from treetop to treetop.

Removal of conifers less than 30 inches DBH by individual tree selection using variable density thinning (VDT) in areas beyond the 200-feet road corridor buffer, aspen stands, meadow potential zones, and the Gibsonville town site resulting in 40 percent average canopy cover. Roadside thinning would be thinning from below to remove small and medium sized trees first and generally retaining the largest healthiest trees. VDT is a compilation of various thinning treatment elements: a) structural thinning and b) radial release of fire-resilient legacy trees.

Removal of conifers by individual tree selection within aspen stands including sawlogs 10 inches in diameter at breast height (DBH) and greater, as well as biomass conifers 3 inches to 9.9 inches DBH. Select ponderosa and Jeffrey pine trees greater than 30 inches DBH will 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 meadows as well as the prolific seeding that is common for white fir.

The priority for thinning would be the removal of the smaller, suppressed, and intermediate-crown class trees (10-16 inches DBH), and removal of some co-dominant and dominant trees with crowns underneath and adjacent to healthy large trees. The preferred species for residual trees in this are shade-intolerant species where they exist. In order of preference, the shade-intolerant species are ponderosa pine, Jeffrey pine, black oak, sugar pine, Douglas-fir, incense-cedar, and true fir.

Mechanical thinning generally utilizes wheeled or tracked processing machines that cut, buck and limb trees onsite. Often, a separate machine carries or drags the logs to the landing area where they are stacked and stored for transport to a mill.

Biomass Removal: Removal of surface and ladder fuels (trees 3.0 - 9.9 inches) following the guidelines stated above for mechanical thinning. Many ladder fuels fall into this size range. Biomass removal allows the option for these trees to be sold for small log uses rather than cut, piled and burned on site.

Mastication: Removal 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 would be masticated, unless the trees are needed for the desired spacing. Most masticated trees would be less than 6 inches DBH.

Hand cut and pile (hand pile): Removal of shrubs and trees up to 10 inches DBH by manually cutting using chainsaws. These ground and ladder fuels are removed from beneath overstory trees, and/or aggregations of small-diameter conifers or plantation trees. The spacing of residual conifers and black oaks would be generally 18-24 feet to allow retention of the healthiest, largest, and tallest conifers and black oaks and to avoid creating openings where future regrowth would be likely.

Under burning and pile burning: The cut trees, shrubs, and existing slash would be manually piled and burned. Under burning is prescribed ground fire designed to reduce fuels on the ground.

Sporax Treatment: To prevent the spread of Heterobasidion (occidentale or irregulare) root disease, the use of sodium tetraborate decahydrate (a fungicide treatment) is proposed for use in areas with evidence of root rot. As a simple rule, Heterobasidion irregulare can kill ponderosa pine, Jeffrey pine, sugar pine, Coulter pine, incense-cedar, western juniper, and pinyon pine, while H. occidentale can kill true firs, hemlock, Douglas-fir, and giant sequoia. Sporax 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. All stumps would be treated the same day or within 24 hours of cutting to maximize incorporation of the product into the stump while the stump is still moist. Sporax is typically applied at a rate of one pound per 50 square feet of stump surface. The application of Sporax will not be allowed within any riparian conservation areas (RCA) or streamside management zones (SMZs). Also see Appendix E, F and G, for the number of acres that would be treated with sporax, the evaluation of human and ecological risk, and the herbicide/pesticide safety spill plan

Regulatory Framework

The Gibsonville Healthy Forest Restoration Project is designed to fulfill the management direction specified in the 1988 Plumas National Forest Land and Resource Management Plan (PNF LRMP) (USDA 1988), as amended by the Sierra Nevada Forest Plan Amendment (SNFPA) FSEIS and ROD (USFS 2004a, USFS 2004b). Fuel and vegetation management activities are designed to comply with the standards and guidelines as described in the SNFPA FSEIS and ROD (USFS 2004b).

National Forest Management Act

The *National Forest Management Act* of 1976, including its amendments to the *Forest and Rangeland Renewable Resources Planning Act* of 1974 state that it is the policy of the Congress that all forested lands in the National Forest System be maintained in appropriate forest cover with species of trees, degree of stocking, rate of growth, and conditions of stand designed to secure the maximum benefits of multiple use sustained yield management in accordance with land management plans. Both acts also state “insure that timber will be harvested from National Forest System land only where -

(i) there is assurance that such lands can be adequately restocked within five years after harvest;

(ii) that soil, slope, or other watershed conditions will not be irreversibly damaged;

(iii) that protection is provided for streams, streambanks, shorelines, lakes, wetlands, and other bodies of water from detrimental changes in water temperatures, blockages of water courses, and deposits of sediment, where harvests are likely to seriously and adversely affect water conditions or fish habitat; and

(iv) tthat he harvesting system to be used is not selected primarily because it will give the greatest dollar return or the greatest unit output of timber (16 U.S.C. 1604 (g)(3)(E)).

National Forest Management Act findings for the Gibsonville Healthy Forest Restoration Project are discussed in the Appendix D of this document.

Plumas National Forest Land Management Plan (1988) as amended by the Sierra Nevada Forest Plan Amendment FSEIS and ROD (2004)

The Gibsonville Healthy Forest Restoration Project is designed to fulfill the management direction specified in the 1988 Plumas National Forest LRMP, as amended by the SNFPA ROD of 2004. Standards and guidelines for fuels and vegetation management activities for Gibsonville project area are shown in Table 1 of the SNFPA ROD. Table 1 includes direction for designing and implementing fuel and vegetation management activities within each of the various land allocations within the project area. The desired condition as described for the wildland urban intermix defense and threat zones contain stands that are fairly open and dominated by larger, fire tolerant trees; surface and ladder fuel conditions make crown fire ignition highly unlikely; the openness and discontinuity of crown fuels, both horizontally and vertically, result in very low probability of a sustained crown fire; and tree density has been reduced to a level consistent with the site's ability to sustain forest health during drought conditions.

Scope of the Analysis

The scope of analysis in determining the environmental consequences (i.e., direct, indirect, and cumulative effects) for each of the alternatives can also be narrowed down in scope to a geographic boundary (i.e., a Forest, a Ranger District, a management area, a timber compartment, a watershed, a sub-watershed, project area, etc.) and a temporal (i.e., 1 year, 10 years, 100 years, etc.) boundary. Each resource area (i.e., aquatics, botanical, hydrological, timber, wildlife, etc.) may have different geographical and temporal boundaries.

Geographic Boundary for the Analysis

Vegetation management activities have localized effects on vegetation attributes such as canopy cover, tree density, and tree size and are generally confined to the treated area. Therefore, the existing conditions, direct, and indirect effects analyses of vegetation resources are geographically bounded to the Gibsonville Healthy Forest Restoration Project area.

The Gibsonville Healthy Forest Restoration Project cumulative effects and seral stage diversity analysis is geographically bound to the sub-watershed area identified in the cumulative watershed effects (CWE) analysis area boundary. Seral stage diversity can be described as the horizontal arrangement of different age groups of vegetation across the landscape. The desired conditions for maintaining various seral stages by vegetation type, size class, and canopy cover does not include lands from private property. Therefore, harvest or thinning projects on private property were not considered for seral stage diversity analysis.

Time Frame Boundary

The time frame for vegetation cumulative effects is approximately 20 to 25 years. The western slope of the Sierra Nevada in the Plumas National Forest has a high rate of vegetation establishment and growth due to high annual precipitation and highly productive forest soils. Within this time frame, vegetation generally has sufficient opportunity to increase canopy closure, basal area, and tree density to a point where subsequent thinning would be needed again to maintain stand vigor, health, and growth. This time frame is also expected to encompass the time period for fuels reduction effectiveness (approximately 10 to 20 years).

Analysis Methods

The California Wildlife Habitat Relationships System (Mayer and Laudenslayer 1988) was used for vegetation typing. Field inventories were conducted in CWHR size class 4 (11-24" DBH) and 5 (>24" DBH) stands that are representative of the analysis area and the areas to be treated in the Gibsonville project area.

Stands were inventoried in the summer of 2013 using the current Common Stand Exam User's Guide for the Pacific Southwest Region (USDA 2008). The Common Stand Exam system is used to collect data from a series of random points located within a number of stands with a possible need for treatment. Each sample point consists of nested plots: (1) A variable radius prism (30 BAF) plot to gather data on large (greater than 4.9 inches DBH) live trees, (2) a 1/100 acre fixed radius plot for live saplings and seedlings, (3) a variable prism (10 BAF) plot for large snags (greater than 14.9 inches DBH and greater than 19.9 feet tall), (4) an 80-foot transect for collecting down woody material and down logs.

For analysis purposes, the stand data was loaded into the Forest Vegetation Simulator, a forest growth model that predicts forest stand development (Dixon 2002). The model was used to quantify existing stand conditions and to predict the effect of alternative treatments on forest development. Stand growth, mortality, regeneration, and development by stand were simulated to predict the effects of treatments over time. The FVS model output predicts average stand conditions and attributes by stand. The stand attributes analyzed include trees per acre, basal area, and canopy cover. Model outputs by stand were utilized to examine the effects of treatment over the larger landscape scale.

Model outputs have unknown variances that may sometimes be large; however, this is normal for modeling efforts, and model outputs are best evaluated in a relative rather than an absolute sense. In addition, model simulations have limited capacity to predict mortality due to drought or insect and disease outbreaks. Considering this, model outputs such as stand density and basal area provide useful metrics for determining relative risk of these effects. This further underscores that interpretation of model outputs are best evaluated in a relative sense in conjunction with professional judgment, firsthand knowledge of stand conditions, forest health evaluations, and pertinent scientific research, studies, and literature.

A Geographic Information System (GIS) was used to analyze forest vegetation on the landscape scale for the analysis area. Forest-wide vegetation typing into California Wildlife Habitat Relationships (CWHR) classifications (Mayer and Laudenslayer 1988) was done for the Plumas-Lassen Administrative Study in 2002 (VESTRA Resources, Inc. 2002). The Herger-Feinstein Quincy Library Group (HFQLG) 2005 Vegetation Mapping Project mapped areas on the Plumas National Forest not covered by VESTRA. These data were combined in a GIS to provide a complete map of the existing vegetation within the analysis area. Then this information was updated and a new existing vegetation layer for Region 5 was created and then used in this analysis. All vegetation information is displayed using CWHR vegetation typing and serves as the baseline acres for analysis. The distribution of CWHR size class and density was analyzed relative to the stand-level effects modeled by CWHR size class.

The topography, slope, and access of a unit were used to determine the most appropriate harvest system. For all treatment units in the Gibsonville project area, only ground-based systems would be used. Silvicultural prescriptions were based on a desired future stand condition and utilized data generated from common stand exam data, Forest Vegetation Simulator projections, aerial photograph interpretation, and field review.

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) Forest health measured by stand density in terms of trees per acre, basal area, and stand density index.

2) Fire resistant stand structure measured in terms of distribution of trees per acre and canopy cover by diameter size classes, species composition, and landscape structure (i.e., CWHR vegetation types, size classes, and density classes).

Trees per acre: The number and distribution of trees per acre by diameter class is an important unit of measure because it shows the effect of treatments on different size trees. High density stands also slow the rate of fire line construction by hand crews and mechanical equipment. Data from natural stands (Dunning and Reineke 1933) indicates that for well-stocked, second-growth 100- to 150-year-old mixed conifer stands, the number of trees per acre range from 71 to 165. However, the desired trees per acre in the fuels reduction units would be lower in order to ensure effectiveness of the treatments for a 10 to 20 year period. For plantations, the desired trees per acre for the second decade would lower tree density to between 100 and 150 well distributed trees per acre, and shrub cover would be maintained between 10 and 20 percent (SNFPA final EIS, volume 1, chapter 2, page 57) (USDA 2004a).

Basal area per acre: Basal area per acre is "the cross-sectional area of all stems in a stand measured at breast height and expressed per unit land area" (in this case, per acre) (Helms 1998). Basal area per acre is commonly used as a measure of stand density. This measure has been used by Oliver (1995) to describe the threshold for ponderosa pine (150 square feet per acre), above which bark beetle related mortality is expected to occur. This threshold is related to Sartwell's work (Sartwell 1971, Sartwell and Stevens 1975, Sartwell and Dolph 1976) with mountain pine beetle outbreaks as described by Powell (1999) where these "outbreaks could be attributed to two primary factors: second-growth ponderosa pine stands were even-aged and ecologically simplified when compared with the uneven "virgin" forest; and man's intentional suppression of wildfire effectively removed an important landscape-level thinning agent, which in turn caused an unnatural accumulation of stand density (basal area) as compared to virgin conditions."

For true fir stands, Oliver's research (1988) found that "plots with 200 square feet per acre or more basal area suffered the bulk of the mortality." This may allow for leaving slightly higher densities in pure true fir stands, however, Powell (1999) recommends for mixed species stands (which are prevalent in the analysis area) that the "lowest stocking-level recommendations could be selected" because other species (such true fir species) would develop acceptably under the lower densities established for the limiting species (pine species). "This is the strategy recommended by Cochran and others (1994)."(Powell 1999).

In addition, basal area per acre has also been used by Landram (2004) to develop insect risk thinning guidelines for the Eastside, transition, and Westside zones of the Plumas National Forest. For the Westside zone (Feather River Ranger District) the insect risk thinning guides for the Plumas suggest thinning down to 200 square feet per acre now and then let the stand grow to 260 square feet per acre (400 stand density index) in 20 years.

Stand density index: The concept of stand density index was first developed for even-aged stands by Reinecke (1933) to compare "the density of stocking of various stands." The relative density concept describes a stand's density relative to the maximum possible density and may serve as a proxy for a stand density relative to its carrying capacity. In general, the concept of stand density as a measure has been further developed for forest management applications for both even-aged and uneven-aged stands (Curtis

1970; Drew and Flewelling 1977, 1979; Long 1985; Long and Daniel 1990; Helms and Tappeiner 1996; Jack and Long 1996; Powell 1999; Woodall et al. 2002).

A relative density between 55 and 60 percent (Figure 1) has been described as the lower limit of the "Zone of Imminent Competition Mortality" above which trees begin to die due to competition related stress (Drew and Flewelling 1977, 1979; Long 1985; Long and Daniel 1990; Smith et al. 1997; Powell 1999; Long and Shaw 2005). For the purpose of this analysis, 60 percent was used as a measure of the onset of competition-related mortality because stress induced by competition increases tree susceptibility to drought, insects, disease, and fire. This threshold serves as an appropriate measure for forest health because stands managed below this threshold are less likely to incur mortality due to the agents mentioned above. Furthermore, Pacific Southwest Region letter of direction on "Conifer Forest Density Management for Multiple Objectives" (Blackwell 2004) directs Forest Supervisors when designing thinning projects, to ensure that density does not exceed an upper limit such as 90% of normal basal area or 60% of maximum stand density index. Also, design thinning projects to ensure that this level will not be reached again for at least 20 years.

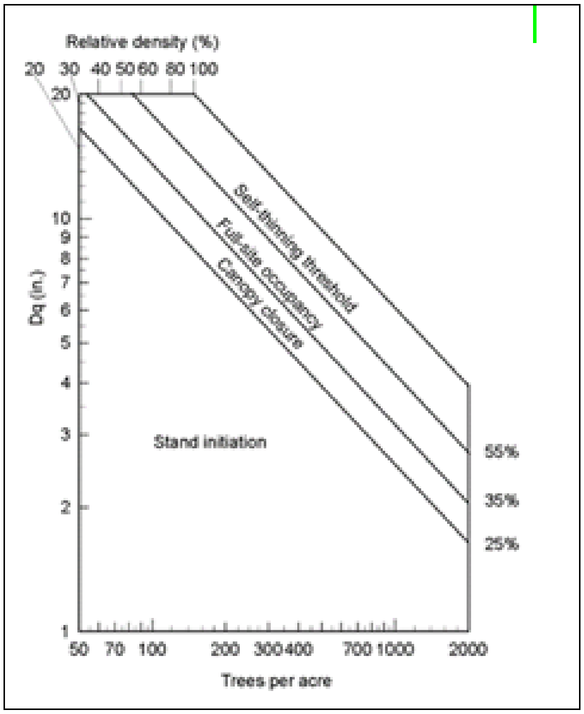


Figure 1. Relative Density Chart

For the Gibsonville project, stand density index (SDI) was not used in determining what level a stand should be thinned down to since trying to maintain a 40 or 50 percent canopy cover appears to be the limiting factor. Trees per acre and basal area were used as a unit of measure to describe how each of the alternatives responds to forest health. GTR-237 does discuss that out of the three metrics (trees per acres, basal area, stand density index) used to predict subsequent levels of bark beetle-caused tree mortality, trees per acre (TPA) was the best predictor of levels of tree mortality following fuel reduction and forest restoration treatments.

Stand Structure (diameter class distribution): Fire resistant stand structure can also be measured by the distribution of trees per acre and canopy cover by diameter classes, since it shows the effect of fuel reduction treatments on different size trees. The Gibsonville project uses a California Wildlife Habitat

Relationships System (CWHR) to show effects of treatments to the distribution of trees per acre and canopy cover by diameter classes (i.e., stand structure) (Table 1). The CWHR classifies existing vegetation types important to wildlife. The CWHR system was developed to recognize and logically categorize major vegetative complexes at a scale sufficient to predict wildlife-habitat relationships. Tree size and tree canopy cover also helps biologists determine which wildlife species may be supported by a particular ecosystem. The diameter classes are based on various aspects of fire behavior (i.e, ladder and canopy fuels, crown bulk density, etc.), wildlife habitat (i.e., tree size and canopy cover), and guidelines for reserve trees (i.e., trees greater than 30 inches DBH) upon which silvicultural prescriptions are based.

Table 1. Tree descriptions by diameter size classes

Description	Diameter at Breast Height (DBH)
Saplings	0 to 6 inches
Poles	6 to 11 inches
Small Trees	11 to 24 inches
Medium/Large Trees	24 to 30 inches
Large Trees	Greater Than 30 inches

Landscape Structure— For the purpose of this analysis, landscape structure refers to the distribution of relative successional (seral) stages on the landscape, and the relative distribution of closed-canopy and open canopy stands. This is an important indicator because it may be used as a measure of landscape heterogeneity and diversity, and as a measure of cumulative effects to forest vegetation on the landscape scale. Landscape structure is measured by calculating the distribution of these seral stages within the vegetation analysis area. The relative distribution of seral stages within the landscape is measured by using CWHR size class as a proxy for seral stage. Table 2 displays the CWHR tree size and density class categories. CWHR size class serves as an effective proxy for seral stage because it classifies forest vegetation by ranges of average tree size which represent discrete developmental stages of tree growth. CWHR density class serves an effective proxy for open and closed-canopy conditions because it classifies canopy cover. In addition, this allows for a congruent analysis of effects on forest vegetation and wildlife habitat. Forest stands were aggregated by CWHR size class because the proposed treatments, stand structure, and effects of treatments on stand structure would not substantially vary by forest vegetation type (as classified by CWHR habitat type).

Table 2. California Wildlife Habitat Relationships (CWHR) tree size and density class crosswalk with seral stage and canopy closure condition.

CWHR Tree Size Categories				CWHR Density Class Categories			
CWHR Size Class	**Tree Sizes (average)**	**Description**	**Seral Stage**	**CWHR Density Class**	**Tree Canopy cover**	**Description**	**Canopy Conditions**
1	< 1" DBH	Seedlings, but definite forest habitat	Early Seral	n/a	< 10%		Open canopy Stands
2	1 -6 " DBH	Sapling		S	10 - 24%	Sparse	
3	6 -11" DBH	Pole-sized tree		P	25 - 39%	Open	
4	11 – 24" DBH	Small Tree	Mid-seral	M	40 - 60%	Moderate	Closed canopy Stands
5	> 24" DBH	Medium/Large tree	Later Seral	D	> 60%	Dense	
6	> 24" DBH	Multilayered canopy with dense cover		n/a	> 60%		

Effects common to all action alternatives

In general, the direct and indirect effects described below would be common to all action alternatives that propose mechanical harvesting as a treatment regardless of silvicultural prescription. All treatments involving mechanical harvesting using ground-based logging systems would share similar effects that include the potential for damage to residual trees; incidental removal of snags and trees greater than 30 inches in diameter; the construction of skid trails, landings, and temporary roads to facilitate logging operations; and the creation of activity-generated slash.

Throughout all treatments, trees greater than 30 inches in diameter would be retained in accordance with the 2004 Record of Decision on the SNFPA Final Supplemental EIS (Table 2)(USDA 2004b), with the exception for operability or removes trees that pose a threat to public safety. In general, trees in the 24- to 30-inch diameter classes and the greater than 30-inch diameter classes would be the favored tree sizes to retain. These larger trees have favorable attributes in terms of fire resistance, desired stand structure, and wildlife habitat. Shade-tolerant species (such as white fir and incense-cedar) would be targeted for removal, particularly in the smaller diameter classes. Shade-intolerant species such as ponderosa pine, Jeffery pine and sugar pine would be retained. In true fir-dominated forest types, species preference would be weighted towards maintaining naturally occurring shade-intolerant species such as ponderosa and Jeffery pine; however, species composition would be maintained at levels appropriate for that ecological forest type.

Existing skid trails, landings, and temporary roads would be used, when available, to facilitate the harvesting and removal of forest products (i.e., sawlogs). Skid trails, landings, and temporary roads could be constructed under all action alternatives to facilitate the removal of forest products when existing infrastructure does not exist. New construction of skid trails, landings, and temporary roads would require incidental removal of trees beyond those described for silvicultural purposes. This may include incidental removal of trees greater than 30 inches in diameter for operability and safety. However, the location and size of skid trails, landings, and temporary roads, and the trees harvested for the construction of such facilities must be approved and agreed upon by the Forest Service. The removal of trees for operability would be incidental and minimized, and therefore, would have negligible effects on stand structure.

All action alternatives propose to use whole-tree *yarding* to treat slash generated by harvest activity, with the exception of leaving cull logs 20 inches DBH and above out in the woods for wildlife purposes. The removal of limbs and tops by such methods would greatly reduce activity-generated surface fuels (Agee and Skinner 2005). Underburning would be used, as determined by post-treatment evaluations, to reduce activity-generated and existing fuels.

Affected Environment and Environmental Consequences

For the action alternatives, effects are discussed in terms of the prescriptions proposed for each treatment type. Prescriptions with similar effects are grouped together for the purposes of this analysis. Prescriptions for treatments are broken down into three groups for this effects analysis: 1) Mechanical thinning, including variable density,thinning from below, and hazard tree removal, 2) Mastication, hand cutting, and piling (hand, tractor, or grapple), and 3) Pile burning and underburning.

There is a description of the existing condition for each indicator, followed by a summary of the direct, indirect, and cumulative effects of the alternatives. Direct effects are likely to be limited to the project implementation phase. Indirect effects would last beyond the implementation period and occur within the temporal bound of the cumulative effects analysis. In order to understand the contribution of past actions to the cumulative effects of the proposed action and alternatives, this analysis relies on current environmental conditions as a proxy for the impacts of past actions. This is because existing conditions reflect the aggregate impact of all prior human actions and natural events that have affected the environment and might contribute to cumulative effects,

This cumulative effects analysis does not attempt to quantify the effects of past human actions by adding up all prior actions on an action-by-action basis, but relies on current environmental conditions as a proxy for the impacts of past actions.

Forest Health Indicator

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 may increase beyond endemic levels associated with forest health. Stand 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.

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 2013).

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 (*Neodiprion abietis*) 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 2013).

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 (*Cronartium ribicola*) 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 (*Arceuthobium* spp.) is also present in these forest types. Dwarf mistletoes (*Arceuthobium* spp.) 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 *(Cytospora abietis)* 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.

Aspen forest types and health have declined in their extent compared to historic occurrences (Shepperd et al. 2006). 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. 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). Finally, aspen regeneration is compounded by deer browsing in some areas.

Table 3 displays the current snag data (trees per acre) by diameter classes for the Gibsonville and Thistle Shaft locations. See Gibsonville Wildlife report about discussion on snags.

Table 3. Snag trees per acre by diameter classes and by location.

Location	0-15" DBH (Trees per acre)	15-30" DBH (Trees per acre)	>30" DBH (Trees per acre)	>15" DBH (Trees per acre)	0-99" DBH (Trees per acre)
Gibsonville	50.5	12.0	2.6	14.6	65.1
Thistle Shaft	34.9	7.0	0.5	7.4	42.3

Alternative A (No Action) – Direct and Indirect Effects

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.

Under Alternative A, the no action alternative, existing stand 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 4 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 *4*. 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 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 under alternative A, 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).

Under alternative A, 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 (SNEP 1996, volume II, chapter 45, pages 1177–1192) 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.

Aspen stands would continue to decline under Alternative A. The aspen patches in the project area are trapped between areas too wet for them to survive (saturated meadows or riparian hardwood communities such as alder bogs) and neighboring conifer forests that are overtopping aspen by growing around and within them. Regeneration is scarce in all but some small portions of the 23 acres as conifer shade is inhibiting aspen sprouts.

Alternative B (Proposed Action) – Direct and Indirect Effects

Mechanical thinning (hazard tree, variable density, thinning from below)

Hazard tree removal, variable density, and thinning from below would remove poor vigor, diseased, and damaged trees. In addition, thinning some of the suppressed, intermediate, and codominant tree classes would help maintain 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 maintained or 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, Wood, and Scarlett 1978; DeMars and Roettgering 1982).

Conifer basal area, trees per acre and canopy cover would be reduced to minimal proportions within aspen stands. Select ponderosa and Jeffrey pine trees greater than 30 inches DBH will be retained for wildlife purposes, structure, and species diversity as well as retention of exceptionally large conifers for aesthetic value. Adult aspen, where existing, are expected to be released from conifer competition and young aspen are expected to sprout due to released light and water resources needed for regeneration. Some aspen trees may be damaged by harvesting operations. Damage to the crown or breakage of the bole would cause suckering to take place in aspen. Aspen has a shallow root system and is susceptible to windthrow in some situations. Removal of conifers surrounding aspen may predispose some aspen to windthrow.

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 5 and 6, thinning down to 30 percent or 40 percent of residual canopy cover comes close in meeting the 200 square feet of basal requirement. However, thinning down to 50 percent or 60 percent of residual canopy cover still leaves the stand overstocked and subject to potential insect and disease attacks and subsequent mortality and high fire risk.

Alternative B would meet the requirements of 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).

Alternative B would improve aspen health and vigor and encourage aspen regeneration by removing overtopping conifer within and adjacent to the aspen stands. Removal of competing conifers allows full sunlight to reach the forest floor and will enhance any natural sucker production that is already occurring in declining aspen clones (Shepperd et.al. 2006). It also has the advantage of retaining any remaining old aspen trees for aesthetic and wildlife purposes (Shepperd 2004).

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%

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%

Biomass removal, mastication, hand cutting, and hand piling

Thinning (biomass, mastication, or hand cutting) would occur in plantations and pole size up to large tree size 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.

The removal of competing conifers and brush through mastication would result in better individual tree growth and vigor of remaining conifers. There may also be an opportunity to selectively remove dwarf mistletoe infected trees, which would limit the spread of dwarf mistletoe to adjacent uninfected trees.

Thinning (biomass, mastication, or hand cutting) would reduce the risk of bark beetle mortality in each stand. When periodic droughts and their associated bark beetle epidemics occur, there is a low probability of extensive pine mortality in the thinned stands. Maintaining good stand growth and vigor would reduce the risk of beetle populations increasing and attacking adjacent stands. Because the conifer stands are currently in the most vigorous growth period of their lifespan, stand densities could again approach undesirable densities within 10 to 20 years after treatment.

Pile burning and Underburning

Prescribed fire treatments would reduce trees per acre by causing fire-induced mortality primarily in the 1 to 10 inch diameter classes and some mortality in the 10 to 20 inch diameter classes (future snags). Mortality in the larger diameter classes may occur as the result of torching and/or delayed conifer mortality as a result of fire-damage and subsequent bark beetle attack.

Overstory canopy is usually not affected by underburning, although torching of individual or small groups of trees can occur where high surface fuel concentrations and ladder fuels occur together. Localized torching from underburning would provide some small openings in the overstory where shade-intolerant species may become established and grow, depending upon the opening size.

Underburning may also enhance aspen suckering and sprouting. Burned plots in an aspen stand had fewer trees and saplings but more seedlings compared to unburned plots indicating that fire removed some overstory trees but increased sprouting (5900 sprouts/burned acre to 2967 sprouts/unburned acre (Cluck 2012).

Prescribed burning is nonselective and may not remove diseased or dwarf mistletoe infected trees. Within the treatment area, dwarf mistletoe trees in the overstory would continue to infect the understory trees and adjacent stands.

Alternative C (Spotted Owl Interim Guidelines) – Direct and Indirect Effects

Mechanical thinning (hazard tree, variable density, thinning from below)

Alternative C would have similar, but slightly less affects to forest health and the stand attributes (i.e., basal area, trees per acres) as Alternative B. Alternative C would treat 116 fewer acres (9.7 percent of the treatment acres) under variable density thinning and would not treat an additional 25 acres (2.1 percent of the treatment acres (Table 7). Pre-commercial thinning (less than 10" DBH) alone would not be quite as effective in reducing overall basal area and trees per acre when compared to commercial thinning (greater than 10" DBH).

Table 7. Comparison of treatment acres by alternative.

Proposed Treatments	Alternative B (Acres)	Alternative C (Acres)	Difference (Acres)
Aspen Release and Biomass	23	23	
Hand cut pile burn and Underburn	345	435	+91
Masticate and Underburn	18	18	
Masticate and Underburn and Biomass	26	26	
Masticate or Hand cut pile burn or Underburn	137	137	
Meadow Restoration and Biomass	9	9	
No Treatment	146	171	+25
Riparian Restoration	16	16	
Roadside Hazard and Hand cut pile burn	54	54	
Roadside Hazard and Hand cut pile burn and Biomass	61	61	
Underburn	7	7	
Variable density thin to an average of 40% canopy cover and Underburn and Biomass	359	243	-116
Grand Total	1,200	1,200	0

Biomass removal, mastication, hand cutting, and hand piling

Alternative C would have similar affects to forest health as Alternative B. Alternative C would treat an additional 91 acres under hand cutting and piling than Alternative B (Table 6).

Pile burning and Underburning

Alternative C would have similar affects to forest health as Alternative B. Alternative C would treat an additional 91 acres under hand cutting and piling than Alternative B (Table 6).

Fire Resistant Stand Structure Indicator

As with many areas in the Sierra Nevada, the landscape in the analysis area has been heavily influenced over the last 150 years by past management activities that include mining, grazing, timber harvesting, fire exclusion, large high-severity fires (Beesley 1996; McKelvey and Johnston 1992), and more recent drought-related mortality during the late 1980s and early 1990s (Guarin and Taylor 2005; Ferrell 1996; Macomber and Woodcock 1994). Past harvest activities were primarily focused on overstory removal and sanitation or salvage harvest, with a shift toward even-aged systems in the 1980s. Past use of these harvest systems is consistent with well-documented overall management practices that occurred over vast areas of the Sierra Nevada during the 20th century (Leiberg 1902). With respect to the removal of ponderosa and Jeffrey pine, and the resulting increase in the occurrence of white and red fir in the watershed of the South Fork of the Feather River and North Fork of the Yuba River, John Leiberg (1902) noted:

> *"Some red and white fir has been taken, together with most of the yellow and sugar pine which grew on these tracts [south of the South Fork of the Feather River" (page 91)* and *"The cutting has been largely selective [in the North Fork of the Yuba River Basin], the yellow and sugar pine being taken, while most of the red and white fir remains" (page 102).*

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. Figures 2 and 3 displays the existing average species composition for CWHR size class 4 and 5 stands. 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.

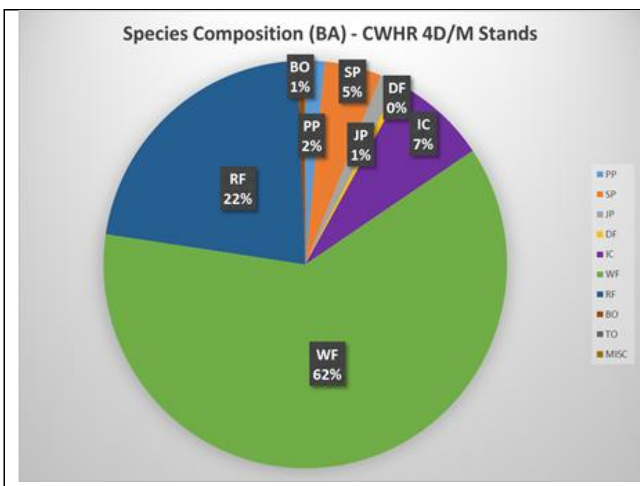


Figure 2. Species composition for CWHR 4 size class stands.

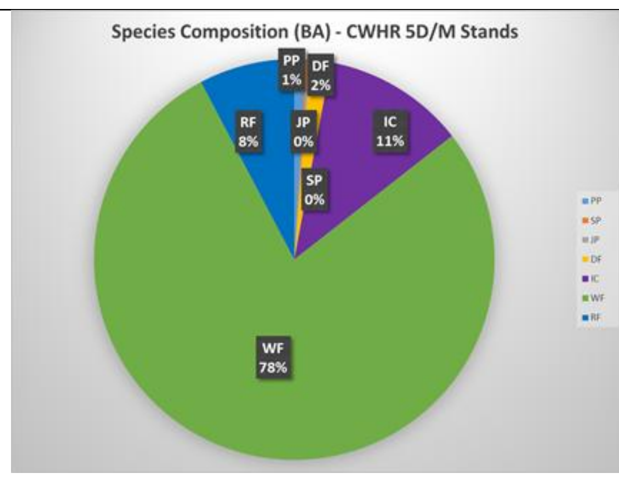


Figure 3. Species composition for CWHR 5 size class stands.

The elevation in the project area ranges from 5,200 feet near Wallace and Slate Creek to 6,400 feet near Gibsonville Ridge. 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 8).

Table 8. Description of forest types found in the project area.

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

There are fewer large (greater than 30 inches DBH) Jefrrey 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

The typical mixed conifer type includes shade-tolerant species (i.e., incense-cedar, red fir, and white fir) 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.

Stand Structure (diameter class distribution): 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 trees per acre and canopy cover percent by CWHR diameter classes are shown in Table 9.

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 stands have high densities of trees, particularly in the 1-11 inch diameter class range, and most stands have moderate densities in the 11-24 inch 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. These high stand densities also increase stress on larger more desirable retention trees due to increased tree competition for water during extended drought periods.

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. There is currently little opportunity for the naturally dominant pine species to reestablish and regenerate themselves without disturbance or naturally created openings.

***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	Total Sub-Watershed Acres (3,952)	Percent of Total Acres
Vegetation type diversity	Barren (includes water and wet meadow)	123	3.1%
	Shrub Types (montane chaparral)	514	13.0%
	Oak woodland, foothill pine		
	Montane hardwoods		
	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%
	1) Seedling (less than 1 inch DBH)		
	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%**

Notes: Total sub-watershed acres does not include acres from private land.

Table 11 displays the existing California wildlife habitat relationship (CWHR) vegetation types, size classes, and density classes within the Gibsonville sub-watersheds.

Table 11. Existing acres of CWHR vegetation type, size class, and density within the Gibsonville project area sub-watersheds.

CWHR	Gibson Creek	Slate Creek	Union Keystone	Wallace Creek	Whiskey Creek	Grand Total	Percent
AGS	2					2	0.1%
BAR	0	13	67		25	104	2.6%
LAC			6		1	7	0.2%
MCP	82	306	74	4	47	514	13.0%
MRI2D			3		2	5	0.1%
PPN3P				3		3	0.1%
RFR2P					0	0	0.0%
RFR2S					4	4	0.1%
RFR3M	1					1	0.0%
RFR4M	59				6	65	1.6%
SMC3D		9		7		16	0.4%
SMC3M			14			14	0.4%
SMC3P	15		12	8	72	107	2.7%
SMC3S	6	3	37		23	69	1.7%
SMC4D	76	111	284	118		589	14.9%
SMC4M	37	62	15	68	52	233	5.9%
SMC4P	123	5	22	5	30	185	4.7%
SMC4S		3		3	4	10	0.3%
SMC5D	261	10				270	6.8%
SMC5M		11	28	60		100	2.5%
SMC5P		18	10		8	37	0.9%
WFR3D	3	61		77		141	3.6%
WFR3M	21			6	4	30	0.8%
WFR3P	5	2	99	2		108	2.7%
WFR3S	4	5	9		59	76	1.9%
WFR4D	116	6	175		210	506	12.8%
WFR4M	22	20		43	319	403	10.2%
WFR4P	10	9	24		56	99	2.5%
WFR4S					3	3	0.1%
WFR5D		39	38	71		148	3.7%
WFR5M	0	41		7		48	1.2%
WFR5P		10	14		27	50	1.3%
WTM				4		4	0.1%
TOTALS	**842**	**744**	**931**	**485**	**950**	**3,952**	**100.0%**

Notes: AGS = grassland; BAR = barren; LAC = Lacustrine; MCP = montane chaparral; MRI =montane riparian; PPN = ponderosa pine; RFR red fir; = SMC = Sierra mixed conifer. WFR = white fir, WTM = wet meadow. See Table 2 for size and density classes.

Total sub-watershed acres does not include acres from private land

Alternative A (No Action) – Direct and Indirect Effects

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

Under Alternative A, the analysis area 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 et al. 1996). 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 such as white fir, 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).

Under Alternative A, trees in the suppressed and intermediate crown classes would continue to provide ladder fuels into the overstory crown canopy. Existing conditions across the project area, including multiple size classes, high trees per acre, and dense canopy indicate high fuel ladder potential and interlocking crowns capable of sustaining crown fires (Table 12 and Figure 4).

Table 12 - Before thinning 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.

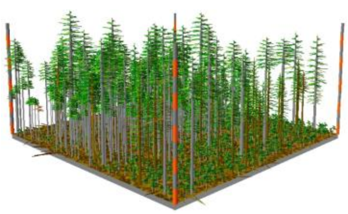
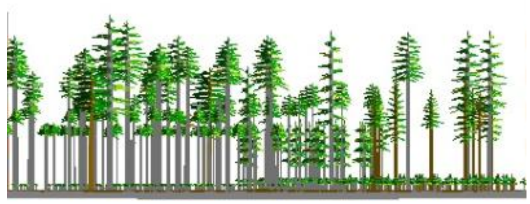
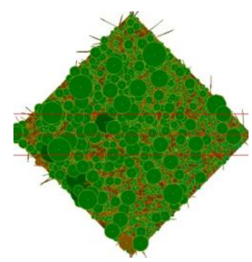
3-D VIEW	PROFILE VIEW	OVERHEAD VIEW
 Existing 60% Canopy Cover	 Fuel Ladder Structure for Existing 60% Canopy Cover	 Existing Canopy Cover

Figure 4. Example stand visualization simulation (SVS) stand structure views for CWHR 4D/M stand.

Landscape Structure: For the purpose of this analysis, landscape structure refers to the distribution of relative successional (seral) stages on the landscape, and the relative distribution of closed-canopy and open canopy stands. This is an important indicator because it may be used as a measure of landscape heterogeneity and diversity, and as a measure of cumulative effects to forest vegetation on the landscape scale. Landscape structure is measured by calculating the distribution of these seral stages within the vegetation analysis area. The relative distribution of seral stages within the landscape is measured by using CWHR size class as a proxy for seral stage. Table 13 a displays the current distribution of CWHR vegetation types, size class and density values (canopy cover) for Alternative A. Since no treatments are being proposed under Alterative A, landscape structure within each sub-watershed would not change (Table 14).

Table 13. Project level landscape structure (veg type, size and density classes) acres for Alternative A.

VEG TYPE	X (Ac)	2D (Ac)	3D (Ac)	3M (Ac)	3P (Ac)	3S (Ac)	4D (Ac)	4M (Ac)	4P (Ac)	4S (Ac)	5D (Ac)	5M (Ac)	Grand Total (Acres)
AGS	2												2
BAR	1												1
MCP	13												13
MRI		3											3
PPN					3								3
RFR								6					6
SMC			12	4	21	0	329	82	17	0	202	1	669
WFR			81	10	3	11	307	63	24				500
WTM	4												4
Total Acres	**20**	**3**	**93**	**15**	**27**	**12**	**637**	**151**	**41**	**0**	**202**	**1**	**1,200**

Notes: AGS = grassland; BAR = barren; MCP = montane chaparral; MRI =montane riparian; PPN = ponderosa pine; RFR = red fire; SMC = Sierra mixed conifer. WFR = white fir, WTM = wet meadow. See Table 2 for size and density classes.

Table 14. Existing acres of CWHR size and density classes within the Gibson project area sub-watersheds for Alternative A.

CWHR Size and Density Class	Gibson Creek	Slate Creek	Union Keystone	Wallace Creek	Whiskey Creek	Grand Total
X	85	319	146	8	73	631
2D			3		2	5
2P					0	0
2S					4	4
3D	3	70		84		157
3M	22		14	6	4	46
3P	20	2	111	12	72	217
3S	10	7	46		82	145
4D	192	117	459	118	210	1,095
4M	118	82	15	111	376	702
4P	133	14	46	5	86	284
4S		3		3	7	13
5D	261	49	38	71		419
5M	0	52	28	67		148
5P		28	24		35	87
Total Acres	842	744	931	485	950	3,952

Notes: See Table 2 for size and density classes. Sub-watershed acres does not include acres from private land.

Alternative B (Proposed Action) – Direct and Indirect Effects

Mechanical thinning (hazard tree, variable density, thinning from below)

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). 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 15).

Table 15. 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 apen, 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. Tables 16 and 17 displays the after thinning results of the stand structure (trees per acre and canopy cover by DBH classes) of the various CWHR size and density classes (i.e., 4D/M, and 5D/5M). Some CWHR 4 and 5 stands adjacent to roads would receive heavier thinning (removal of more trees and thin down to 30% canopy cover) 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 thin down to 50% 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. Figure 5 shows a visualization of stand structure by 30, 40, 50, and 60 percent canopy cover percent.

Table 16. After thinning stand structure for CWHR 4D/M stands by trees per acre and canopy cover percent.

Residual Canopy Cover	Trees per acre stand structure by DBH size classes and residual canopy cover					
	1-6"	6-11"	11-24"	24-30"	>30"	Total
Existing	630	41	50	15	24	760
30%	8	7	10	4	24	53
40%	28	12	19	8	24	91
50%	31	20	35	13	24	122
60%	68	34	46	14	24	186
Residual Canopy Cover	**Canopy Cover stand structure by DBH size classes and residual canopy cover**					
	1-6"	6-11"	11-24"	24-30"	>30"	Total
Existing	14	9	19	11	26	52
30%	0	2	5	3	26	34
40%	2	3	9	7	26	40
50%	2	5	15	11	26	47
60%	4	8	18	11	26	51

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

Table 17. After thinning stand structure for CWHR 5D/M stands by trees per acre and canopy cover percent.

Residual Canopy Cover	Trees per acre stand structure by DBH size classes and residual canopy cover					
	1-6"	6-11"	11-24"	24-30"	>30"	Total
Existing	470	44	68	18	19	620
30%	7	5	16	4	19	52
40%	7	9	25	13	19	74
50%	7	15	54	18	19	113
60%	149	44	68	18	19	298
Residual Canopy Cover	**Canopy cover stand structure by DBH size classes and residual canopy cover**					
	1-6"	6-11"	11-24"	24-30"	>30"	Total
Existing	14	9	25	13	22	55
30%	0	1	7	3	22	32
40%	0	2	11	10	22	40
50%	0	3	22	13	22	50
60%	8	9	25	13	22	55

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

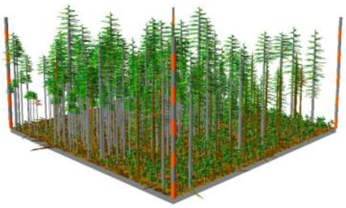
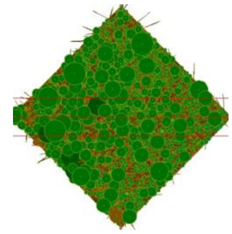
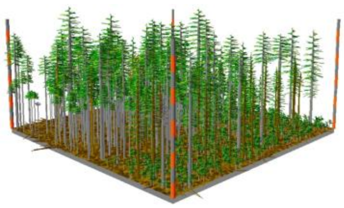
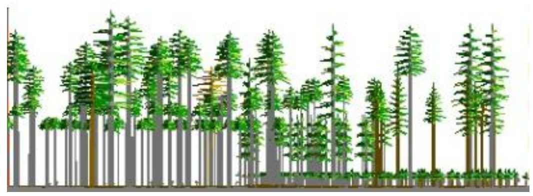
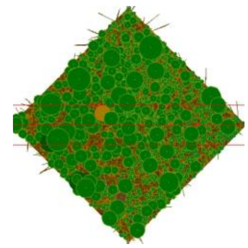
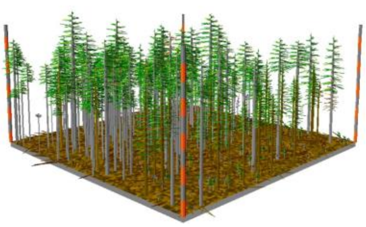
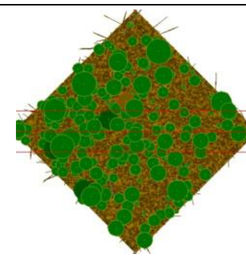
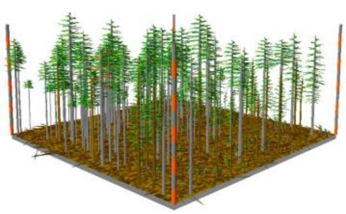
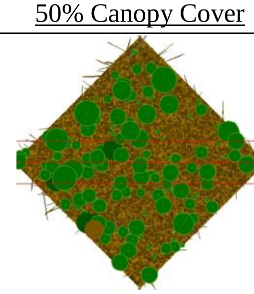
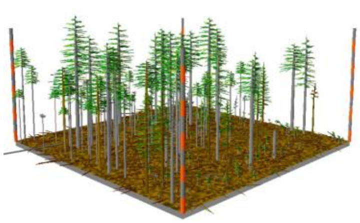
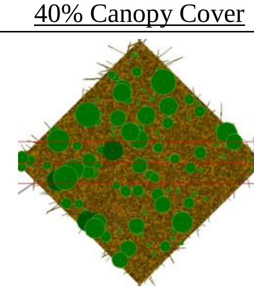
3-D VIEW	PROFILE VIEW	OVERHEAD VIEW
 60% Existing Canopy Cover	 Fuel Ladder Structure for Existing Canopy Cover	 60% Existing Canopy Cover
 Thin to 60% Canopy Cover	 Fuel Ladder Structure for 60% Canopy Cover	 60% Canopy Cover
 Thin to 50% Canopy Cover	 Fuel Ladder Structure for 50% Canopy Cover	 50% Canopy Cover
 Thin to 40% Canopy Cover	 Fuel Ladder Structure for 40% Canopy Cover	 40% Canopy Cover
 Thin to 30% Canopy Cover	 Fuel Ladder Structure for 30% Canopy Cover	 30% Canopy Cover

Figure 5. Example stand visualization simulation (SVS) comparing stand structure views for various residual canopy cover percent's.

Landscape Structure: For the purpose of this analysis, landscape structure refers to the distribution of relative successional (seral) stages on the landscape, and the relative distribution of closed-canopy and open canopy stands. This is an important indicator because it may be used as a measure of landscape heterogeneity and diversity, and as a measure of cumulative effects to forest vegetation on the landscape scale. Landscape structure is measured by calculating the distribution of these seral stages within the vegetation analysis area. The relative distribution of seral stages within the landscape is measured by using CWHR size class as a proxy for seral stage.

Table 18 displays the pre-treatment distribution of CWHR size class and density values (canopy cover) at the project level (i.e., 1,200 acres). Table 19 displays the post-treatment distribution of CWHR size class and density values (canopy cover) at the project level (i.e., 1,200 acres). Most of the changes have occurred in the 4D, 4M, 5D, and 5M size and density classes, Table 20 displays the distribution of CWHR size class and density values (canopy cover) at the sub-watershed level (i.e., 3,952 acres)..

Table 18. Pre-treatment landscape structure (CWHR size and density classes) acres by treatments for Alternative B.

Proposed Treatment	X	2D	2S	3D	3M	3P	3S	4D	4M	4P	4S	5D	5M	5P	Grand Total
Aspen Release and BIOMASS		0					1	21							23
HCPB and UB	1			39	3	13		145	106	7	0	29	1		345
MAST and UB		0						18							18
MAST and UB and BIOMASS	0					7		0	7	13		0			26
MAST or HCPB or UB	0			8				122	6						137
Meadow Restoration and BIOMASS	2				6				0	0		0			9
NT	11				4	6	5	105	10	6		0			146
Riparian Restoration	4	3					5	5							16
Roadside Hazard and HCPB	0				0	0		54	0						54
Roadside Hazard and HCPB and BIOMASS	0				0	2		16	16	0		25			61
UB	1							3		3					7
VDT 40% and UB and BIOMASS	0	0		46	1	1	1	147	5	12		147			359
Total Acres	**20**	**3**		**93**	**15**	**27**	**12**	**637**	**151**	**41**	**0**	**202**	**1**		**1,200**

Table 19. Post-treatment landscape structure (CWHR size and density classes) acres by treatments for Alternative B.

Proposed Treatment	X	2D	2S	3D	3M	3P	3S	4D	4M	4P	4S	5D	5M	5P	Grand Total
Aspen Release and BIOMASS			0				1				21				23
HCPB and UB	1				39	16		145	106	7	0	29	1		345
MAST and UB		0						18							18
MAST and UB and BIOMASS	0					7		0	7	13		0			26
MAST or HCPB or UB	0					8		122	6						137
Meadow Restoration and BIOMASS	2					6				0		0			9
NT	11				4	6	5	105	10	6		0			146
Riparian Restoration	4	3					5	5							16
Roadside Hazard and HCPB	0					0				54					54
Roadside Hazard and HCPB and BIOMASS	0					2				33				25	61
UB	1							3		3					7
VDT 40% and UB and BIOMASS	0	0		46	1	1	1		152	12			147		359
Total Acres	**20**	**3**	**0**	**46**	**44**	**45**	**12**	**398**	**282**	**127**	**22**	**29**	**147**	**25**	**1,200**
Acre differences from Alternative B Pre-Treatment	**0**	**0**	**0**	**-47**	**29**	**18**	**0**	**-239**	**131**	**86**	**21**	**-172**	**147**	**25**	**0**

Table 20. Alternative B landscape structure (size and density classes) acres within the Gibson project area sub-watersheds.

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CWHR Size and Density Class	Gibson Creek	Slate Creek	Union Keystone	Wallace Creek	Whiskey Creek	Grand Total
X	85	319	146	8	73	631
2D	0	0	3	0	2	5
2P	0	0	0	0	0	0
2S	0	0	0	0	4	4
3D	3	35	0	72	0	110
3M	16	24	14	18	4	75
3P	26	13	111	12	72	235
3S	10	7	46	0	82	145
4D	187	117	347	103	103	856
4M	107	82	62	126	456	833
4P	148	14	106	5	97	370
4S	0	3	6	3	23	35
5D	88	49	38	71	0	246
5M	147	52	28	67	0	295
5P	25	28	24	0	35	112
Total Acres	**842**	**744**	**931**	**485**	**950**	**3,952**

Notes: See Table 2 for size and density classes. Sub-watershed acres does not include acres from private land.

Biomass removal, mastication, hand cutting, and piling (hand, tractor, or grapple)

Biomass removal, mastication, and hand cutting would change the structure (by reducing ladder fuels), density, and size of fuels in the stand but would not necessarily change the total fuel loading.

Biomass removal, mastication, and hand cutting would occur in plantations and pole sized stands and would re-arrange brush and conifer tree ladder fuels less than 10 inches in diameter. Biomass removal, mastication, and 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. Trees per acre and basal area per acre would be reduced as well.

Biomass removal, mastication, and 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.

Biomass removal, mastication, and 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).

Pile burning and Underburning

Underburning is nonselective, and it may kill some dominant and codominant trees that may have otherwise been retained in mechanical treatments. Implementation of prescribed burning treatments would have a negligible to minor effect on species composition in underburn units. Localized torching from underburning would occur, thereby creating small openings in the overstory where shade-intolerant species may become established and grow, depending on size.

Prescribed fire treatments would not notably affect species composition. However, prescribed fire treatments are the first step in the process of re-introducing fire into landscapes that have not burned for decades. Multiple entries of prescribed or natural fire may favor fire adapted shade-intolerant species over decades if not a century.

Prescribed fire treatments would not notably affect stand size class and density. Prescribed fire treatments would incur mortality of the smaller diameter trees, primarily those less than 10 inches in diameter with some incidental mortality of larger trees due to torching or post-fire delayed conifer mortality. Canopy cover density could be reduced by isolated torching; however, most tree mortality resulting from prescribed fire treatments would occur in the understory which would not notably affect the overstory canopy cover.

Alternative C (Spotted Owl Interim Guidelines) – Direct and Indirect Effects

Mechanical thinning (hazard tree, variable density, thinning from below)

Alternative C would have similar, but slightly less affects to stand structure and landscape structure (i.e., , trees per acres and canopy cover by DBH size classes) as Alternative B. Alternative C would treat 116 fewer acres under variable density thinning and would not treat an additional 25 acres. 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). Table 21 displays the post-treatment distribution of CWHR size class and density values (canopy cover) at the project level (i.e., 1,200 acres) for Alternative C. Table 22 displays the distribution of CWHR size class and density values (canopy cover) at the sub-watershed level (i.e., 3,952 acres) for Alternative C.

Table 21. Post-treatment landscape structure (CWHR size and density classes) acres by treatments for Alternative C.

Proposed Treatment	X	2D	2S	3D	3M	3P	3S	4D	4M	4P	4S	5D	5M	5P	Grand Total
Aspen Release and BIOMASS				0			1				21				23
HCPB and UB	2				85	16		160	108	7	0	56	1		435
MAST and UB			0					18							18
MAST and UB and BIOMASS	0					7		0	7	13		0			26
MAST or HCPB or UB	0					8		122	6						137
Meadow Restoration and BIOMASS	2					6			0	0		0			9
NT	11				4	6	5	130	10	6		0			171
Riparian Restoration	4	3					5	5							16
Roadside Hazard and HCPB	0					0				54					54
Roadside Hazard and HCPB and BIOMASS	0					2				33				25	61
UB	1							3		3					7
VDT 40% and UB and BIOMASS	0	0			1		1		110	12			119		243
Total Acres	**20**	**3**	**0**	**0**	**90**	**45**	**12**	**438**	**241**	**127**	**22**	**57**	**120**	**25**	**1,200**
Acre differences from Alternative B Pre-Treatment	**0**	**0**	**0**	**-93**	**75**	**18**	**0**	**-198**	**91**	**86**	**21**	**-145**	**119**	**25**	**0**
Acre differences from Alternative B Post-Treatment	**0**	**0**	**0**	**-46**	**46**	**0**	**0**	**40**	**-40**	**0**	**0**	**28**	**-28**	**0**	**0**

Biomass removal, mastication, hand cutting, and piling (hand, tractor, or grapple)

Alternative C would have similar affects to stand structure and landscape structure as Alternative B. Alternative C would treat an additional 91 acres under hand cutting and piling than Alternative B.

Pile burning and Underburning

Alternative C would have similar affects to stand structure and landscape structure as Alternative B. Alternative C would treat an additional 91 acres under hand cutting and piling than Alternative B.

Table 22. Alternative C landscape structure (size and density classes) acres within the Gibsonville project area sub-watersheds.

CWHR Size and Density Class	Gibson Creek	Slate Creek	Union Keystone	Wallace Creek	Whiskey Creek	Grand Total
X	85	319	146	8	73	631
2D			3		2	5
2P					0	0
2S					4	4
3D	3	70		84		157
3M	22		14	6	4	46
3P	20	2	111	12	72	217
3S	10	7	46		82	145
4D	192	117	459	118	210	1,095
4M	118	82	15	111	376	702
4P	133	14	46	5	86	284
4S		3		3	7	13
5D	261	49	38	71		419
5M	0	52	28	67		148
5P		28	24		35	87
Total Acres	842	744	931	485	950	3,952

Notes: See Table 2 for size and density classes. Sub-watershed acres does not include acres from private land.

Summary of Cumulative Effects

Cumulative Effects - Forest Health and Fire Resistant Stand Structure

On a landscape scale, existing vegetation type, size class distribution, and canopy cover distribution would change very little from mechanical treatments. The area proposed to be thinned in Alternative B (1,055 acres) is a small component of the 3,952 acre sub-watershed analysis area (Forest Service land only).

Alternative A would not meet the purpose and need and would not restore aspen, meadows, or riparian area nor reduce hazardous fuel accumulations to improve forest health or public safety. The existing forest and landscape structure could lead to a greater potential for large, moderate to high-severity fires in forested areas, including the wildland urban interface, riparian conservation areas, protected activity centers, and home range core areas in the analysis area during a wildfire under severe weather conditions.

Alternative A would rely on density-dependent mortality, wildfires, and continued fire exclusion, to shape overall landscape structure. These high stand densities and closed-canopy forests would favor a gradual shift in species composition toward exclusively shade-tolerant species, which would have an adverse effect on species diversity across the landscape. Over the long term, mortality occurring in high-density stands would continue to increase surface fuel loads. These increased surface fuels, combined with continuous ladder and canopy fuels, would continue to hinder suppression effectiveness and would likely maintain stands susceptible to high-mortality fires.

Alternative A would not improve firefighter and public safety, which could lead to potential future injuries or fatalities during wildfire events. The no-action alternative would also not reduce potential tree mortality or protect rare species and associated habitat from the major adverse effects of severe wildfire (Stephens and Moghaddas 2005; Agee 2002).

Alternative B would best meet desired conditions for both the fuels reduction and forest health objectives and would enhance forest resiliency to trends presented by climate change. Particularly, the prescriptions (variable density and thinning from below) that would be implemented under Alternative B would enhance heterogeneity at multiple scales - both the stand and landscape scale – while reducing fuels and potential fire behavior and improving forest stand structure, species composition, and forest health, in general. Thinning would convert stands with dense (greater than 60 percent) canopy cover into stands with open (25–39 percent) or moderate (40–59 percent) canopy cover.

While treatments under Alternative B could enhance structural diversity at the stand level depending on individual stand conditions, the capacity of these treatments to enhance heterogeneity and improve species composition are somewhat limited by the upper diameter limits (i.e., 30 inch DBH) and canopy cover restrictions (i.e., 50 percent) associated with the treatments and prescriptions.

Alternative C would have similar affects to Alternative B. Alternative C would treat less acres of variable density thinning (116 acres) and would treat more acres with hand thinning (91 acres) and no treatments (25 acres) than Alternative B.

Past, Present, and Foreseeable Future Actions

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

The Council of Environmental Quality (CEQ) issued an interpretive memorandum on June 24, 2005 regarding analysis of past actions, which states, “agencies can conduct an adequate cumulative effects analysis by focusing on the current aggregate effects of past actions without delving into the historical details of individual past actions.” For these reasons, the analysis of past actions in this section is based on current environmental conditions.

The cumulative effect of past management practices, logging, mining, fire exclusion, and high-mortality fires have largely shaped the forest that exists in the project area today. These past projects and events are reflected in the vegetation layer used to characterize the existing conditions (the baselines for analysis) in the project area.

Table 23 displays the past, present, and foreseeable future actions or activities that have contributed to the current environmental conditions. Changes in vegetation structure as a result of fires and recent past projects since the baseline data was collected has been incorporated into the Gibsonville Project’s cumulative effects analysis. The table displays the acres for each project, the type of activity, and the number of acres that are located within the Gibsonville project and sub-watershed analysis areas.

The projects listed in Table 23 would have no cumulative effects on vegetation attributes (i.e., tree density, canopy cover, species composition, stand structure, etc.) since the treatments themselves (i.e., underburning, hand cutting, or mastication) would have minimal effects. At the sub-watershed level (3,952 acres), Alternatives B and C would have a less than a 13.2 percent change in the small to large trees (i.e., canopy cover, stand structure, and landscape structure).

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 150-200 foot road corridor (see Appendix C, Table C-1). Roadside hazard tree projects also would not change seral stage diversity classes (i.e., CWHR size and density classes for each vegetation type).

Botanical (i.e., aspen restoration, noxious weed control), watershed (i.e., meadow or stream restoration), special uses (i.e., mining) and wildlife projects (i.e., oak enhancement) 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-level analysis area due limited access (i.e., adjacent to roads) and to the seasonal and dispersed nature of these activities.

The desired conditions for maintaining various seral stages or timber strata by vegetation type, size class, and canopy cover (CWHR) does not include lands on private property. Therefore, harvest or thinning projects on private property would have no cumulative effects on vegetation attributes, (i.e., tree density, canopy cover, species composition, stand structure, etc.) for the Gibsonville project.

Table 23. Past, Present, and Future Foreseeable Actions within the Gibsonville Sub-Watersheds.

PAST, PRESENT, AND FUTURE ACTIONS	ACRES	TIME PERIOD	PROJECT LEVEL CUMULATIVE EFFECTS (Indicators and Units of Measure) (1,200 ACRES)				SUB-WATERSHED AREA CUMULATIVE EFFECTS (3,952 ACRES)
PROJECT / ACTIVITY			FOREST HEALTH INDICATOR		FIRE RESISTENCE INDICATOR		CWHR DIVERSITY & LANDSCAPE STRUCTURE
			Trees per Acre	Basal Area	Stand Structure - Trees per Acre by DBH Classes	Stand Structure - Canopy Cover by DBH Classes	
PAST PROJECTS	NA	< 2000	Cumulative effects of past projects were taken into account based upon the updated timber type layers and the 2012 aerial photograph interpretation		Cumulative effects of past projects were taken into account based upon the updated timber type layers and the 2012 aerial photograph interpretation		Effects of past projects were taken into account for CWHR habitat analysis using the updated GIS timber type layers
Gibsonville Resale	4.6	1997	Very minimal effect. Less than 1.0% overall change		Very minimal effect. Less than 1.0% overall change		Very minimal effect. Less than 0.3% overall change
Tree Release and Weed	7.2	2000					
Pre-commercial Thin	45.7	2003	Very minimal effect. Less than 3.8% overall change		Very minimal effect. Less than 3.8% overall change		Very minimal effect Less than 1.2% overall change
La Porte-Quincy Hazard Tree	28.8	2014	An average of 2-6 trees per acre removed. Very minimal effect.		An average of 2-6 trees per acre removed. Very minimal effect.		An average of 2-6 trees per acre removed. Very minimal effect.
Single Tree Selection	1.9	2015					
Gibsonville Project							
Variable Density Thinning	359	2017-2018	Commercial thin is about 30% of the project.		Commercial thin is about 30% of the project.		Low effect. Less than 9.1% overall change.
Roadside Hazard	115	2017-2018	Roadside hazard tree removal is about 9.6% of the project. An average of 2-6 trees per acre removed.		Roadside hazard tree removal is about 9.6% of the project. An average of 2-6 trees per acre removed.		Very minimal effect. Less than 2.9% overall change.
Aspen, Meadow, and Riparian Restoration	48	2017-2018	Restoration treatments are about 4.0% of the project.		Restoration treatments are about 4.0% of the project.		Very minimal effect. Less than 1.2% overall change.
Mastication and Underburing	181	2018-2019	Mastication is about 15.1% of the project.		Mastication is about 15.1% of the project. Minimal effect to canopy cover.		Minimal effect. Less than 4.6% overall change.
Handcut Pile burn and Underburn	352	2018-2019	Handcutting and underburning are about 29.3% of the project.		Handcutting and underburning are about 29.3% of the project. Minimal effect to canopy cover.		Low effect. Less than 8.9% overall change.
Sugarloaf Project	34	2018-2020	Very minimal effect. Less than 2.8% overall change		Very minimal effect. Less than 2.8% overall change		Very minimal effect. Less than 0.9% overall change
Tree Release and Weed							

Notes: Sub-watershed acres does not include acres from private land.

Trends in Climate Change

The majority of scientific research concerning climate trends indicates that climate has been changing likely due to the increase in human activities which emit greenhouse gases such as the combustion of fossil fuels. Trends suggest that the Northern Sierra Nevada may become generally warmer and wetter, with longer periods of prolonged summer drought. While warmer and wetter weather patterns may increase forest growth and carbon sequestration, warmer temperatures in combination with longer periods of prolonged summer drought may likely increase forest insect and disease outbreaks and the occurrence of high severity fire – disturbances which may result in increased carbon losses. Such high severity disturbances could result in conversion of forest to shrub lands in forested ecosystems that are not adapted to such disturbance patterns – which could drastically alter carbon cycles in the short and long term.

Current trends have been quantified showing an increase in the proportion of high severity fire in the Sierra Nevada mountain range. High severity patches more than a few acres in size were unusual in fires in the Sierra Nevada before Euro-American settlement (Show and Kotok 1924, Kilgore 1973, Stephenson et al 1991, Skinner 1995, Skinner and Chang 1996, Weatherspoon and Skinner 1996). Miller et al. (2009) have also shown that the average size of high severity patches in Sierra Nevada wildfires has increased by about 100% over the last 25 years.

While the occurrence of fire (including low, moderate, and high severity fire) on the landscape is a natural disturbance that is essential to ecosystem function, the large scale of these fires, particularly the vast proportion that burned under high severity, are well outside the natural range of variability in fire size and severity experienced on the Plumas National Forest in the past and are uncharacteristic of the “natural” fire regimes typically described for the dry Sierra Nevada forests (Miller et al. 2009, Safford et al. 2007, Beaty and Taylor 2007, Moody and Stephens 2002, Beaty and Taylor 2001, Gruell 2001, McKelvey et al. 1996, Weatherspoon 1996, Weatherspoon and Skinner 1996, Skinner and Chang 1996, McKelvey and Johnston 1992).

In addition, recent occurrences of large scale Heterobasidion root disease and bark beetle outbreaks have been linked to recent drought periods that have affected areas in the Southern California Mountains, and in the Lake Tahoe area (Guarin and Taylor 2005, Macomber and Woodock 1994). Such disturbances that result in abnormally large levels of mortality have the potential to affect fuels dynamics, potential fire behavior, and resulting future forest structure and composition.

Such warming trends may lead to the reproductive and overwintering success of forest pathogens and insects, thereby increasing their severity, while prolonged summer droughts, exacerbated by high stand densities, mistletoe and root disease infection, will likely lead to increased moisture stress and decreased health and vigor of forest trees making them more susceptible to mortality from such pathogens and insects (Battles et al. 2008).

Battles et al. (2008) evaluated the impacts of climate change on the mixed-conifer region in California providing insight to forest health and management implications for forest managers. This study found that changes in climate could “exacerbate forest health concerns” by increasing weakened tree susceptibility to mortality as a result of fire, disease epidemics and insect outbreaks and potentially enabling forest insects and disease to expand ranges or increase potential for widespread damage. The authors suggest that forest management strategies that increase species diversity, promote heterogeneity, and create lower density stands would be effective in providing "structures that are more resilient to catastrophic events like fire and epidemics" (Battles et al. 2008).

Predicted climate change is likely to impact trees growing in the Gibsonville area over the next 100 years. Although no Plumas National Forest specific climate change models are available at this time, there is a general consensus among California models that summers will be drier than they are currently. The risk of bark beetle caused tree mortality will likely increase for all conifer species under this scenario, especially drought intolerant white fir. Improving the resilience of stands to future disturbance events through density, size class and species composition management will be critical to maintaining a healthy forested landscape (Cluck 2014).

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Appendices

Appendix A – Comparison of Treatments by Units and Alternatives

Table A-1. Comparison of treatments by units and alternatives.

Unit	Hazard tree removal		Mechanical thinning		Biomass removal		Mastication		Cut and pile and/or underburn		Acres
	AltB	AltC	AltB	AltC	AltB	AltC	AltB	AltC	AltB	AltC	
A01			Yes	Yes	Yes	Yes					3.73
A02			Yes	Yes	Yes	Yes					11.92
A03			Yes	Yes	Yes	Yes					5.17
A04			Yes	Yes	Yes	Yes					2.02
R01			Yes	Yes	Optional	Optional					6.20
R02			Yes	Yes	Optional	Optional					3.07
R03			Yes	Yes	Optional	Optional					1.35
R04			Yes	Yes	Optional	Optional					4.48
R05			Yes	Yes	Optional	Optional					0.63
R06			Yes	Yes	Optional	Optional					0.08
RB01			Yes	Yes	Optional	Optional					2.24
RB02			Yes	Yes	Optional	Optional					6.62
1									Yes	Yes	124.53
2							Optional	Optional	Yes	Yes	70.56
549									Yes	Yes	5.72
551			Yes	No	Optional	No			Yes	Yes	6.68
555			Yes	No	Optional	No			Yes	Yes	22.95
556									Yes	Yes	13.62
557			Yes	No	Optional	No			Yes	Yes	7.24
559									Yes	Yes	3.49
560			Yes	No	Optional	No			Yes	Yes	22.94
565	Yes	Yes			Optional	Optional			Yes	Yes	5.45
569									Yes	Yes	88.77
570			Yes	No	Optional	No			Yes	Yes	2.99
571					Optional	Optional	Optional	Optional	Yes	Yes	6.82
575			Yes	Yes	Optional	Optional					3.71
576	Yes	Yes			Optional	Optional			Yes	Yes	2.64
579			Yes	Yes	Optional	Optional			Yes	Yes	16.87
581	Yes	Yes			Optional	Optional			Yes	Yes	5.07
582	Yes	Yes			Optional	Optional			Yes	Yes	6.01
583			Yes	Yes	Optional	Optional			Yes	Yes	35.57
584	Yes	Yes			Optional	Optional			Yes	Yes	7.27
607											6.59
608			Yes	Yes	Optional	Optional			Yes	Yes	41.33
609			Yes	Yes	Optional	Optional			Yes	Yes	34.93
610			Yes	No	Optional	No			Yes	Yes	27.75
611	Yes	Yes			Optional	Optional			Yes	Yes	14.85
612									Yes	Yes	60.19
625											11.86
629											7.03
631											3.99
635											11.52
637	Yes	Yes			Optional	Optional			Yes	Yes	6.96
639											12.33
643	Yes	Yes							Yes	Yes	54.45
645											3.03
647							Optional	Optional	Yes	Yes	66.10
649									Yes	Yes	34.54

Unit	Hazard tree removal		Mechanical thinning		Biomass removal		Mastication		Cut and pile and/or underburn		Acres
	AltB	AltC	AltB	AltC	AltB	AltC	AltB	AltC	AltB	AltC	
651											35.06
653											5.45
655											13.41
657											3.99
659											21.98
720									Yes	Yes	5.82
722									Yes	Yes	4.11
724											5.12
726			Yes	Yes	Optional	Optional			Yes	Yes	8.03
728							Optional	Optional	Yes	Yes	8.33
730							Optional	Optional	Yes	Yes	9.73
732									Yes	Yes	8.13
734			Yes	Yes	Optional	Optional			Yes	Yes	4.92
736			Yes	Yes	Optional	Optional			Yes	Yes	8.45
740			Yes	Yes	Optional	Optional			Yes	Yes	26.91
742											1.65
744			Yes	Yes	Optional	Optional			Yes	Yes	12.63
746									Yes	Yes	2.94
748			Yes	Yes	Optional	Optional			Yes	Yes	4.74
750			Yes	Yes	Optional	Optional			Yes	Yes	7.24
752			Yes	No	Optional	No			Yes	Yes	16.87
754			Yes	No	Optional	No			Yes	Yes	8.31
756			Yes	Yes	Optional	Optional			Yes	Yes	21.93
762					Optional	Optional	Optional	Optional	Yes	Yes	19.49
764	Yes	Yes			Optional	Optional			Yes	Yes	4.24
765											2.96
766	Yes	Yes			Optional	Optional			Yes	Yes	8.11
768			Yes	Yes	Optional	Optional			Yes	Yes	8.09
770			Yes	Yes	Optional	Optional			Yes	Yes	7.99
Total Project Acres											1200.5

Appendix B – Mitigation Measures and Management Constraints

A. Minimizing impacts from slash breeding bark beetles in pine plantations, adjacent to pine plantations, or within pine dominated timber stands.

1. If possible, conduct pre-commercial thinning or pruning operations from June through October to minimize the buildup and subsequent damage of slash breeding insects, such as the pine engravers (*lps* spp.) to the residual stand.

2. If creating green slash is unavoidable during the high-risk months (November through May), several slash treatments are available to help minimize potential impacts.

   a. Chipping: If there is adequate road access, then chip the activity slash.
   b. Lopping and Scattering: Slash shall be lopped and scattered away from the bole of leave trees so that it lies outside of the drip line.
   c. Piling and burning: Piles shall be placed away from residual leave trees to avoid being scorched during burning. Piles cannot be located on or against stumps and logs. Keep the piles small and pile smaller material in the center with larger material piled on the outside to promote a more uniform drying of all sized material. Burn as soon as practicable. A burn permit may be needed in order to burn piles.

B. To prevent the spread of Heterobasidion (*occidentale or irregulare*) root disease, the use of sodium tetraborate decahydrate (a fungicide treatment) is proposed for use ***in areas with evidence of root rot***. As a simple rule, *Heterobasidion irregulare* can kill ponderosa pine, Jeffrey pine, sugar pine, Coulter pine, incense-cedar, western juniper, and pinyon pine, while *H. occidentale* can kill true firs, hemlock, Douglas-fir, and giant sequoia.

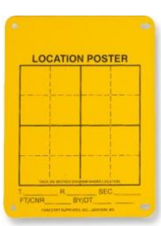
1. Apply borax treatments to stumps of trees 14 inches in diameter and greater for roadside tree removal projects. Apply borax treatments to stumps along a 200-foot wide buffer along each side of the road.

2. A borax-based (i.e., Cellu-Treat®, Sporax®) treatment would be to stumps in areas with evidence of root rot (*Heterobasidium sp.*) to minimize disease spread.

3. All stumps are to be treated the same day or within 24 hours of cutting to maximize incorporation of the product into the stump while the stump is still moist. Borax is typically applied at a rate of one pound per 50 square feet of stump surface.

4. The application of borax will not be allowed within any riparian conservation areas (RCAs) or streamside management zones (SMZs). See Hydrology Management Requirements and Mitigation Measures for buffer widths.

C. Protection of Specially-Identified Trees (i.e., location, survey marker, or bearing trees; proven rust resistant sugar pine trees; or genetically superior tree of any species). They are usually identified with various types of tags. Some examples of these tags are pictured below.





D. Hardwood Management.

1. Retain all large hardwoods (12 inches DBH or greater) on the Westside, except where large trees pose an immediate threat to human life or property.

2. Within riparian zones, wetlands, and meadows, minimize damage to riparian species.

E. Hazard Tree Removal (live and dying trees).

1. Use the "***Hazard Tree Guidelines for Forest Service Facilities and Roads in the Pacific Southwest Region***", April 2012 (Report # RO-12-01) for hazard tree determination.

Appendix C – Hazard Tree Sale Cruise Information

Table B-1. Hazard tree removal projects by DBH size class and watersheds.

Little Grass Valley Reservoir Subwatershed

SALE NAME	Black Rock	Lost Creek	Silver Tip	Fowler Peak	AVERAGES
Estimated Acres	450	58.3	240.0	232	245.1
DBH Size Class	# of Trees	# of Trees		# of Trees	Total Trees
00 - 10" DBH	12.0	0.0	0.0	0	3.0
10 - 20" DBH	395.0	116.0	578.0	504	398.3
20 - 30" DBH	697.0	254.7	477.0	300	432.2
>30" DBH	1467.0	206.3	312.0	277	565.6
Total Trees Marked	2571	577.0	1367.0	1081	1,399.0
DBH Size Class	Trees per Acre	Trees per Acre	Trees per Acre	Trees per Acre	Trees per Acre
00 - 10" DBH TPA	0.0	0.0	0.0	0.0	0.0
10 - 20" DBH TPA	0.9	2.0	2.4	2.2	1.6
20 - 30" DBH TPA	1.5	4.4	2.0	1.3	1.8
>30" TPA	3.3	3.5	1.3	1.2	2.3
Average trees per acre	5.7	9.9	5.7	4.7	5.7

Slate Creek Subwatershed

SALE NAME	American House	Lexington Hill	AVERAGES
Estimated Acres	100	50	75.0
DBH Size Class	# of Trees	# of Trees	Total Trees
00 - 10" DBH	0	2	1.0
10 - 20" DBH	38	158	98.0
20 - 30" DBH	47	99	73.0
>30" DBH	107	65	86
Total Trees Marked	192	324	258
DBH Size Class	Trees per Acre	Trees per Acre	Trees per Acre
00 - 10" DBH TPA	0.0	0.0	0.0
10 - 20" DBH TPA	0.4	3.2	1.3
20 - 30" DBH TPA	0.5	2.0	1.0
>30" TPA	1.1	1.3	1.1
Average trees per acre	1.9	6.5	3.4

Pinchard Creek Subwatershed

SALE NAME	Hartman Bar	Tamarack Flat	Lost Creek	AVERAGES
Estimated Acres	200	250	58.3	169.4
DBH Size Class	# of Trees	# of Trees	# of Trees	Total Trees
00 - 10" DBH	10	0	0.0	3.3
10 - 20" DBH	48	92	116.0	85.3
20 - 30" DBH	52	92	254.7	132.9
>30" DBH	81	115	206.3	134.1
Total Trees Marked	191	299	577.0	355.7
DBH Size Class	Trees per Acre	Trees per Acre	Trees per Acre	Trees per Acre
00 - 10" DBH TPA	0.1	0.0	0.0	0.0
10 - 20" DBH TPA	0.2	0.4	2.0	0.5
20 - 30" DBH TPA	0.3	0.4	4.4	0.8
>30" TPA	0.4	0.5	3.5	0.8
Average trees per acre	1.0	1.2	9.9	2.1

Fall River Subwatershed

SALE NAME	Mule	Lost Creek	AVERAGES
Estimated Acres	100	58.3	79.2
DBH Size Class	# of Trees	# of Trees	Total Trees
00 - 10" DBH	0	0.0	0.0
10 - 20" DBH	86	116.0	101.0
20 - 30" DBH	139	254.7	196.8
>30" DBH	179	206.3	192.7
Total Trees Marked	404	577.0	490.5
DBH Size Class	Trees per Acre	Trees per Acre	Trees per Acre
00 - 10" DBH TPA	0.0	0.0	0.0
10 - 20" DBH TPA	0.9	2.0	1.3
20 - 30" DBH TPA	1.4	4.4	2.5
>30" TPA	1.8	3.5	2.4
Average trees per acre	4.0	9.9	6.2

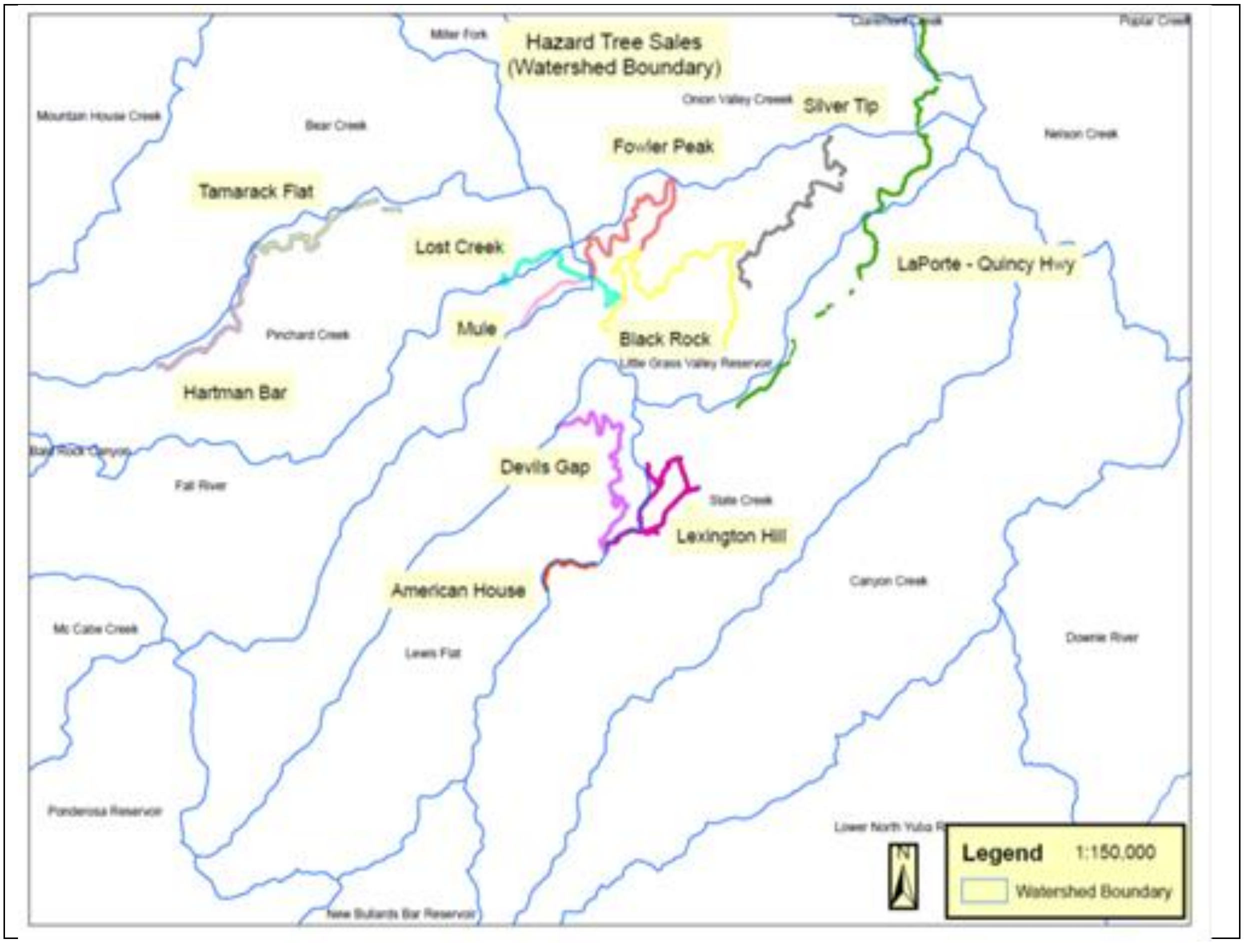


Figure B-1. Map showing previous hazard tree sales by watersheds.

Appendix D – National Forest Management Act Findings

FINDINGS REQUIRED BY OTHER LAWS AND REGULATIONS

Based on the analysis and prescriptions for stands in the Gibsonville Healthy Forest Restoration Project, the following finding of facts pursuant to the *National Forest Management Act* (NFMA) (16 USC 1604), are as follows:

A. The minimum specific management requirements to be met in carrying out projects and activities for the National Forest System are set forth in this section. Under 16 U.S.C. 1604 (g)(3)(E) a Responsible Official may authorize project and activity decisions on NFS lands to harvest timber only where:

1. **Soil, slope, or other watershed conditions will not be irreversibly damaged.**

   The Plumas National Forest Land and Resource Management Plan (LRMP) Forest-wide Standards and Guidelines as amended by the Sierra Nevada Forest Plan Amendment Final Supplemental Environmental Impact Statement Record of Decision (SNFPA FS EIS ROD) relating to soil cover, water quality, and riparian system protection, along with Best Management Practices (BMPs) would be implemented to protect and mitigate potential impacts to soil and water quality.

   The District Hydrologist has determined through a Cumulative Watershed Effects (CWE) Analysis that no irreversible or irretrievable commitments of soils, riparian, or water resources are expected for any alternative (See Hydrology and Soils Reports).

2. **There is assurance that such lands can be adequately restocked within five years after harvest (FSM 1921.12g).**

   All trees proposed for removal under the Gibsonville Healthy Forest Restoration Project would be thinned by thinning from below or variable density thinning (clumps and gaps) prescriptions or removed because there are a hazard to the road system or private property. Therefore, no regeneration harvests are proposed under this project. However, the gap areas (up to 0.5 acres) proposed for harvest under variable density thinning can be regenerated using standard reforestation techniques.

3. **Protection is provided for streams, streambanks, shorelines, lakes, wetlands, and other bodies of water from detrimental changes in water temperatures, blockages of water courses, and deposits of sediment, where harvests are likely to seriously and adversely affect water conditions or fish habitat.**

   The Plumas National Forest Land and Resource Management Plan Forest-wide Standards and Guidelines as amended by the Sierra Nevada Forest Plan Amendment Final Supplemental Environmental Impact Statement Record of Decision (SNFPA FS EIS ROD) relating to soil cover, water quality, and riparian system protection, along with Best Management Practices (BMPs) would be implemented to protect and mitigate potential impacts to soil and water quality. See the riparian conservation area (RCA) analysis report).

4. **The harvesting system to be used is not selected primarily because it will give the greatest dollar return or the greatest unit output of timber.**

   Trees proposed for removal under this project are in contained in strategically placed areas around the project area to improve travel management and firefighter safety and reduce hazardous fuels. The purpose is to remove hazard trees and to reduce ladder fuels and crown density. Harvest and treatment methods are used to implement this direction within the limits imposed by SNFPA FS EIS ROD. In those areas where trees are removed for commercial purposes, the primary silvicultural method is intermediate harvest (hazard tree removal, thinning from below, or variable density thinning) and utilizes ground-based equipment.

   It is likely there would be an economic timber sale with this proposal, but there would also be service contracts needed to implement the treatments (mastication, hand cutting, etc.) in the proposed action. Wood products would be removed from the area for use in local mills or energy plants but not in the quantities anticipated with SNFPA FS

   SNFPA FS EIS ROD standards and guides reduce opportunities for an economical return and would produce nominal timber outputs. The various treatment methods and systems were prescribed to provide a viable method of meeting a wide variety of resource management objectives without optimizing one resource at the expense of another.

B. **A Responsible Official may authorize project and activity decisions on National Forest System lands using clearcutting, seed tree cutting, shelterwood cutting, and other cuts designed to regenerate an even-aged stand of timber as a cutting method only where:**

1. **For clearcutting, it is determined to be the optimum method, and for other such cuts it is determined to be appropriate, to meet the objectives and requirements of the relevant land management plan (16 U.S.C. 1604 (g)(3)(F)(i));**

   Clearcutiing or even-aged management would not be applied to the stands within the Gibsonville Healthy Forest Restoration Project area at this time.

2. **The interdisciplinary (ID) review as determined by the Secretary has been completed and the potential environmental, biological, esthetic, engineering, and economic impacts on each advertised sale area have been assessed, as well as the consistency of the sale with the multiple use of the general area (16 U.S.C. 1604 (g)(3)(F)(ii));**

   The ID team used a systematic, interdisciplinary approach to analyze the affected area and estimate the environmental effects. The analysis included input through public involvement. The ID analysis was based on LRMP direction, as amended by SNFPA FS EIS ROD of 2004.

3. **Cut blocks, patches, or strips are shaped and blended to the extent practicable with the natural terrain (16 U.S.C. 1604 (g)(3)(F)(iii));**

   Clearcutting or even-aged management would not be applied to the stands at this time. However, gaps from variable density thinning areas are dispersed, and the shapes are, indeed, naturally appearing.

4. **There are established according to geographic areas, forest types, or other suitable classifications the maximum size limits for areas to be cut in one harvest operation, including provision to exceed the established limits after appropriate public notice and review by the responsible Forest Service officer one level above the Forest Service officer who normally would approve the harvest proposal; provided, that such limits shall not apply to the size of areas harvested as a result of natural catastrophic conditions such as fire, insect and disease attack, or windstorm (16 U.S.C. 1604 (g)(3)(F)(iv)); and**

   The Gibsonville Healthy Forest Restoration Project is designed to fulfill the management direction specified in the Plumas National Forest Land and Resource Management Plan, as amended by the SNFPA FS EIS ROD (January 21, 2004).

5. **Such cuts are carried out in a manner consistent with the protection of soil, watershed, fish, wildlife, recreation, and esthetic resources, and the regeneration of the timber resource (16 U.S.C. 1604 (g) (3) (F) (v)).**

   No harvest cuts are designed to regenerate even-aged stands. However, soil, watershed, fish and wildlife, recreation, and aesthetic resources would be protected. Also, as stated above all areas can be regenerated using standard reforestation methods.

6. **Under 16 U.S.C. 1604 (m) even-aged stands of trees scheduled for regeneration harvest generally have reached culmination of mean annual increment of growth, unless the purpose of the timber cutting is excepted in the land management plan (FSM 1921.12f).**

   Even-aged management would not be applied to the stands at this time. Gaps created from variable density thinning (0.1 – 0.5 acres) are an uneven age management method.

Appendix E – Unit Numbers and Sporax Application Acres

Table E-1. Borax/Sporax Acres (200 foot buffer on each side of the road) for each unit.

UNIT	Aspen Release and Biomass (Acres)	Roadside Hazard and Handcut Pile Burn (Acres)	Roadside Hazard and Handcut Pile Burn and Biomass (Acres)	Variable Density Thin 40% and Underburn and Biomass (Acres)	Grand Total (Acres)
565			4.7		4.7
575				0.5	0.5
576			2.6		2.6
579				0.2	0.2
581			3.0		3.0
582			5.3		5.3
583				13.0	13.0
584			4.8		4.8
608				16.3	16.3
609				12.5	12.5
611			13.3		13.3
637			6.5		6.5
643		28.6			28.6
726				0.0	0.0
734				2.8	2.8
736				4.5	4.5
740				7.2	7.2
744				6.3	6.3
748				2.9	2.9
750				4.8	4.8
752				6.6	6.6
754				2.5	2.5
756				10.1	10.1
760	0.0				0.0
764			4.2		4.2
766			5.2		5.2
768				3.8	3.8
770				4.3	4.3
A01	2.1				2.1
A02	1.8				1.8
A04	1.8				1.8
Grand Total	**5.7**	**28.6**	**49.7**	**98.3**	**182.3**

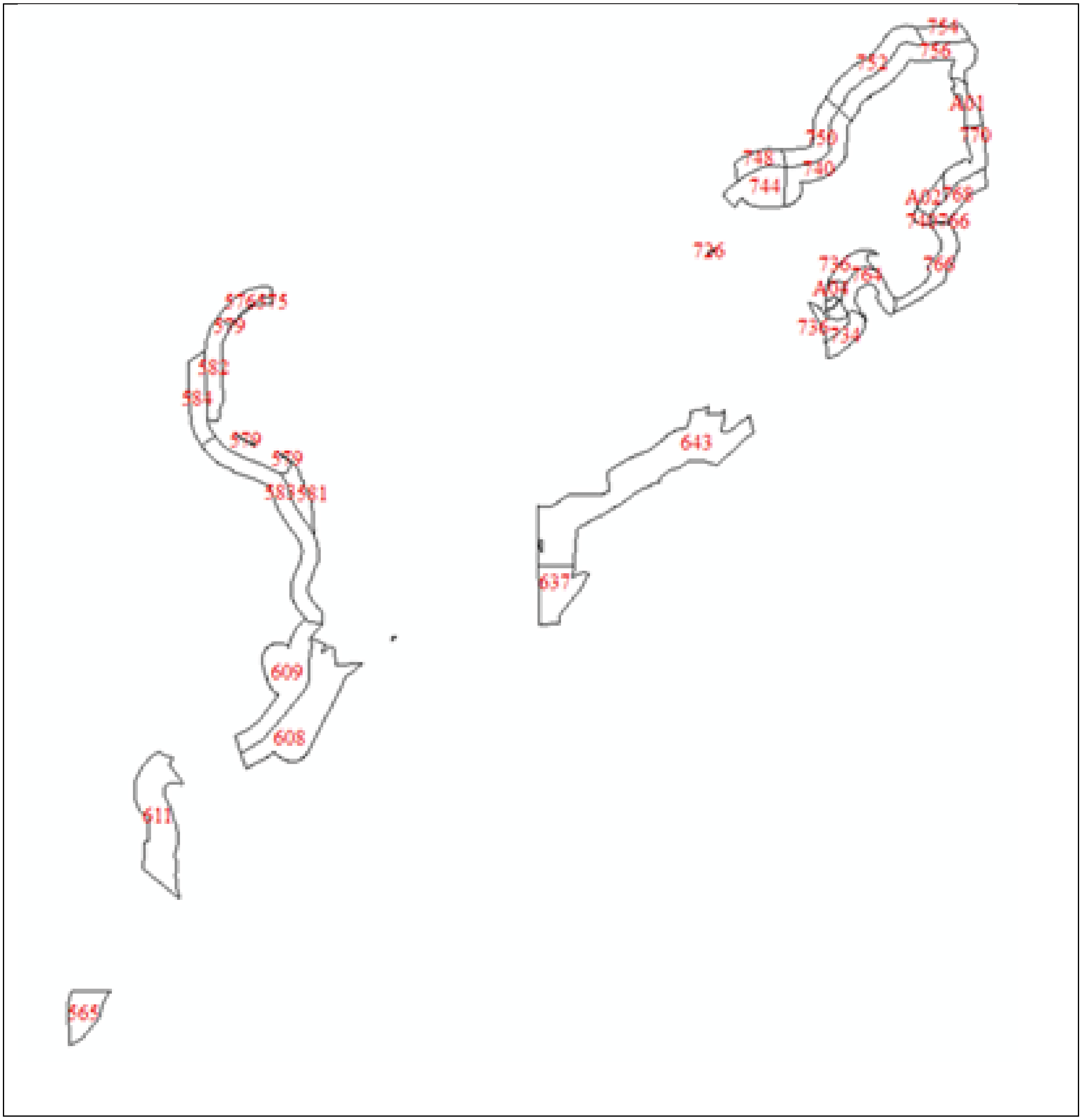


Figure E-1. Simplified map of Borax/Sporax units along 200-foot road buffers.

Appendix F – Evaluation of Human and Ecological Risk for Borax Stump Treatments

PRODUCT SUMMARY
Borax ($Na_2 B_4 O_7 10H_2O$ sodium tetraborate decahydrate) is used as a registered pesticide (fungicide) EPA Reg. No. 2935-501, EPA Est. No. 66196-CA-01 **(**WILBUR-ELLIS SPORAX®). For prevention of Heterobasidion annosum (annosus) root disease, borax is applied to freshly-cut stump surfaces at a rate of one pound per 50 square feet of stump surface. This is equivalent to one pound of borax on 60 twelve-inch stumps (Sporax label, Wilbur-Ellis Company). Borax as used in forestry is identical to the material sold throughout North America as a household-cleaning agent (Dost 1996 page 1). Sporax® does not have any inert ingredients. No contaminants have been identified in Sporax (Pesticide Fact Sheet).

HAZARDS
Humans
Acute (short-term) Hazards
Borax is a low oral and dermal toxicity pesticide in Class III, but it carries a DANGER signal word, due to the fact that it is a severe eye irritant. Primary body entry routes are through eyes and damaged skin. Immediate or acute health hazards from overexposure may be judged by comparing borax's toxicities with standard toxicity ranges. The higher the number in the chart, the less toxic the material is to test animals.

TOXICITY

TOXICITY CLASS		Units	Dermal LD 50 mg/kg	Oral LD 50 mg/kg
DANGER	I		200	<50
WARNING	II		200-2,000	50-500
CAUTION	III		2,000-20,000	500-5,000
BORAX			>2,000	>6,000

Accidental ingestion of borax may include nausea, vomiting, diarrhea, and abdominal pain. Intact skin is a barrier to absorption of borax. Borax is rapidly absorbed through damaged skin. Boron is rapidly eliminated from the body without change by humans and other species, regardless of the route of intake (Dost 1996 p.57). Borax is not expected to cause skin irritation if handled properly. The EPA has not required inhalation studies for borax (Pesticide Fact Sheet).

Chronic (long-term) Hazards
Borax is not classified as an agent that causes cancer, genetic damage, or birth defects. Studies have indicated that chronic exposure to borax may cause reproductive damage and infertility. An EPA review has classified the related compound boric acid as a Group E carcinogen (evidence of non-carcinogenicity for humans).

Plants
Borax and other boron compounds at high levels may kill plants. Borax may be used as a nonselective herbicide. However, boron is an essential nutrient for plants, and boron compounds (including borax) occur widely in nature. Borax is also used in fertilizer formulations to supply boron. Boron is taken up from soil by plants in proportion to the amount of boron in the soil. (Pesticide Fact Sheet). It bio-accumulates in plants (Phelps, Hodges, and Russel, undated, p.13)

Soil microorganisms
At high levels, borax could be toxic to many soil microorganisms (Pesticide Fact Sheet). A range of soil micro-organisms can utilize it as a source of energy and nitrogen. Borax is considered to have small or non-existent effects on various soil organisms (Phelps, Hodges, and Russel, undated, p.13).

Aquatic animals
Borax is practically nontoxic to fish, and practically nontoxic to aquatic invertebrate animals. It does not build up (bio-accumulate) in fish (Pesticide Fact Sheet).

Terrestrial animals
Borax is practically nontoxic to birds and mammals. It is relatively nontoxic to bees. Relatively high concentrations of boron compounds are toxic to insects, and borax is used for insect control in some cases. (Pesticide Fact Sheet)

Cattle
Borax is considered non-toxic to cattle (Meister, 1981 p. C48).

Soil and Water
Borax absorbs to mineral soil particles. Soil naturally contains boron at a concentration of 5 to 150 parts per million. (Pesticide Fact Sheet). Borax persists in the soil for one or more years depending on soil types and rainfall. The decahydrate may not persist beyond one growing season in areas of 35 inches or greater precipitation (Phelps, Hodges, and Russel, undated, p.13). The potential for leaching is low. Borax may leach more rapidly under high rainfall conditions. The average boron concentration in surface waters ranges from 0.001 mg/Liter to 0.1 mg/Liter (Pesticide Fact Sheet).

EXPOSURE AND RISKS

Project Area Information
For the areas to be harvested in the Gibsonville Project an average of approximately 1 to 1.5 pounds per acre of borax would be applied to stumps 14 inches in diameter and greater along a 200-foot buffer along each side of the roads.

The Gibsonville Project area receives an average of 50-85 inches of precipitation. There are perennial and intermittent channels within the treatment area of this project. These streams would not be harvested and therefore would not receive Sporax application.

Exposure of and Risk to Soil and Water
Overland flow or leaching due to massive storms would be the only potential movement to the water. Migration of Boron away from the site into water sources and aquatic flora and fauna at some distance from the site is unlikely (Dost 1996, pages 4 and 11).

Exposure of and Risk to Humans
Those that may be exposed as a result of this project are workers and the public. Workers include applicators, supervisors, and other personnel directly involved in the application of borax. The public includes forest workers who are not directly involved in the borax application and forest visitors. This analysis utilizes Dost (1996) as a direct comparison to this project since stump treatments with borax are the same. Dost discussed information from studies that generally deal with laboratory or work environments that had substantially greater exposure levels than the levels that occur in forest stump treatments. He reviewed these studies and compared them to the potential exposure routes during stump treatment applications.

Exposure of forest workers has few potential routes of exposure. The most likely exposure of humans should be during handling because either borax can be spilled or otherwise brought into contact with eyes, skin or digestive tract. Contact can be made through sitting on treated stumps, but is unlikely.

The public exposure could be by sitting on treated stumps but this is unlikely. They could possibly eat big game that has consumed vegetation that has had uptake of boron.

For an exposure level and risk calibration point, Dost relates the following: in an industrial setting with visible borax dust, workers have been exposed over full time work schedules over extended period with no evidence of effect other than transient upper respiratory irritation (Dost pages 54-55).

For forest workers, the exposure is very limited and substantially less than the industrial setting mentioned above. Dost (1996 pages 55, 56) presents a scenario for exposure and risk to forest workers. The most likely exposure route is through abraded skin. Assume that 100 12 inch trees are treated in a work day, treatment at the label rate would consume 750 g borax or about 86 g boron over a work day. Assume that one percent or 0.86 g boron actually reaches the skin. As a hypothetical, assume a worker has enough abraded or otherwise vulnerable skin to permit absorption of 0.5 percent of the amount that reached the skin. The assumed dose becomes 4.3mg boron, for a person weighing 70 kg. Dose per unit body weight becomes 0.53 mg borax/kg/day or 0.061 mg boron/kg/day. The assumed ratio of absorbed boron dose to applied material in this example is on the order of 1/20,000 (Dost 1996, p.56).

Dost used a rate of 10 mg boron/kg/day as the no effect level for purposes of risk assessment for humans (Dost 1996, p.58). This provides a margin of safety, or ratio of the no effect level to dose, of 162. The hypothetical exposure to forest workers is substantially less (in order of magnitudes) than the margin of safety. He concludes that workers who apply borax to cut stumps are not at risk of adverse effects due to boron exposure (Dost 1996 page 61).

In a relative comparison to the industrial setting and forest worker scenario described above, the limited exposure with any absorbed dose to forest users (walking through a treated area or sitting on a stump) is inconsequential (Dost 1996 p.59). Foraging herbivores can consume vegetation that may have taken up excess boron that migrated from the stump. Given high background boron content of forage plants and the absence of any detectable increases in those levels, this possibility may be dismissed, as may exposures of predators or hunters through consumption of herbivores (Dost 1996 page 55).

Exposure of and Risk to Plants

Exposure routes would be through borax washing off the treated surface to the surrounding vicinity of the stump or through a spill. Measurements of herbs and foliage at distances up to 5 meters from the stump and at various times after application do not show differences from measurements prior to application. (Dost 1996 page 60). Under normal application there is essentially no risk to plants. The risk to plants would be from a spill. Borax is toxic to plants in high concentrations. Applicators generally carry about 1 pound of chemical. Assuming a worker completely spilled the container and the 1 pound covered 10 square feet or less, plants could die. The spill would act as a herbicide for a few years. Then plants would reoccupy the location. However, spill instructions are for personnel to scoop up the spill and place it back in the application container. Spilled material is to be used as per normal label application instructions. When proper spill procedures are maintained, it is unlikely that plants would be harmed.

Exposure of and Risk to Fish

There are no exposure routes for fish in this project. A hypothetical exposure route of a spill is discussed below. The treatment of stumps with the borax fungicide has no impact on water quality. Borax is practically nontoxic to fish and aquatic invertebrates and does not bio-accumulate in fish. Acute toxic levels are greater than 1,000 parts per million (USDA Pesticide Fact Sheet). Even in a worse-case scenario, where someone crossing a stream spills a large quantity of Borax (assume 5 pounds) directly into a stream, dilution is such that only 650 gallons of water would be needed to dilute the borax below 1,000 parts per million, and thus below a toxic level. Chances of this scenario happening in the Gibsonville Project are practically non-existent as there are no streams to cross. The application rate of about one pound of borax per acre, and the unlikelihood of any borax reaching a stream, makes the possibility any harmful levels of borax in streams extremely unlikely.

Exposure of and Risk to Livestock and Wildlife

Exposure routes for cattle or wildlife may be ingesting borax directly from a stump surface after application, or they may consume vegetation into which boron has moved as it is washed away from the stump over time. Deer displayed no attraction or aversion to application of borax to cut surfaces and there was no observed toxicity to them (Campbell undated). Grazing permittees have not observed unusual behavior of cattle in treated areas (Dost 1996 page 59).

Surface litter is largely fallen vegetation and serves as a food source for some small mammals and invertebrates. Dost (pages 10-12 1996) sampled and analyzed treated stumps and surrounding soil, litter and foliage. From these findings he made the following generalizations: There does not appear to be measurable penetration of boron into stumps (it concentrates in the first 3 centimeters); no treatment related increases in boron content of adjacent foliage, litter or soil; variation of background boron levels among areas is substantial; following spring sampling resulted in high variability (greater breakdown had already occurred) among trees and accompanying soil, litter and vegetation; absence of detectable uptake by plants also indicates that migration of boron away from the site into water sources and aquatic flora and fauna at some distance away from the site is unlikely. Measurements of herbs and foliage at distances up to 5 meters from the stump and at various times after application do not show differences from measurements prior to application. (Dost 1996 page 60).

Poultry chicks where boric acid was applied at rates of 127 g/m^2 did not accumulate any boron in any tissues assayed. For comparison, distribution over a forest site after use of one pound of borax per 50 square feet of stump area would be 0.012 g/m^2 (Dost 1996 page 60).

Dost concludes that data indicates that adverse effects of forest uses of borax on wildlife or livestock are improbable and should be expected to have no effect on surrounding plants, invertebrates or microorganisms (Dost 1996 page 61).

Exposure of and Risk to Invertebrates, Soil Micro-organisms

Exposure routes would be through borax washing off the treated surface to the surrounding vicinity of the stump or through a spill. As discussed above under exposure and risk to plants, effects from a spill would be negated by spill procedures. Due to the low dose rates in stump applications and comparison to available literature, Dost concludes that use of borax for stump treatment should be expected to have no effect on surrounding plants, invertebrates or microorganisms (Dost 1996 page 61).
(Dost 1996, page 61).

Exposure and Risk to Fungi

Exposure routes would be through borax washing off the treated surface to the surrounding vicinity of the stump or through a spill. As discussed above under exposure and risk to plants, effects from a spill would be negated by spill procedures. The application rate of stump treatments would be substantially lower than rates that found some fungi to actually benefit from borax concentrations (Dost 1996, page 36).

Literature Cited

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Appendix G – Herbicide / Pesticide Safety Spill Plan

FEATHER RIVER RANGER DISTRICT
HERBICIDE / PESTICDE SAFETY SPILL PLAN

Updated 3/2/2016

I. INTRODUCTION

This plan is an outline of the specific actions to take to prevent and manage any incident or injury involving the use of herbicides on the Plumas National Forest (PNF), Feather River Ranger District (FRRD) during the implementation of this herbicide project.

This plan is tiered to and supplements the following documents:

- The Forest Service Health and Safety Code Handbook 6709.11.

  The Forest Service Health and Safety Code Handbook (sections 20-18 through 20-21 and 60-50 through 60-52) address safety procedures to be followed by employees while dealing with pesticides.

- The Sierra Cascade Province, Lassen, Modoc and Plumas National Forests, Safety Plan, October 4, 2004

  The Sierra Cascade Province Safety Plan provides information and procedures relating to hazardous materials in the following appendices: Appendix L - Hazmat Emergency Response Plan; Appendix M - Hazard Communication Plan; and Appendix V - Hazardous Waste Contingency Plan

- The 2015 Safety Action Plan, Plumas National Forest, Feather River Ranger District.

  The district safety plan lists information and procedures on hazardous materials, such as storage, handling, training, and notification.

- Specimen labels and material safety data sheets (MSDS)

  The specimen labels and material safety data sheets for the chemicals proposed for use in this project contain additional safety precautions and procedures in case of accidental exposure or spill.

Copies of the above plans, specimen labels, and MSDS are located in the project file.

II. PESTICIDE SAFETY

A. TRAINING/LICENSING

1. Contractors: All contractors must be licensed by the State of California as a Pest Control Operator. In the absence of the contractor, they must have on the job site, at all times, a representative or batcher/mixer that is at the minimum licensed as a Qualified Applicator (QAL-Brown Card). All crews will have at least one certified Qualified Applicator (QAC-Silver Card) supervising each crew. All contractors' employees must receive any training that is required under federal, state, and local laws for the chemicals they are applying.

2. Forest Service Contracting Officer Representatives (COR) must be certified as Qualified Applicators (QAC). A safety training session will be held before any work starts. A job hazard analysis will also be prepared and reviewed before work starts.

B. TRANSPORTATION OF HERBICIDES

Although the herbicides that could be used for vegetation or noxious weed control are not highly toxic, our commitment to safety dictates that caution must be taken when transporting herbicides.

1. Contractors will be required to purchase and transport all herbicides (in compliance with Federal and State regulations).

2. It is essential to take all possible steps to prevent damage to containers to ensure no leaks develop.

3. Special precautions must be taken while loading and unloading herbicide containers on and off vehicles. Containers should be loaded so none can move, roll, or fall during travel periods. It is particularly important to ensure no container could fall from a vehicle.

4. Open containers must never be transported. Partly used containers must be securely resealed before movement.

5. Transportation routes should be carefully chosen to limit the number of stream crossings and routes adjacent to stream courses. The contract will specify which routes will be used.

6. No more herbicide should be transported than what is estimated to be needed to complete the day's work. Herbicide mix is to be batched at each unit. No more herbicide other than what is estimated to be needed for that unit should be batched. This will reduce the amount of herbicide concentrate and mix that is transported to the project area and between units. This will reduce the amount of material spilled should an accident occur.

7. After transportation, all herbicide containers should be inspected for leaks, and the vehicle should be carefully examined for contamination.

8. Trucks used to transport herbicides must never be used to transport food, clothing, beverages, household goods, food or animal feed, or similar commodities in the same compartment where herbicides were held without proper cleaning prior to use.

9. All containers must be properly labeled to identify the herbicide.

10. All transport vehicles must be placarded and manifested as required by the U.S. Department of Transportation. A copy of the manifests must be present in the vehicle and must be available to the Contracting Officer Representative.

C. SPECIAL HERBICIDE BATCH TRUCK PRECAUTIONS

1. All valves capable of emptying herbicide batch tank must be lockable.

2. A separate vehicle for water collection and transport must be provided by the contractor.

3. Mixing of spray solutions will be done away from streams, drains, ditches leading to streams, or wet areas. Mixing should be done on level areas where major spills would be absorbed into the soil before reaching a waterway.

D. STORAGE OF HERBICIDES

1. Under herbicide application contracts, the contractor will be required to provide a locked, secure storage facility for herbicides.

E. GENERAL SAFETY PROCEDURES FOR MIXING, APPLICATION, AND INSPECTION

Although the herbicides that would be used for defensible fuel profile zone (DFPZ) or noxious weed control are not highly toxic, a good habit to develop is treating them as if they are dangerous chemicals. This cautious approach will minimize exposure and contamination.

In contracts for application of herbicides, contractors will be required to perform all work associated with mixing and application of herbicides and assume all responsibility for safety of their employees. Forest Service personnel would administer and inspect the contract.

1. Routes of Possible Exposure

   Pesticides can enter the body by one or more of four direct exposure routes. All personnel involved with spraying operations will be advised of these possible routes of exposure.

   a. Oral: This represents a serious potential for contamination. Chemical may be splashed into the mouth while pouring, measuring, or mixing operations. Also by licking the lips, rubbing the mouth, or smoking, eating, or drinking with contaminated hands and fingers.

b. Dermal: This is usually the primary route of exposure. Although face, neck, armpits, and genitals will absorb chemical more easily, the hands usually have the highest exposure.

c. Cuts and Abrasions: Chemical may be absorbed very quickly in the blood stream through these surfaces.

d. Respiratory: Although exposure is at a minimum through the respiratory route, absorption is at a maximum, as almost all of the contaminate inhaled is absorbed internally. Diluted mists carried in the air during the ground application may be breathed.

2. General Personal Hygiene

All inspectors, applicators, and mixers will wear fresh coveralls every day and will rinse gloves, boots and any other contaminated safety clothing at the job site at the end of each working day. All persons shall wash before eating or handling foods, drinking, or smoking.

3. Personal Protective Equipment

The purpose of personal protective equipment is to prevent pesticides from contacting the body and clothing. This equipment also protects the eyes and prevents inhaling toxic chemicals. Personal safety equipment is effective only if it fits correctly, is used properly, and is kept cleaned and maintained. Label requirements for personal protective equipment are the minimum required, but you should select equipment that offers maximum protection.

All personal protective equipment designated for pesticide projects will be specific for those uses and will not be worn or used for other purposes. Contractor and the Forest Service will be required to furnish water, soap, and disposable towels in sufficient quantities for all employees. Each party must also furnish eyewash facilities or canteens of water for washing eyes. Disposal of contaminated equipment must be done with the same caution as accorded the active ingredient of the herbicide that it was contaminated with and done in accordance with State of California and Federal EPA regulations.

The type and amount of personal protective equipment required for employees is related to the type of work that being done and the risk of exposure to a pesticide. The following lists of personal protective equipment are required for the corresponding task involved in herbicide use. Inspectors should monitor the Contractor's employees for appropriate personal protective equipment. Where changes in label or law require additional safety equipment, these changes will be carried out for this project.

a. Handling/Loading/Unloading Concentrate

- disposable or washable coveralls
- chemical splash proof goggles
- rubber gloves

b. Mixer/Loader

- hard hat (without leather head band)
- cartridge respirator (when required by label)
- full face shield or chemical splash proof goggles
- disposable or washable coveralls
- rubber gloves
- rubber boots or overshoes
- rubber apron (when mixing Category 1 or 2 herbicide)

c. Applicator

- hard hat (without leather head band)
- chemical splash proof goggles or safety glasses
- washable or disposable coveralls
- rubber gloves
- sturdy leather shoes and socks
- canteen of water for washing eyes or portable eyewash kit on person

d. Inspector

- hard hat (without leather head band)
- chemical splash proof goggles or safety glasses (to be worn within 50 feet of any ongoing chemical applications or where herbicide has not dried)
- disposable or washable coveralls
- rubber gloves
- sturdy leather boots, rubber boots or overshoes
- canteen of water for washing eyes or portable eyewash kit on person

4. Public Safety

a. All units will be checked for members of the public immediately prior to application. Unauthorized persons will be asked to leave.

b. Units will be posted 24 hours or less before the scheduled application at common entry points, and will comply with Federal EPA Regulations. Posting will continued during the prescribed reentry-period on the herbicide label and will be removed within 3 days after the end of the re-entry period or the time period specified in the management requirements of the environmental document. Information to be posted includes the type of herbicide applied, date of treatment, and name of the person to contact for further information. An environmental analysis may have additional requirements for posting signs.

c. All persons within a 1/4 mile radius will be notified at least 1/2 hour before application.

d. A minimum 15 foot buffer strip adjacent to private land will be observed, unless a larger buffer is designated in an environmental analysis. Property boundaries which are not obvious will be flagged prior to application.

e. No applications will be made on system roads.

f. For streamside management zones or riparian habitat conservation areas (RHCA), buffer strips described in management requirements of the environmental document shall be no application zones.

g. The management requirements listed in the environmental document, specimen labels, and MSDS will be followed to reduce off site movement, drift, or volatilization.

F. DISPOSAL OF EMPTY HERBICIDE CONTAINERS

In contracts for application of herbicides, government personnel have no disposal responsibilities. The contractor shall dispose of all unused chemical and containers.

1. All empty containers and unused amounts of herbicides must be securely held in a safe and secure herbicide storage area until reuse or proper disposal can occur. Copies of disposal chain of custody manifests must be provided to the COR prior to final payment being released.

2. A regular system of disposal is necessary, empty containers should not be allowed to accumulate.

3. Disposal hazards can be reduced by:

    - Carefully calculating the required herbicide quantities needed so any possible disposal is kept to a minimum;
    - Immediately after emptying a container, rinse 3 times with the diluents used for mixing and pour the rinse into the spray tank load for distribution. Also wash the outside of the container. Volume of rinse should be 10 percent of the volume of the container for each rinse.

4. The containers must be disposed of ONLY at approved landfills. The contractor is responsible for locating and utilizing approved landfills.

5. Arrangements for disposal need to be made in advance of the delivery of the containers to allow the disposal site operator to have the necessary equipment available to crush and bury the containers.

III. HERBICIDE SPILL AND ACCIDENT PROCEDURES

A. NOTIFICATION PROCEDURES FOR REPORTING ACCIDENTS OR INCIDENTS INVOLVING HERBICIDES

Spill accidents are categorized as emergency or non-emergency. A spill is defined as an emergency if it moves off site and threatens water supplies or is otherwise potentially harmful to human health or the environment.

If a spill of any quantity occurs, the Contracting Officer (C0), Contracting Officer's Representative (COR) or inspector will be the first to be contacted by the contractor. If an emergency spill occurs the CO, COR, or inspector will contact the Plumas National Forest Dispatcher. In the event the CO or COR cannot be reached, the contractor will notify the **Plumas National Forest Dispatcher**.

1. Notification Numbers

   - Plumas National Forest (PNF) Dispatcher - **(530) 283-7854**. If no answer, call **911**.
   - FRRD HAZMAT Coordinator – District Safety Committee at **(530) 534-6500**
   - PNF Pesticide Use Coordinator – Ryan Tompkins at **530- 283-7841**

2 All accidents or incidents resulting from herbicide use are to be reported to the Forest Dispatcher who will notify the District HAZMAT Coordinator and Forest Pesticide Use Coordinator. The following information should be given to the Dispatcher.

   a. Name of Project.
   b. Location of spill.
   c. What chemical was spilled?
   d. Estimate of how much was spilled.
   e. Nature of the spill.

3. The report will be by telephone when possible. Radio communication will be used as backup to the Forest Dispatcher then to Forest Pesticide Use Coordinator.

4. The R-5 "Report of Accidental Discharge" Form will be completed for ALL spills regardless of size, with a copy sent to the Supervisor's Office, attention Forest Pesticide Use Coordinator. Keep a copy on the District in a permanent file. Make sure it shows the date completed and is signed.

5. A follow-up written report covering all details of the accident will be submitted immediately to the Forest Pesticide Use Coordinator. All aspects of the accident or

incident should be covered in the written report.

6 Items to be included in the report are:

a. Names of people involved.
b. Location of accident or incident.
c. Date of accident or incident.
d. Type of accident or incident.
e. Estimated quantity of spill.
f. Name and manufacturer of herbicide involved.
g. Formulation of herbicide.
h. Weather information at time of accident or incident.
i. A detailed narrative statement explaining how the accident or incident occurred and what actions were taken.

B. LIST OF POISON CONTROL CENTERS

Normally the dispatcher will be notified by the COR or inspector of any poisoning occurring on the job site. The dispatcher will ensure that emergency medical personnel respond to the incident. Try to determine the type of poisoning and symptoms and relay the information to the dispatcher. The following is a list of poison control centers that can be contacted should acute poisoning occur:

IF IN DOUBT AS TO THE EXPOSURE LEVEL, CALL THE POISON CONTROL CENTER

1. Poison Control Centers

The California Poison Control System:
24-Hour Emergency Phone: 1-800-222-1222

The California Poison Control System is managed by the University of California San Francisco, School of Pharmacy consisting of four answering sites:

- Sacramento Division; UC Davis Medical Center
- San Francisco Division, San Francisco General Hospital
- Fresno/Madera Division; Valley Children's Hospital
- San Diego Division, UC San Diego Medical Center

The answering site closest to the project area is the:

Sacramento Division; UC Davis Medical Center
2315 Stockton Boulevard
Sacramento, CA 95817
Emergency Phone: (800) 876-4766
Emergency Phone for Hearing Impaired: (800) 972-3323

2. Local Hospitals

   Oroville Hospital
   2767 Olive Highway, Oroville, CA 95966
   (530) 533-8500

   Enloe Medical Center
   1531 Esplanade, Chico, CA 95926
   (530) 332-7300

   Feather River Hospital
   5974 Pentz Road, Paradise, CA 95969
   (530) 877-9361

3. Non Acute Illness-Environmental Exposure from Drift, Contaminated Water, or Food.

   Butte County Department of Public Health
   Mark A. Lundberg M.D., - Health Officer,
   202 Mira Loma Drive, Oroville, CA 95965,
   (530) 538-2163, Fax (530) 538-2165

   Yuba County Health and Human Services Department
   Dr. Nichole Quick - Health Officer
   5730 Packard Avenue, Suite 100, Marysville, CA 95901
   Office (530) 749-6366, Fax (530) 749-6397

C. PROCEDURE FOR CONTAINMENT AND CLEAN-UP OF HERBICIDE SPILLS

The contractor will provide a specific spill and employee health and safety plan which must include project specific information. For example, what types of Personal Protection Equipment is necessary for the chemicals being used, names of certified OSHA HAZMAT workers or HAZMAT cleanup companies who will be available for spill cleanup, and establish decontamination procedures for personnel and equipment. In the event of a spill, the spiller (contractor) is responsible. However, government agencies may initiate cleanup at the contractor's expense if timely and adequate action is not undertaken by the responsible owner or operator.

1. In the event of accidental spill, the objective is to take immediate action, in a safe manner, to minimize the spill contamination until specialized personnel and equipment arrives.

2. If the spill involves a vehicle accident, determine the extent of any possible injuries and notify the dispatcher so that emergency medical equipment and personnel can be dispatched. Threats to human life are a priority over spill containment and cleanup. NOTE: The degree of urgency for environmental monitoring is directly related to the

amount of herbicide spilled and its location. Forest Service personnel will not assist in cleanup, but will assist in indirect containment efforts such as blocking overside drains and culverts ahead of the flow of the spill.

3. In the event of an accident, both the Forest Service and contractor shall:

    a. Eliminate fire danger and administer first aid to seriously injured victims.

    b. Put out flaggers or flares to prevent additional accidents. Be careful using flares around spilled material.

    c. Try to prevent the material from entering waterways.

    d. Determine:

        - The chemical spilled.
        - Date and time of spill.
        - If in water, stream name and exact location.
        - An estimate of the amount spilled.
        - The concentration; is the spilled material concentrate or mixed chemical?

    e. Control traffic if necessary.

4. In the event of a spill the contractor shall also:

    a. Prevent ignition of flammable material by eliminating sources of ignition such as exhausts, electric motors, gasoline engines, or cigarettes.

    b. Take immediate action to stop the spill by either plugging the leak or doing whatever is safely possible to ensure the spill is stopped from coming out of the source container. Only properly trained and certified personnel may handle the pesticides. Consistent with employee qualifications, confine the spill to prevent it from spreading. Encircle the spill area with a dike of absorbent material such as kitty litter for water soluble pesticides, or construct an earthen berm. If necessary, dig a ditch to direct the spill flow away from sensitive areas. Consistent with employee qualifications, cover the spill with an absorbent material if the spill is liquid; if the spill is dry chemical, cover with a plastic tarpaulin and secure. (Note: Used absorbent materials must be disposed of as required by law.)

    c. Take immediate action to contain the spill by temporarily diverting it from water sources into a local ponding area. If needed, secure available equipment to build ponding areas so the spill does not reach waterways.

    d. If efforts to contain the spill fail and the spill enters a waterway, immediate notice of the spill should be given to the Forest Dispatcher so corrective action can be taken as soon as possible.

e. Separate leaking container(s) from other containers.

f. Prevent unprotected personnel from entering the spill area.

g. Contractor will not wash the spill into a ditch, drainage, stream, sewer drain, or off the road, since this serves to further spread the chemical.

h. Contractor will use safe removal procedures. Use certified hazardous waste transportation firms and disposal facilities when appropriate. Utilize manufactures disposal recommendations and state regulations for determining the best removal and disposal for specific quantities and chemicals. Provide the COR with copies of disposal manifests prior to final payment release.

- Transport waste to approved dumping area using EPA and state approved containers and methods.
- Contaminated soil will be disposed of as hazardous waste.
- Decontaminate tools, vehicles, concrete slabs, and any other object coming in contact with the chemical. Scrub thoroughly and follow with a clean water rinse. Provide for appropriate disposal of decontamination fluids.
- Inspect the surrounding area for possible contamination and leave entire area safe for the public and wildlife.

D. SPILL KIT EQUIPMENT

The contractor is required to maintain a spill kit on site for each application crew at all times. The contractor shall provide a spill kit equipment list to the Forest Service. Spill kit contents shall be approved by the Forest Service Contracting Officer (CO). Recommended items:

1. Personal protective equipment (PPE)

- 1 pair rubber or neoprene boots or overshoes
- 2 pair rubber or neoprene gloves
- 1 pair chemical splash proof goggles
- 1 respirator and spare cartridges
- 1 pair chemical splash proof coveralls
- 1 portable eyewash
- 1 pint of liquid detergent

2. Spill cleanup equipment

- 2 push brooms
- 1 dustpan
- 1 shop brush
- 1 round point shovel

- 1 square point shovel
- 1 polyethylene or plastic tarp
- Polyethylene bags with ties.

3. Spill containment

- Instructions on how to deal with spill.
- Powersorb spill kit with safe and send salvage drum (kit contains universal absorbents in boom, roll, and pad form)
- twenty five pounds of absorbent material such as kitty litter
- 1 container of epoxy sealer (to plug leaking containers)
- Twenty five pound bag of lime (acid neutralizing agent)

4. Public Safety

- Cellular phone, handheld radios for traffic control
- Traffic direction hand signs (slow/stop paddles)
- Reflectors or road flares
- High visibility traffic direction vests
- 1 ABC type fire extinguisher

E. LIST OF HAZMAT CLEANUP COMPANIES

Following is a list of private HAZMAT clean-up company(s) that may be contacted in case of a large emergency spill. The contractor is responsible for spill cleanup. In the event that the contractor does not perform his/her obligations the dispatcher or Forest or District HAZMAT Coordinator will contact a HAZMAT clean up company to initiate cleanup. This list is provided as a reference.

NRC Chico
1111 Marauder Street
Chico, CA 95973
Phone: (530) 343-5488
24-Hour Emergency Number: **(800) 337-7455**

LIST OF PHONE NUMBERS

Notification

Plumas National Forest Dispatcher - **(530) 283-7854**. If no answer, call **911**.
FRRD HAZMAT Coordinator – District Safety Committee at **(530) 534-6500**
PNF Pesticide Use Coordinator – Ryan Tompkins at **530- 283-7841**

Poison Control Centers

The California Poison Control System:
24-Hour Emergency Phone: **(800) 222-1222**

Sacramento Division; UC Davis Medical Center
Emergency Phone: **(800) 876-4766**
Emergency Phone for Hearing Impaired: **(800) 972-3323**

Hospitals

Oroville Hospital, 2767 Olive Highway, Oroville, CA 95966, **(530) 533-8500**
Enloe Medical Center, 1531 Esplanade, Chico, CA 95926, **(530) 332-7300**
Feather River Hospital, 5974 Pentz Road, Paradise, CA 95969, **(530) 877-9361**

County Health Departments

Butte County Department of Public Health
Mark A. Lundberg M.D., - Health Officer
202 Mira Loma Drive, Oroville, CA 95965,
(**530) 538-2163**, Fax (530) 538-2165

Yuba County Health and Human Services Department
Dr. Nichole Quick - Health Officer
5730 Packard Avenue, Suite 100, Marysville, CA 95901
Office (530) 749-6366, Fax (530) 749-6397

HAZMAT Cleanup

NRC Chico
1111 Marauder Street
Chico, CA 95973
Phone: (530) 343-5488
24-Hour Emergency Number: **(800) 337-7455**