United States Department of the Interior

BUREAU OF LAND MANAGEMENT
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‘Inimim Forest fuels reduction projects, FY 2012 (CA-180-11-52)
Finding of No Significant Impact
November 2011

It is my determination that this decision will not result in significant impacts to the quality of the human environment. Anticipated impacts are within the range of impacts addressed in the Sierra Resource Management Plan (RMP)/Final Environmental Impact Statement. The proposed action does not constitute a major federal action having a significant effect on the human environment; therefore, an environmental impact statement is not necessary and will not be prepared. This conclusion is based on my consideration of CEQ’s following criteria for significance (40 CFR §1508.27), regarding the context and intensity of the impacts described in the EA, and based on my understanding of the proposed action:

1) Impacts can be both beneficial and adverse and a significant effect may exist regardless of the perceived balance of effects. Potential impacts include temporary dust and noise caused by the use of chainsaws to cut and pile vegetation and temporary smoke due to pile burning. However, with the project design features, none of these impacts would be significant at the local or regional scale (cumulatively) because of the small scale of the proposed action.

2) The degree of the impact on public health or safety. No aspects of the proposed action have been identified as having the potential to significantly and adversely impact public health or safety. In fact, the project is designed to help firefighters fight wildfire and to protect nearby private residences from wildfire; therefore protecting public health and safety, especially for local residents.

3) Unique characteristics of the geographic area. The areas affected by the proposed action contain soils, vegetation, wildlife, and cultural resources are all typical for the elevation and terrain in the west central Sierra Nevada. There is unusually high biodiversity. The proposed action is designed to protect and even enhance this biodiversity.

4) The degree to which the effects on the quality of the human environment are likely to be highly controversial effects. No anticipated effects have been identified that are scientifically controversial. As a factor for determining within the meaning of 40 C.F.R. § 1508.27(b)(4) whether or not to prepare a detailed environmental impact statement, “controversy” is not equated with “the existence of opposition to a use.” *Northwest Environmental Defense Center v. Bonneville Power Administration*, 117 F.3d 1520, 1536 (9th Cir. 1997). “The term ‘highly controversial’ refers to instances in which ‘a substantial dispute exists as to the size, nature, or effect of the major federal action rather than the mere existence of opposition to a use.’” *Hells Canyon Preservation Council v. Jacoby*, 9 F.Supp.2d 1216, 1242 (D. Or. 1998).

5) The degree to which the possible effects on the human environment are likely to be highly uncertain or involve unique or unknown risks. The analysis does not show that the proposed action would involve any unique or unknown risks.

6) The degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration. Fuels reduction using hand crews is not precedent setting. BLM undertakes these types of projects on a regular basis.

7) Whether the action is related to other actions with individually insignificant but cumulatively significant impacts. No significant cumulative impacts have been identified. The proposed action is relatively small in scale and is consistent with the actions and impacts anticipated in the Sierra RMP. BLM has not recently proposed any projects of this scope within the 'Inimim Forest. Nothing like this is planned in the foreseeable future.

8) The degree to which the action may adversely affect National Historic Register listed or eligible to be listed sites or may cause loss or destruction of significant scientific, cultural or historical resources. The proposed action would not affect cultural resources listed on or eligible for the National Register of Historic Places.

9) The degree to which the action may adversely affect ESA listed species or critical habitat. No ESA listed species (or their habitat) would be affected by the proposed action.

10) Whether the action threatens a violation of environmental protection law or requirements. There is no indication that this decision would result in actions that would threaten such a violation.

_____ _____

William S. Haigh Date
Field Manager, Mother Lode Field Office

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EA Number: CA-180-11-52

Project Name: 'Inimim Forest fuels reduction projects, FY 2012

Location: Shields Camp (285 acres) MDM T 18 N, R 9 E, Section 34
T 17 N, R 9 E, Section 3

Bear Tree (147 acres) MDM T 17 N, R 9 E, Sections 4, 5, and 8

Nevada County, CA (See attached project area maps in Appendix B)

1.0 Purpose of and Need for Action

1.1 Need for Action

The Bureau of Land Management's Mother Lode Field Office (BLM) administers scattered public lands on the San Juan Ridge—what is referred to as the 'Inimim Forest. These lands are managed by the BLM in conjunction with the Yuba Watershed Institute (YWI) and other members of the local community.

Much of this area has either not experienced wildfire or has not been subjected to fuels reduction treatment in many years. Shrub stands have aged and now contain a larger proportion of dead fuels, and in many forest stands understory fuels have increased markedly, creating unhealthy forest conditions and making the probability that the area will experience a devastating wildfire more likely. At the same time, the local community has grown. There are now numerous private residences in the area, some of them are in close proximity to 'Inimim Forest parcels containing dense fuels. This area is considered to be within the wild land-urban interface (WUI) and the local community (North Columbia) is considered "at risk." YWI members and other members of the local community are concerned about this situation and have been working with the BLM to improve forest health and reduce hazardous fuels within the 'Inimim Forest.

With this need in mind, the primary purpose of the proposed action is to create healthy forest conditions and reduce the fire danger on two parcels of forested public land within the 'Inimim Forest. These parcels are called Shields Camp (285 acres) and Bear Tree (147 acres).

Our definition of healthy forest conditions within the project area derives from the findings of long-term US Forest Service research in the montane/mixed conifer forests of the west-central Sierra Nevada. This research is summarized in a report titled *An ecosystem management strategy for Sierran mixed-conifer forests* (North et al. 2009). This report contains key concepts and silvicultural principles that have been incorporated into the proposed action to achieve the goal of creating healthy forest conditions within the project area. Appendix A presents a summary of the research findings in this report.

A key finding is that mixed coniferous forests of this region (including forests types within the 'Inimim Forest/project area) are well adapted to, and perhaps dependent upon, regular low severity, low intensity wildfire. In other words, wildfire was likely an integral part of the lifecycle of western Sierran forests. The consequences of decades of suppression have been, most obviously, the buildup of dead brush, slash, and litter debris in the understory and dense thickets of conifers (especially incense-cedar and ponderosa pine). These conditions are considered unhealthy with many potential downsides, such as loss of ecological diversity, and greater susceptibility to disease/insect infestation. Critically, these conditions are more likely to support a high severity, high intensity fire—such as a crown fire—that could be devastating to the environment, not to mention property and lives. A key consideration, then, is how to restore the healthier pre-suppression conditions to the project area. This outcome would have the important effect of increasing the resilience of the forest to future wildfires and reducing the possibility of a high severity, high intensity fire on the San Juan Ridge. This is good for the environment as well as for local residents.

The most basic question is what would this forest look like if fire had been left to play its natural role? There would be far less brush and shrubs, fewer small diameter trees (including thickets of ponderosa pine and incense cedar), and widely spaced large diameter dominant trees of diverse species (sugar pine, Douglas fir, ponderosa pine, incense cedar, black oak, canyon live oak, madrone, etc.). There would also be more diversity in the herbaceous layer. This is the desired future condition we are working toward in the proposed action.

If a fire were to occur in this stand during the normal fire season in California, it would likely move into the upper story burning virtually all the trees and vegetation within the project area. The proposed treatments would move this stand to a healthier, more resilient condition so if a fire were to occur after treatment, it would just kill the small evergreens trees and remove much of the shrub and forb understory—which is what likely occurred historically.

Of note, a portion of the project area (Shield's Camp parcel) was treated in 1995 by the BLM using a combination broadcast burn and mechanical approach (refer to EA CA-018-95-08). This approach had various effects (some good, some not as good) on vegetation within the parcel, as will be discussed later in this EA under the affected environment section. Since 1995, a number of conditions have changed (i.e., close proximity to several homes/communities, air quality issues, the massive accumulation of fuels, budget constraints, etc.). The result is that a broadcast burn is now infeasible. Therefore, broadcast burning is not considered in this EA.

1.2 Conformance with Applicable Land Use Plans

The proposed action—to improve the health of forests on public land within the 'Inimim Forest and to make this forest more fire resistant to help protect adjacent private property—is consistent with the Sierra Resource Management Plan, approved in February 2008. The Sierra Resource Management Plan's Record of Decision (pages 15-16) gives BLM the goal of establishing a cost-efficient fire management program commensurate with threats to life, property, public safety, and environmental resources. BLM's objectives for meeting these goals are to 1). reduce the risk of wildfire in WUI communities; 2). reduce the risk of catastrophic wildfire through fuels management; 3). use prescribed fire, mechanical, and biological treatments to reduce fuels and promote ecosystem diversity and resilience, control invasive species, reduce fuel hazard, improve wildlife habitat, increase water yield, and enhance watersheds. The Folsom/Mother Lode Field Office Fire Management Plan, approved in March 2008, gives BLM various fire and fuels treatment objectives and strategies for specific lands under BLM's administration. Specific objectives and strategies for the fire management unit, in which the project area is located, are laid out in the plan. The proposed action is consistent with these objectives and strategies.

The proposed action is also consistent with the 1994 'Inimim Forest Management Plan, which was incorporated into the 2008 Sierra RMP. The 'Inimim Forest Management Plan came about as a partnership among the Yuba Watershed Institute, Timber Framer's Guild of North America, and the BLM. It is considered a "community-based" plan—it was developed largely through the input of these groups. The major goals of the plan (page 2) are to promote late seral forest conditions; reduce the risk of catastrophic fire; maintain all native plant and animal species; maintain and improve soils (no net loss of soils); and designate the 'Inimim an ACEC. The basic practices (page 14-16) and partnership goals (page 21) are acknowledged in this EA and will guide the proposed action to the extent possible.

2.0 Proposed Action and Alternatives

2.1 Proposed Action

The proposed action consists of two separate but related actions. The first would be carried out by the BLM. The BLM action is a large-scale fuels reduction project focusing on both the Shields Camp and Bear Tree parcels. The proposed work would occur primarily from fall 2011 to spring 2012, with follow-up maintenance work over the next ten years. The other action considered in this EA is much smaller volunteer workdays/projects organized and led by the YWI. The YWI work would occur in the Shields Camp parcel mainly during fall 2011 and winter 2012 and would involve manual methods to remove a small infestation of Scotchbroom and to clear shrubby vegetation and other hazardous ladder fuels around large conifers in order to "Save the Big Trees" from wildfire. The BLM and YWI actions are described in more detail below.

BLM proposed action: This action would occur in two phases. The first phase would change the arrangement of fuels by cutting select vegetation and placing it in 6 x 6 foot piles. Approximately 50 piles per acre would be constructed. The second phase would involve the use of prescribed fire to burn the piles in accordance with all applicable BLM and state of California rules, regulations, and policies. This would reduce the fuels. All work would be done by a hand crew (i.e., California Conservation Crew, contracted fuels crew, inmates, Hotshots, etc.) using chainsaws and other hand tools. The crew would be under the close supervision of BLM's fuel/fire management specialists. A masticator, chipper, or other similar heavy machinery would not be used. The work would focus on both the Shields Camp and Bear Tree parcels.

During the first phase, dead and decadent stands of whiteleaf manzanita, buckbrush, deerbrush, and other shrubby vegetation would be cut and placed in 6 x 6 foot piles. Black and live oaks would be retained regardless of canopy position unless they constitute a potential ladder fuel. Portions of the Shields Camp parcel contain dense stands of volunteer black oak. In these areas, nearly all black oaks less than 8 inches diameter at breast height (DBH) would be cut and placed in burn piles. Other broadleaf tree species such as madrone, tanoak, and dogwood would be left to create diversity unless they constitute a potential ladder fuel.

Douglas fir, ponderosa pine, incense-cedar, and other conifers less than 8 inches DBH would be cut and placed in burn piles. Some conifers less than 8 inches DBH would be retained to ensure species diversity and a full range of size and age classes would be represented. Large conifers and groups of large conifers would be retained, with strategic clearing of potential ladder fuels around them to give them additional protection and to create some open gaps in the canopy. This means that some conifers greater than 8 inches DBH would be removed if they are potential ladder fuels and to decrease overall stand density. Any conifers greater than 8 inches DBH that are to be removed to protect the larger "leave" trees and tree clusters would be marked by a BLM forester or fuels specialist.

A higher density of tree stems and canopy cover would be retained in the cooler moister microsites, such as along Spring Creek (outside of the riparian buffer) within the Shields Camp parcel, and along prominent unnamed ephemeral drainages in the Bear Tree parcel. Defect trees, snags, and downed logs would be retained for wildlife to the extent feasible. In particular, snags greater than 24 inches DBH provide hiding, denning, nesting, and food storage sites for a variety of wildlife. These large snags would be retained unless to do so would create an unusually unsafe concentration of fuels.

The second phase would involve the use of prescribed fire to burn the 6 x 6 foot piles, in accordance with a BLM-approved burn plan, other BLM policy, and state of California rules and regulations. This would reduce the fuel loading. If conditions are favorable and necessary safety procedures can be maintained, the prescribed burn would be allowed to "creep" on the forest floor around the piles to emulate a low intensity surface fire. This would potentially reduce the one-hour fuels built up over time within the conifer stands and leave a "mosaic" pattern across the forest floor. During the construction of 6 x 6 foot piles, bark and branches around the basal area of the larger conifers would be reduced by 50 percent, lowering the likelihood that these trees would be killed during low-intensity, low-severity wildfire.

YWI proposed action: The YWI has been receiving grant funding through the US Forest Service and other sources to do vegetation projects within the Spring Creek watershed on the San Juan Ridge. The YWI would like to hold volunteer workdays within the BLM's Shields Camp parcel during fall 2011 and winter 2012 to help meet the requirements of the grant. The YWI is also interested in other 'Inimim Forest parcels such as the Spring Creek parcel, which is not covered in this EA. The workdays within the Shields Camp parcel would involve removing an infestation of Scotchbroom and continuing the YWI's effort to "Save the Big Trees" in accordance with the 'Inimim Forest Management Plan.

1. An infestation of Scotchbroom is located in a shallow drainage along the west side of Casey Ranch Road, north of Shields Camp. The patch is less than one acre. The YWI would pull the weeds by hand, probably using weed wrenches. The Scotchbroom would then be piled in 6 x 6 foot piles and burned by BLM crews at a later date in accordance with a BLM-approved fire plan, other BLM policy, and state of California rules and regulations. Additional monitoring and follow-up work would be done in future years using the same methods (or placing the pulled broom in plastic garbage bags and disposing of them at a suitable disposal site) until the patch is entirely eradicated.

2. Clearing shrubby vegetation and other fuels around large conifers in order to help protect these trees from being destroyed by wildfire (and carrying fire into the canopy). Specifically, the YWI would remove all fire hazard vegetation up to 6 inches in diameter within the drip line of large diameter trees (greater than 30 inches DBH). Certain species of shrubs and trees such as dogwood and hazel determined to not be fire hazards would be retained. As many as five trees would be treated per acre. Cut vegetation would be piled in 6 x 6 foot piles and later burned by the BLM in accordance with a BLM-approved fire plan, other BLM policy, and state of California rules and regulations.

Follow-up work: After 10 years the present EA will be reviewed by staff to determine whether it is still adequate to reauthorize the proposed action and/or other kinds of fuels work. If not, additional NEPA would be completed. The BLM fuels/fire and the YWI and their partners must inform the BLM archaeologist, botanist, and wildlife biologist at least three months in advance before doing any follow-up work beyond FY 2012 so that sensitive environmental resources can be identified/flagged for avoidance and other project design features in 2.2 can be enforced.

Any fuels treatment work (i.e., broadcast prescribed burn, use of a masticator, use of a chipper, etc.) that BLM may propose in the future outside of the scope of the above described proposed action and/or

affecting land outside of the project area analyzed in this EA would be subject to BLM's full environmental review/decision-making process. In other words, a new NEPA document may be needed, including new cultural and biological recommendations.

2.2 Project Design Features

All treatment work would be conducted subject to the following stipulations.

1. **Minimize New Ground Disturbance.** Under the proposed action, no chippers, masticators, or other heavy equipment would be used to treat fuels. Only hand work would be allowed. Cut vegetation would be dragged across the ground and placed in 6 x 6 foot piles to be burned later, in accordance with applicable rules and regulations.

2. **Erosion and Sedimentation Control.** Erosion and sedimentation are potential issues affecting drainages within the project area. Spring Creek is a perennial stream that runs through the Shields Camp parcel. This and other drainages have been degraded by previous land use. Mining and timber harvest have left areas without vegetation which has caused some sedimentation in the channel. Under the proposed action, no chippers, masticators, or other heavy equipment would be used. Only hand work would be allowed.

3. **Weed Control.** To minimize the potential for introduction or spread of invasive weeds, equipment used for the proposed action would be cleaned prior to entering the area and, where possible, would avoid operating within weed-infested areas, such as stands of Scotchbroom. Occurrences of these weed species were primarily found at the edge of the public land and avoidance should be feasible. If small infestations are identified within the project area, these will be pulled and piled for burning. If more weeds are discovered during project implementation, they will be appropriately treated or marked and avoided until a plan is developed. A large patch of Scotchbroom would be treated by the YWI under the proposed action. The treatment methods are described above under section 2.1.

   Crews will be educated by BLM to use best management practices to prevent weed spread, including cleaning equipment prior to entry into the project area.

4. **Cultural Resources.** Flagging-tape buffers would be established around identified cultural resources. These cultural resources would be protected during project implementation.

5. **Wildlife.** Attempt to implement the project outside the breeding season, generally spring (March-June) so as not to disrupt nests, dens, and young animals.

6. **Wildlife.** Avoid wood rat nests and large woody debris when creating burn piles. If a potential nest cannot be avoided, check the pile for signs of wildlife before lighting. If nests or dens are found, leave the pile alone. If it must be burned, restack it nearby or give the animal a path to escape from the fire.

7. **Wildlife.** Leave an uncut patch (minimum of 0.25 acres) for every 10 acres harvested, with patches totaling 5 percent of the area. Use leave trees or large snags as the center for uncut patches. Riparian and other buffers can help to satisfy this goal.

8. **Wildlife.** Retain live trees with existing cavities.

9. **Wildlife.** Avoid damaging existing downed woody debris, especially large (18+ inches) hollow or rotten logs and rotten stumps during all harvesting operations. Leave all existing coarse woody material (more than 6 inches in diameter at the large end) and snags as possible.

10. **Wildlife.** Retention of coarse woody debris in managed stands should more closely model coarse woody debris found in natural stands. Retain and scatter tops and limbs from 20 percent of the trees harvested.

2.3 No Action

Under the no action alternative, the BLM and the YWI would not do the planned fuels reduction and weed treatments within the project area. The infestation of Scotchbroom would continue to spread throughout the Shields Camp parcel. Left untreated, this noxious weed is known to spread rapidly, often forming thick homogeneous mats in the understory of mixed conifer forests. It has already seriously undermined the native ecology (especially the herbaceous and shrubby components) of forestlands on the San Juan Ridge and throughout the region. Fuels would continue to build up, increasing the likelihood of a high severity high intensity fire. Ladder fuels could carry wildfire into the tree canopy creating crown fire conditions. These conditions can be devastating to the environment, not to mention lives and property. Without the Save the Big Trees effort, even a low intensity surface fire has the potential to move into the canopy of the larger conifers, potentially killing these trees and causing a relatively small fire to intensify and grow into a catastrophic crown fire.

2.4 Alternatives Considered but Eliminated from Detailed Analysis

A portion of the project area (Shield's Camp parcel) was treated in 1995 by the BLM using a combination broadcast burn and mechanical approach (refer to EA CA-018-95-08). Since 1995, the management situation the BLM faces on the San Juan Ridge has changed markedly. It is now extremely unlikely that the BLM would be able to conduct a broadcast prescribed burn within the project area. Some of the obstacles include the project area's close proximity to homes, air quality issues, the massive accumulation of fuels, and budget constraints. Therefore, broadcast burning is eliminated from detailed analysis in this EA.

3.0 Affected Environment

The project area is located in the north-central Sierra Nevada. The project area is located on the middle portion of the San Juan Ridge—the divide between the middle and south forks of the Yuba River, in the western foothills/low mountains of the Sierra Nevada. The project area consists of two separate parcels referred to as Bear Tree (147 acres) and Shields Camp (285 acres). The parcels are about 1.25 air miles from each other, on southern-facing slopes of the San Juan Ridge. The Bear Tree parcel is further south and west. Elevations within this parcel range from 2680 to 2968 feet amsl. Elevations within the Shields Camp parcel range from 3040 to 3640 feet amsl. Please refer to the project area location maps in Appendix B. Detailed descriptions of the affected environment of each parcel are described, by resource, in the following.

Soil – Air – Water. The 1992 Chico Sheet (geologic map) indicates that the project area has complex geology. The far northeastern portion of the Shield Camp parcel contains a steep grade underlain by rhyolite, welded and non-welded tufts, sandstone, siltstone, claystone, and conglomerate of Oligocene-Miocene age (probably the Valley Springs formation). The middle of the northern portion of the parcel is underlain by andesitic mudflows, breccia, tufts and volcanic sediments of Miocene-Pliocene age (probably the Mehrten formation). The middle and southern portion, including along Spring Creek, contains Eocene river channel deposits. The northwestern portion of the parcel is underlain by metasedimentary rocks of Mesozoic and/or Paleozoic age, as well as diorite (plutonic) of Mesozoic (Cretaceous-Jurassic) age. The soils present within the Shield Camp parcel include Cohasset cobbly

loam (30-50 percent slopes) and Sites very stony loam (15-50 percent slopes) within the northwestern portion of the parcel; Cohasset cobbly loam and Secca-Rock outcrop complex (2-50 percent slopes) within the northeastern portion of the parcel; Cohasset cobbly loam (5-30 percent slopes) and Chaix-Rock outcropping complex (30-75 percent) in the middle of the northern portion; and Horseshoe gravelly loam (15-30 percent slopes) in the southern portion of the parcel.

The Bear Tree parcel is underlain predominately by metasedimentary rocks of Mesozoic and/or Paleozoic age. To the northwest, north, and east of the parcel are Eocene river channel deposits/extensive hydraulic mining areas. Soil types include Sites loam (9-15 percent slopes) mainly within the northern portion of the parcel; Horseshoe gravelly loam (9-15 percent slopes) along the northwestern boundary of the parcel; Josephine loam (15-30 percent slopes) and Josephine-Mariposa complex (50-75 percent slopes) within the southern portion of the parcel.

Generally, the project area has a mean minimum temperature of 34 degrees F in January, a mean maximum temperature of 92 degrees F in July, and one of the highest annual precipitation rates in California (50 to 60 inches). Snowfall is usually just 15 percent of wintertime precipitation. Summers are usually hot and arid, though the area has the state's highest rate of warm season precipitation (8 to 12 inches) south of Humboldt County (Raven and Axelrod 1978:figure 9).

There are various drainages within the project area, all within the South Yuba River watershed. The only perennial drainages are Spring Creek and Holden Spring Creek, both of which run through the Shields Camp parcel. Spring Creek is a major drainage on the middle part of the San Juan Ridge. It runs northwest-southeast through the Shields Camp parcel. Holden Spring Creek runs through the northwest corner of the parcel. It drains into Spring Creek which drains into the South Yuba River (the confluence is just downstream of Edwards Crossing). There are meadows, springs, and seeps as well as manmade ponds within the Shields Camp parcel. The prominent ephemeral drainages in the southern half of the Bear Tree parcel are tributaries of Spring Creek. Air quality is generally good.

Vegetation. Vegetation within the project area varies depending on elevation, soils, aspect, etc. The project area was inventoried by BLM botanists in the summer of 2011. The area was also inventoried by BLM botanists and others (foresters, YWI specialists) in the past for other projects.

Vegetation within the Bear Tree parcel is described in EA CA-040-0-90. This EA was prepared by the BLM in 1980 for a timber sale focusing on this parcel. Ponderosa pine is described as dominant on the ridges and Douglas fir is dominant on the northern slopes, with considerable incense cedar, black oak, and madrone in the overstory and abundant mountain misery, whiteleaf manzanita, and deerbrush in the understory. The timber sale analyzed in the 1980 EA was implemented by the BLM. Aside from road and landing construction/use, the impacts of the timber sale on the parcel's vegetation are unclear. The 1994 'Inimin Forest Management Plan indicates that the Bear Tree parcel is dominated by ponderosa pine. There is an open area dominated by whiteleaf manzanita on the southern slope of a ridge in the southern portion of the parcel. In the southwest corner of the parcel is a dense stand of Douglas fir, ponderosa pine, incense cedar, black oak, live oak, and madrone. The understory consists of azalea, dogwood, wood rose, snowberry, and toyon.

Vegetation within the Shields Camp parcel is described in detail in EA CA-018-95-08 (pages 6-8). This EA was prepared by the BLM in November 1994 for a combination broadcast burn and mechanical fuels reduction project focusing on most of this parcel as well as the nearby Big View parcel (which is not subject to the proposed action in this EA). Riparian zones of Spring Creek and Holden Spring Creek contain bigleaf maple, dogwood, madrone, and yew among other species. A few tanoak occur on slopes above the riparian zone. The northern half of the parcel contains a mixed conifer forest with ponderosa pine, Douglas fir, incense cedar, sugar pine, madrone, canyon live oak,

black oak, and other species. The composition of this forest depends on elevation, soils, aspect, moisture, etc. The west half of the northern part of the parcel (in Section 34) contains a nearly pure stand of ponderosa pine of good size and health. Closer to Holden Spring Creek, in the east half of the northern part of the parcel, white fir is beginning to succeed an overstory of ponderosa pine and Douglas fir.

Just north of Spring Creek is an even aged stand of almost entirely ponderosa pine of around 100 years old. The northeast corner of the parcel (in Section 34) is predominantly a black oak forest with some tanoak and canyon live oak. Mountain misery covers most of the ground. At the base of the steep grade in the west half of the northern part of the parcel is a 1.5-acre area dominated by large madrone with trunks up to 42 inches DBH. There is a series of meadows south of the steep grade, including a large meadow with springs at the Shields Camp site. Around the meadows are scattered large ponderosa pine, oak and madrone with a sparser ground cover of mountain misery. There are also several large buckeye found around the meadow . The northern portion of the parcel contains many large yews with 7-10 inch DBH. Shrubs include hazelnut, deerbrush, buckbrush, whiteleaf manzanita, poison oak, black oak, blackberry, raspberry, and snowberry. The southern half of the parcel contains a broad flat area dominated by ponderosa pine, many of which are large, interspaced with incense cedar and black oak. The understory consists of ponderosa pine, black oak, incense cedar, ceanothus, and whiteleaf manzanita. The burn/mechanical fuels project was implemented in 1995 with mixed results still evident today. Deerbrush and other shrubby vegetation have come back in force. Dense thickets of deerbrush have come up along the roadways within the parcel. Black oak has also returned.

There is low potential for Butte County fritillary (*Fritillaria eastwoodiae*) within the project area. This species is noted as rare by the California Native Plant Society (CNPS) but is not a BLM sensitive species, which means the BLM is not mandated to protect this species. However, this species was surveyed for and is included in the EA to prevent the need for listing of this species in the future. There are documented occurrences of Butte County fritillary within four miles of the project area according to the California Native Diversity Database; however, extensive surveys in 2011 did not locate any individuals. This finding is consistent with the 1994 inventory and interviews with local naturalists.

Butte County fritillary is an herbaceous perennial which grows from a bulb. It blooms in early spring, and has distinct easily identifiable flowering stalks. It typically occurs in chaparral and lower montane coniferous forests. This species has the tendency to occur in small patches with few individuals and can be difficult to detect. The botanical survey covered a large representative portion of the habitat, but the possibility of Butte County fritillary cannot be completely ruled out. This species is dormant throughout the fall and winter, and is considered to be adapted to withstand low intensity fires.

Wildlife. The vegetation within the two project area parcels provides habitat for a variety of wildlife. Blacktail deer are commonly seen large mammals. There is abundant evidence of black bear, coyote and gray fox. Western gray squirrel, northern flying squirrel, moles, voles, cotton tail rabbit, jackrabbit, mice, and wood rats are common small mammals. Local residents have reported observing mountain lion, bobcat, raccoon, and Virginia opossum.

To date, 103 species of birds have been documented to occur either seasonally or as permanent residents to the Inimim Forest. Wild turkeys can be found. Several species of woodpeckers, including the pileated woodpecker, are present. Wood warblers are commonly seen in spring and early summer. Several birds including American robin, dark-eyed junco, chestnut-backed and black-capped chickadees, Steller's jay, and red-breasted nuthatch are common residents. Several raptor species, including two BLM sensitive raptors, California spotted owl and northern goshawk occur on the Shields Camp parcel. In 1982, California spotted owl was documented on the northeastern portion of

the Bear Tree parcel. The current status of the Bear Tree California spotted owl is unknown. However, habitat for both California spotted owl and northern goshawk is present on both parcels.

Several species of reptiles and amphibians are present. Included among the reptiles are the western fence lizard, western skink, side-blotched lizard, Northern Alligator lizard, racer, western rattlesnake, rubber boa and king snake. Among the known amphibians are the California newt, western toad, Pacific tree frog, and the introduced bull frog. Foothill yellow-legged frog, a BLM sensitive amphibian species, occurs in Spring Creek in the Shields Camp parcel. The creek also supports rainbow trout.

Cultural Resources. The San Juan Ridge, including the project, was inhabited for 4500 (and perhaps as long as 10 to 12 thousand years) prior to Euro-American settlement starting during the Gold Rush (1848 to circa 1858). Beginning during the Gold Rush the San Juan Ridge experienced substantial gold mining. Gold mining (and later logging) was historically the backbone of the region's economy. Many of the current towns in the vicinity of the project area such as North Columbia were founded during the mining heyday (late 1860s-1884). The San Juan Ridge had some of the largest hydraulic mines in California. The largest was the Malakoff pit, which is now within a state historic park. The mining industry on the San Juan Ridge was effectively shut down by the 1884 Sawyer Decision—a court ruling that enjoined hydraulic mining on the west slopes of the Sierra Nevada. Evidence of mining and logging activity within the project area is a legacy of the region's historic mining and logging economies. The project area is highly sensitive for cultural resources. It was inventoried by the BLM archaeologist in summer/fall 2011. For more information about the cultural resources found within the project area, refer to the attached cultural resources inventory report by the BLM archaeologist (2011).

Recreation. The project area is near the boundary of the Tahoe National Forest. In fact, the Shields Camp parcel is adjacent to the Forest. There are residences on private land in the general area, including adjacent to both the Shields Camp and Bear Tree parcels. The level of recreational use in the project area is quite low. The project area may see some use by hunters.

Visual Resources. The BLM manages this area in accordance with class II visual resource management (VRM) standards. The BLM's objective for class II is to retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape.

Other. There are several active mining claims within the project area. The BLM is regulating the use of these claims under the federal mining regulations at 43 CFR 3809

4.0 Environmental Effects

The following critical elements have been considered in this environmental assessment and have been determined to be unaffected by the proposal: areas of critical environmental concern, prime/unique farmlands, floodplains, wilderness, and environmental justice.

4.1 Impacts of the Proposed Action and Alternatives

Soil – Air – Water. The proposed action would have negligible short-term negative impacts on atmospheric, water, and soil resources in the project area. No heavy equipment would be operated within the project area. The proposed action would not have more than a negligible impact on soils and water quality. Cutting and burning of vegetation, as proposed, would create some dust and smoke, but

again dust and smoke created by the proposed action is small and not enough to seriously affect air quality. All applicable rules and regulations would be followed.

Vegetation. The BLM botanist analyzed the impacts of the proposed action on botanical/vegetation resources, especially special status plants. The analysis is designed to help BLM meet its obligations under the Endangered Species Act and other authorities and BLM policies. The botanist recommended that the proposed action would not affect threatened and endangered plants or BLM sensitive plants. While it is unlikely that the Butte County fritillary is present in the project area, if it does occur, its numbers would most likely be small and would not represent a large portion of the population. Because this species has been shown to withstand low intensity fires, and because the project work would be done in the fall and winter when the plant is dormant, this species should not be adversely affected by the proposed action.

Project area plant communities including meadow environments, riparian zones along Spring Creek, and mixed conifer forests are adapted to periodic wildfire. The proposed treatments would mimic the effects of a low intensity low severity wildfire. The project area has experienced natural wildfire events in the past (as well as broadcast burning) and has recovered after the removal of shrubs and other understory vegetation. Likewise, the common woody species (e.g., deerbrush, small black oak, whiteleaf manzanita, etc.) that would be cut in the course of the proposed action would reestablish themselves within the project area over time.

Wildlife. The BLM wildlife biologist analyzed the impacts of the proposed action on wildlife, especially on special status wildlife. Her analysis was designed to help BLM meet its obligations under the Endangered Species Act and other authorities and BLM policies. The biologist recommended that the proposed action would not affect threatened and endangered wildlife or other BLM special status wildlife.

While fuels treatments can decrease the risk of catastrophic fire, they do not provide the ecosystem benefits of low intensity low severity fire, and they alter habitat needed by wildlife. In general, fire-dependent species, species preferring open habitats, and species that are associated with early successional vegetation or that consume seeds and fruit appear to benefit from mechanical fuel reduction activities. Increasing understory light for shrub patch development can increase habitat for some small mammals and birds. In contrast, species that prefer closed-canopy forests or dense understory, and species closely associated with those habitat elements that may be removed or consumed by fuel reductions, would likely be negatively affected by fuel reductions. Some habitat loss may persist for only a few months or a few years, such as the loss of shrubby understory vegetation which can recover quickly. The loss of large-diameter snags and down wood, which are important habitat elements for many wildlife and invertebrate species, may take decades to recover and thus represent some of the most important habitat elements to conserve during fuel reduction treatments. Retention of snags is addressed in the proposed action. Downed wood retention is addressed in project design features 9 and 10. These measures would reduce this impact.

Overall, direct mortality of wildlife owing to crushing from heavy equipment during fuel reduction is considered to be low, but this is mostly based on anecdotal information. It is believed that most species are able to find refuge microsites (e.g., inside burrows or under surface objects) or move away from approaching equipment. However, spring-season thinning during the breeding season may result in mortality of ground- and shrub-nesting bird nestlings and species living within litter such as small mammals, reptiles, amphibians, and invertebrates. Project design feature 5 that attempts to avoid the breeding/nesting period would reduce this impact.

Black bear. By volume, about 25 percent of black bear diet can consist of insects (mainly ants and yellowjackets) obtained primarily from down logs. A decrease in down wood would result in fewer ants and yellowjacket nests available to black bears. Project design features 9 and 10 address the retention of coarse woody material. Fuels reduction would likely increase the amount of grasses and berries used by black bears for foraging.

Deer. The proposed fuels reduction strategy would increase forage quantity and quality for deer. However, escape cover for mule deer, and other animals that need high shrub cover to avoid predators would be reduced. Project design feature 7 which calls for the retention of uncut patches of vegetation would reduce the impacts of less escape cover.

Small Mammals. Shrubs, down wood, and snags provide important cover from predators thus the loss of these habitat elements may have negative consequences for some small mammal species. The strategy to be implemented, along with project design features 9 and 10, address snag and down wood retention and would reduce this impact. Small mammal species that need high shrub cover to avoid predators may be negatively affected by shrub removal for the first few years post-treatment, but then exceed pretreatment population levels when shrubs recover and food sources are high from increased light, herbaceous growth, and seed production. Project design feature 7 that retains patches of uncut vegetation would reduce the impacts of shrub removal. However, other species prefer open habitat conditions and may benefit from the food resources provided by plentiful grasses and forbs that may establish after fuel reduction. Some species of small mammals prefer high canopy closure, such as northern flying squirrel, and thus may be adversely affected by thinning treatments. Thinned stands would likely be poor bushy tailed woodrat habitat due to their association with abundant large snags, mistletoe brooms and soft log cover. Project design feature 10 that addresses retention of pre-harvest coarse woody material and the proposed action which addresses retention of snags will reduce these impacts.

Bats. Several species of bats roost under the bark of tall, large-diameter trees or in cavities of large snags. If large-diameter snags and trees are protected during fuel reduction as proposed, it is likely that fuels reduction may have minimal or even positive effects on bat populations. Retention of large trees and snags is addressed in the proposed action and project design features.

Birds. Fuels reduction conducted during the nesting season is more likely to result in high mortality of nestlings, especially for species nesting on the ground and in shrubs and small trees. Project design feature 5 that attempts to avoid the breeding/nesting period would reduce this impact. Fuels reduction prior to the nesting season is likely to reduce nesting habitat for ground- and shrub-nesting species. At the population level, the proposed project would not have a measurable negative effect on migratory bird populations. This is in part because the project is relatively small compared to the amount of mixed conifer forest within the field office boundary. The impact is further reduced by project design feature 7 which leaves patches of uncut vegetation.

Bird responses to fuels reduction are dependent on the species and other factors. Some bird species prefer early successional and open habitats, and these species are likely to increase in abundance after fuel reduction. In contrast, some bird species may be less abundant after fuel reduction. Hurteau et. al (2008) found that mountain chickadee and yellow-rumped warbler were particularly sensitive to thinning treatment in his study at the Southwestern Plateau. Removal of large trees or snags would likely affect species nesting in tree canopies and cavities of snags or live tree boles. Recruitment of large snags for cavity nesters may take decades or longer, depending on existing stand conditions. The proposed action which addresses the retention of large trees and snags would reduce these impacts. Further, project design feature 8 that addresses retention of live trees with cavities would reduce these impacts.

Cavity-nesting birds. If fuel treatments involve removing or eliminating snags, then a net loss of nesting habitat for primary and secondary cavity-nesting birds might be expected for many years. The majority of research studies report that fuel treatments result in a decrease in populations of cavity nesters owing to loss of dead trees used for nesting and roosting. The proposed action which addresses the retention of large trees and snags would reduce these impacts. Further, project design feature 9 that addresses retention of live trees with cavities would reduce these impacts.

Raptors. The more open understory created by fuel reduction may be advantageous to some species of hawks and owls that prey on small mammals and birds in open forests and small clearings. Prey species that have less cover are more easily captured, and some prey species prefer open forests (for example, deer mice). However, some raptor species and some small mammals and avian prey prefer closed canopy forests and thus may avoid stands that have been treated to reduce fuels. Raptor species that prefer closed canopy forest, such as California spotted owl and northern goshawk, are present in the project area. Thinning from below, while still retaining large trees, snags, large downed wood, and high canopy closure should allow continued habitat suitability for northern goshawk and California spotted owl. Although vegetation manipulation to reduce wildfire hazard may create less than optimum habitat for northern goshawk and California spotted owl, this should be weighed against the hazard for stand replacement fires and complete loss of habitat over large areas. Retaining large trees, snags, large downed wood, and patches of high canopy closure is addressed in the proposed action and the project design features. In addition, the proposed action that YWI will be carrying out is specifically designed to protect big trees which are preferred by these species, from being consumed by wild fire. The thinning from below will also promote the growth and vigor of these large trees. The removal of trees with dwarf mistletoe brooms during thinning treatments would likely be detrimental to wildlife species that nest in mistletoe brooms, including great horned owl, northern goshawk, Cooper's hawk, California spotted owl, and red-tailed hawk. Retention of defect trees which is addressed in the proposed action would reduce this impact.

Amphibians. A few amphibians are strictly aquatic, but most use upland habitats at various times during the year, and a few species are strictly terrestrial. Upland habitat use by forest amphibians largely depends on the availability of moist duff and litter and rotting down wood. Amphibian response to reducing canopy cover would likely be unfavorable because of the warmer and drier conditions created in the understory vegetation, down wood, litter, and soil. Most terrestrial salamanders require moist soils or decomposing wood to maintain water balance, and dry conditions usually result in suppressed populations. Project design features 9 and 10 that address retention of downed wood would reduce this impact. Anurans (frogs and toads) may be less affected by changes in environmental conditions associated with the proposed fuel reduction project because of their tendency to travel at night and during rain events, their greater vagility than salamanders, and their close association with wetlands. Still, species that frequently occupy terrestrial habitats such as many salamanders, boreal toads, and tree frogs may be killed during fuel treatments or find post-treatment conditions unsuitable. These negative effects would be expected to be short-term. The direct mortality of amphibians during fuels reduction treatment is not anticipated to be high. Fuels reduction treatments may contribute fine sediment to streams because of increased surface runoff. Sedimentation causes reduced survivorship of eggs and tadpoles of some stream-breeding amphibians that lay their eggs and rear tadpoles under rocks or within interstitial spaces in the substratum. Project design feature 2 that establishes erosion and sedimentation controls to reduce this impact. The riparian buffer that has been established in the project design will also reduce this impact.

Reptiles. James and M'Closkey (2003) found that the removal of dead trees (standing and prone) during fuels treatment on the Colorado Plateau may limit the local distribution, abundance, and diversity of lizards, which include dead trees in their microhabitat for shelter, perching, foraging,

courting, and defending territories. Removal of dead trees could seriously affect the local abundance and diversity of lizard species, which spend substantial time in this microhabitat. Project design features 10 and 11 address the retention of coarse woody debris, and the proposed action addresses retention of snags. The retention of snags and coarse woody debris would reduce these impacts.

Coarse Woody Debris. One of the key differences between biomass removal and a traditional timber harvest is the reduction of dead wood on the forest floor. Besides providing wildlife habitat, dead wood serves as a seedbed for regeneration, releases nutrients back into the soil and forest, decreases runoff and erosion, facilitates nitrogen fixation, and stores forest carbon.

Butts and McComb (2000) found in their study site in western Oregon that coarse woody debris reductions associated with thinning of stands may negatively impact salamanders and shrews. The abundance of ensatina and clouded salamanders increased with the volume of coarse woody debris. In addition, the probability of encountering either ensatina or Trowbridge's shrew increased with cover of coarse woody debris on the forest floor. The study suggests that current management guidelines for coarse woody debris retention may not provide adequate habitat for forest-floor vertebrates that depend on this component of the habitat. The authors suggest that the retention of coarse woody debris in managed stands should more closely model coarse woody debris found in natural stands, and thus recommend coarse woody debris retention in the range of 100-300 m3/hectare. This is more likely to provide coarse woody debris for terrestrial salamanders.

In three regions (West, North and East) of south and central Sweden, Gunnarson et. al. (2004) studied short-term effects of slash removal on species richness and abundance of beetles in coniferous and mixed forests. The study concluded that extensive slash removal leads to impoverished species richness of beetles at a local scale. Slash heaps left on site may provide important refuges for ground-active beetles. Moreover, the results support the general theory that microhabitat structure affects arthropod abundance and diversity. Project design features 9 and 10 that address the retention of coarse woody debris would reduce these impacts.

Cultural Resources. The BLM archaeologist has conducted a cultural resource study for the proposed action to determine whether significant cultural resources could be affected by the proposed action. The study includes a background records search, Native American consultation, and field inventory. The study is designed to help BLM meet its obligations under Section 106 of the Historic Preservation Act. The backgrounds record search and field inventory indicate very high sensitivity for prehistoric resources. The project area also has very high sensitivity for historic-era gold-mining- and logging-related resources. Logging during the last 30 years has also left a mark on the project area in the form of skid roads, stumps, and eroded areas. The Bear Tree parcel was subjected to timber sale around 1980. All cultural resources found within the project that could be affected by the proposed action would be flagged for avoidance. In other words, no cultural resources would be affected by the proposed action. It is anticipated that the proposed actions would not affect significant cultural resources. Consultation with Native Americans is occurring as this EA is put out for public review. All Native American input will be carefully considered. We do not anticipate that any places of traditional religious and cultural significance to Native Americans would be affected. If we do identify such places we will work with the affected Native Americans to modify the proposed action to avoid negative effects. Project design feature 4 addresses cultural resource protection.

Recreation. The proposed action could have negligible short-term negative impacts on recreational use. Hunters and motorists on designated routes might be inconvenienced temporarily during project implementation due to the noise and the dust caused by cutting and chipping fuels, and the use of the roads in the area by project-related vehicles. Recreationists would continue to use the project area after the proposed action is implemented with no additional inconvenience.

Visual Resources. The project area is not known for its visual resources. The proposed project would have a negligible impact on visual resources. Vegetation would be removed. Some might consider this an improvement to the scenery. Most importantly, the proposed action would be consistent with BLM's VRM class II management objective under the 2008 Sierra RMP, which is to retain the existing character of the landscape.

4.2 Impacts of the No Action Alternative

There would be no direct impacts to environmental resources, such as atmospheric, soil, water, biological, and cultural resources. Though highly variable and difficult to predict with certainty, not implementing the proposed action could lead to detrimental impacts to forest health, firefighting efforts, and adjacent private properties. If a fire were to occur within the project area during the usual California fire season, it would likely move into the upper story—a crown fire—burning virtually all the trees and vegetation within the project area. By doing proposed treatment, we can move this stand to a healthier, more resilient condition so if a fire were to occur after treatment, it would just kill the small evergreens trees and remove much of the shrub and forb understory—which is what likely occurred historically.

4.3 Cumulative Impacts

Negative cumulative impacts on the larger watershed scale are not anticipated. The proposed action would have negligible negative impacts on commonplace plants and wildlife. The current condition of the vegetation has been influenced by decades of wildfire suppression. Other than prescribed fire (or an uncontrolled wildfire), which has been removed from further consideration in this EA for a variety of reasons (refer to Section 2.4), there is not at present a better way to reduce dense understory vegetation that would have been reduced by wildfire in the past, before fire suppression was practiced. Prescribed burning is severely limited by safety and air quality concerns, especially in the wildland urban interface. The number of homes in close proximity to the project area would make burning here problematic. The proposed action is expected to have beneficial cumulative impact on wildfire suppression in the area, as long as BLM maintains the treatment area.

With respect to atmospheric, soil, and water resources, negative cumulative impacts on the watershed scale are not anticipated. The project design features would greatly limit the amount of potential erosion of sediments into the drainages/tributaries of the South Yuba River. The BLM has not recently proposed any projects of this scope on the San Juan Ridge within the South Yuba River watershed. Nothing like this is planned in the foreseeable future.

5.0 Agencies and Persons Consulted

5.1 Authors

James Barnes, BLM NEPA coordinator/archaeologist
Brian Mulhollen, BLM fuels specialist
Beth Breneman, BLM botanist
Lauren Fety, BLM biological technician
Peggy Cranston, BLM wildlife biologist

5.2 BLM Interdisciplinary Team/Reviewers:

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NEPA coordinator/Archaeologist Date

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Fuels specialist Date

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Forester Date

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Wildlife biologist Date

/s/ Beth S. Brenneman *10-18-11*

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Botanist Date

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Outdoor recreation planner/VRM specialist Date

5.3 Availability of Document and Comment Procedures

This EA will be posted on Mother Lode Field Office's website (www.blm.gov/ca/motherlode) under NEPA and will be available for a 30-day public review period. The EA is also available by mail upon request during this 30-day public review period. Comments should be sent to James Barnes at Bureau of Land Management, Mother Lode Field Office, 5152 Hillsdale Circle, El Dorado Hills, California 95762 or emailed to jjbarnes@blm.gov.

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Appendix A

Silvicultural Prescription for Sierran Mixed-Confier/Lower Montane Forest

A.1 Background and the Importance of Fire

Our definition of healthy forest conditions within the project area draws heavily from the research of North et al. (2009) in the western Sierra Nevada. Their recent report titled *An ecosystem management strategy for Sierran mixed-conifer forests* (North et al. 2009) contains key concepts and silvicultural principles that we feel can be incorporated into the proposed action to achieve the goal of creating a healthy forest conditions within the project area.

Chief among these concepts is the importance of wildfire. North et al (2009) explains that:

> Fire plays a pivotal role in reshaping and maintaining mixed-conifer ecosystems. Fire was once very common in most of the western Sierra and has been a primary force shaping the structure, composition, and function of mixed-conifer forests. … [Most of the fires were of low intensity and returned at frequent intervals.] The main effect of low-intensity fire is its reduction of natural and human-created (i.e., resulting from management activities) fuels, litter, shrub cover, and small trees. These reductions open growing space, provide a flush of soil nutrients, and increase the diversity of plants and invertebrates. By reducing canopy cover, fire also increases habitat and microclimate heterogeneity at site, stand, and landscape levels [North et al. 2009:5-6].
>
> Forest fuels are usually assessed in three general categories: surface, ladder, and canopy bulk density. Fuel treatments often focus on ladder fuels (generally defined to be variably sized understory trees that provide vertical continuity of fuels from the forest floor to the crowns of overstory trees.) Some studies and models, however, suggest a crown fire entering a stand is rarely sustained (i.e., sustained only under extreme weather conditions) if understory fuels are too sparse to generate sufficient radiant and convective heat. [North et al. 2009:3].
>
> By itself, prescribed fire is difficult to apply in some forests owing to fuel accumulations, changes in stand structure, and operational limitations on its use. Mechanical treatments can be effective tools to modify stand structure and influence subsequent fire severity and extent and are often a required first treatment in forests containing excessive fuel loads. [North et al. 2009:6-7]
>
> Prescribed fire is generally implemented very carefully, killing only the smaller size class trees. In some cases, it is ineffective for restoring resilience, at least in the first pass. For example, prescribed fire may not kill many of the larger ladder-fuel or co-dominant true fir trees that have grown in with fire suppression. In many stands, mechanical thinning followed by prescribed fire may be necessary to achieve forest resilience much faster than with prescribed fire alone. [North et al. 2009:7]
>
> Some forests cannot be prescription burned, at least as an initial treatment, because of air quality regulations, increasing wildland home construction, and limited budgets. Yet restoration of these forests still depends on modifying fuels because it reduces wildfire intensity when a fire does occur and can produce stand conditions that simulate **some** of fire's ecological effects. [North et al. 2009:7]

One measure of resilience is that fire disturbance produces mortality patterns consistent with the dynamics under which the forest evolved. Mixed-conifer resilience might be best ensured by (1) reducing fuels such that if the forest burned, the fire would most likely be a low severity surface and (2) producing a forest structure that keeps insect and pathogen mortality at low, chronic levels. Where intermediate-size trees are abundant, they may present a fire and fuels risk, especially when live crowns are continuous to the forest floor (North et al. 2009:v).

Intermediate-size trees can contribute to overly dense stands that are moisture stressed and at risk of bark beetle attacks:

In addition to ladder and surface fuels, managers have been concerned with reducing canopy bulk density in DFPZs and the defense zone of wildland urban interfaces (WUI). Overstory trees are commonly removed, and residual trees are evenly spaced to increase crown separation. The efficacy of canopy bulk density reduction in modifying fire behavior is largely a function of weather conditions. Research has suggested there is often limited reduction in crown fire potential through overstory thinning alone, without also treating surface fuels. [North et al. 2009:4]

A concern with the widespread use of canopy bulk density thinning in defensible fuel profile and defense zones is the ecological effects of the regular tree spacing. In the Sierra Nevada, historical data, narratives, and reconstruction studies indicate mixed conifer forests were highly clustered with groups of trees separated by sparsely treed or open gap conditions. This clustering can be important for regenerating shade-intolerant pine, increasing plant diversity and shrub cover moderating surface and canopy microclimate conditions within the tree cluster and providing a variety of microhabitat conditions for birds and small mammals. [North et al. 2009:4]

A.2 Importance of Stand Heterogeneity and Density

Recent studies have shown that spatial heterogeneity was a key feature in forest resiliency and characteristic of frequent fire's effect on mixed-conifer forests. Fuel treatments that produce uniform tree spacing reduce this ecologically important spatial heterogeneity. North et al. (2009) explains that:

Horizontal heterogeneity, however, used to be relatively common in Sierran mixed-conifer forests [due to logging/reforestation practices]. All of the Sierran reconstruction studies suggest mixed-conifer forests, under an active fire regime, had a naturally clumped distribution containing a variety of size and age classes. [North et al. 2009:15]

At the stand level, vertical heterogeneity can still be provided by separating groups of trees by their canopy strata. For example, a group of intermediate-size trees that could serve as ladder fuels might be thinned or removed if they are growing under large overstory trees. The same size trees in a discrete group, however, might be lightly thinned to accelerate residual tree growth or left alone if the group does not present a ladder fuel hazard for large, overstory trees. [North et al. 2009:15-16]

To increase horizontal heterogeneity, we suggest using microtopography as a template. Wetter areas, such as seeps, concave pockets, and cold air drainages, may have burned less frequently or at lower intensity. Limiting thinning to ladder fuels in these areas is suggested because with their potentially higher productivity and cooler microclimate, they can support greater stem densities, higher canopy cover, and reduced fire effects. A concern with current uniform fuel reduction is that these microsite habitats associated with sensitive species would be eliminated. Surface fuel loads at these microsites should still be reduced to lower their vulnerability to high-intensity fire.

In contrast, upslope areas, where soils may be shallower and drier and where fire can burn with greater intensity, historically had lower stem densities and canopy cover. On these sites, thinning might reduce the density of small or, where appropriate, intermediate trees and ladder and surface fuels toward a more open condition. In some circumstances this thinning may reduce water stress, accelerating the development of large residual trees. Within a stand, varying stem density according to potential fire intensity effects on stand structure would create horizontal heterogeneity. [North et al. 2009:16-18]

Historical forests can provide a better understanding of the ecological processes that have shaped mixed-conifer forest and the habitat conditions to which wildlife have adapted. All reconstruction studies, old forest survey data sets, and 19th-century photographs suggest that frequently burned forests had very low tree densities. … Studies reconstructing pre-European conditions all indicate that forests had a greater percentage of pine, a clustered pattern with highly variable canopy cover, and a high percentage of the growing stock in more fire resistant, large-diameter classes. … What these reconstructions do provide is inference about the cumulative process effects of fire, insects, pathogens, wind, and forest dynamics on stand structure and composition, producing forests resilient to most disturbances, including wildfire. … [Modeling] found a low-density forest dominated by large pines was most resilient to wildfire, sequestered the most carbon, and had the lowest carbon dioxide (CO2) emissions and thus contributed less to global warming. An analysis of carbon emissions and storage from different fuel treatments, found

> understory thinning followed by prescribed fire produced the greatest reduction in potential wildfire severity without severely reducing carbon stocks. [North et al. 2009:9].
>
> In fire-suppressed forests, shrubs are often shaded out, reducing their size, abundance, and fruit and seed production in low-light forest understories. Anecdotal narratives, a forest reconstruction, and a few early plot maps suggest shrub cover in active-fire conditions might have been much higher than in current forests, mostly owing to large shrub patches that occupied some of the gaps between tree clusters. [North et al. 2009:12]
>
> Studies in the Sierra Nevada and Klamath Mountains found that mixed-conifer structure and composition varied by fire patterns that were controlled by landscape physiographic features. Fire intensity, and consequently a more open forest condition, increased with higher slope positions and more southwesterly aspects. … Cumulatively these studies suggest that forest landscapes varied depending on what structural conditions would be produced by topography's influence on fire frequency and intensity. [North et al. 2009:19]

A.3 Silvicultural Strategy

North et al. (2009) asserts that a new silviculture for Sierran mixed-conifer forest that

> balances ecological restoration and wildlife habitat with fuel reduction can meet multiple forest objectives. By necessity, recent Sierran silviculture has first been focused on reducing fire severity through fuel reduction. For many reasons, including maintaining or restoring resilient forests, public safety, and property loss, fuel reduction remains a priority. We suggest that , with some modification, wildlife and ecological objectives can also be met. [North et. al. 2009:22]
>
> Diameter-limit prescriptions applied equally to all species will not remedy the significant deficit of hardwoods and pines in current forests. Prescriptions that differ by species can retain hardwoods, which are important for wildlife, and favor pines that can increase the forest's fire resilience. Given their current scarcity in many locations, there are few instances that warrant cutting either hardwoods or pines in mixed-conifer forests. [Id.]

In general, leaving pine and thinning white fir, Douglas-fir, and incense-cedar will help restore historical species composition and increase the forest's fire resilience. There are times, however, where removing pine can reduce fuels, decrease the risk of drought or insect induced mortality, and accelerate the growth of the residual pine trees.

> We suggest creating landscape heterogeneity in the Sierra Nevada by mimicking the forest conditions that would be created by the fire behavior and return interval associated with differences in slope position, aspect, and slope steepness. In general, stem density and canopy cover would be highest in drainages and riparian areas, and then decrease over the midslope and become lowest near and on ridgetops. Stem density and canopy cover in all three areas would be higher on northeast aspects compared to southwest. Stand density would also vary with slope becoming more open as slopes steepen. [North et al. 2009:20]

Locating gaps in areas with thinner soils or lower productivity may be logical to foster lower canopy cover since these areas historically supported lower tree densities and fuel loads. In the forest matrix between tree groups and gaps, frequent-fire forests generally consisted of widely spaced, large trees, most of which were pines. The relative proportion of these conditions (i.e., low density, dispersed large trees, and large and small gaps and tree groups) and their composition could be varied depending on existing forest conditions and topographic position.

> The proposed silvicultural approach is a multiaged-stand strategy driven by the need for wildlife habitat, fire-resistant stand structures, and restoration of stand and landscape patterns similar to active-fire conditions in mixed-conifer forests. Although we use the term multiage, we are most interested in size and structure, and their associated ecological attributes. Multiaged stands are a flexible means of including variable stand structures with two or more age classes and integrating existing stand structures into silvicultural prescriptions. [North et al. 2009:22]

> Clusters of intermediate to large trees (i.e., >20 inches diameter at breast height [DBH]) are sometimes marked for thinning with the belief that they are overstocked and thinning would reduce moisture stress. Some evidence, however, suggests these groups of large trees may not be moisture stressed by within-group competition…. Reconstructions of Sierran forests with active fire regimes have consistently found large trees in groups. These groups, however, can be at risk if intermediate and small trees grow within the large tree groups. Thinning these small and intermediate trees will reduce fire laddering. [North et al. 2009:23-24]

What is considered a ladder fuel differs from stand to stand, but typically these are trees in the 10- to 16-inch DBH classes. Trees larger than this may be thinned, for additional fuel reduction by reducing canopy bulk density in strategic locations. Removal of some of the intermediate sized trees would also have the economic benefit of providing revenue to help offset the costs of the fuels reduction and could fund additional projects (North et al. 2009:24).

> Thinned intermediate-size trees should only be fire-sensitive, shade-tolerant species such as white fir, Douglas-fir, and incense-cedar. In mixed-conifer forest, attempt to keep intermediate-size pines and hardwoods because of their relative scarcity and importance to wildlife and fire resilience. . . Some intermediate-size trees can still function as ladder fuel, particularly those that were initially grown in more open conditions. These trees can have live and dead limbs that extend down close to the forest floor providing a continuous fuel ladder. . . [In] middle to upper slope topographic position … some thinning of intermediate-size trees may help accelerate the development of large "leave" trees. We suggest, however, that these criteria not be applied to riparian areas, moist microsites often associated with deeper soils, concave topography, or drainage bottoms because these areas may have supported higher tree densities and probably greater numbers of intermediate size trees. [North et al. 2009:24-25]

Appendix B

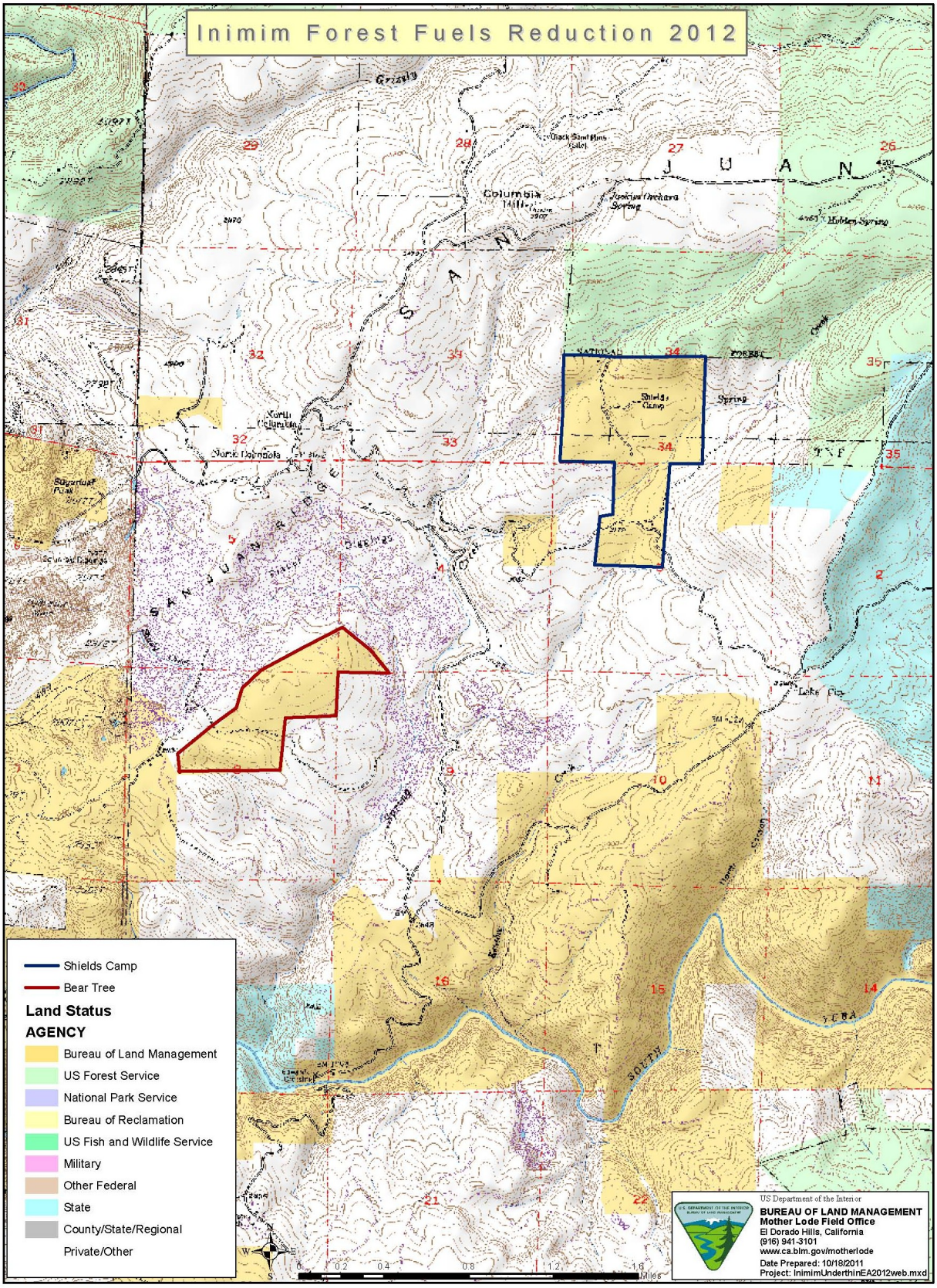
Project area maps

R9E

T18N

T18N

Inimim Forest Fuels Reduction 2012



T17N

T17N

R9E