Draft

REVISED ‘INIMIM FOREST MANAGEMENT PLAN

Prepared for
U.S. Bureau of Land Management and
Yuba Watershed Institute

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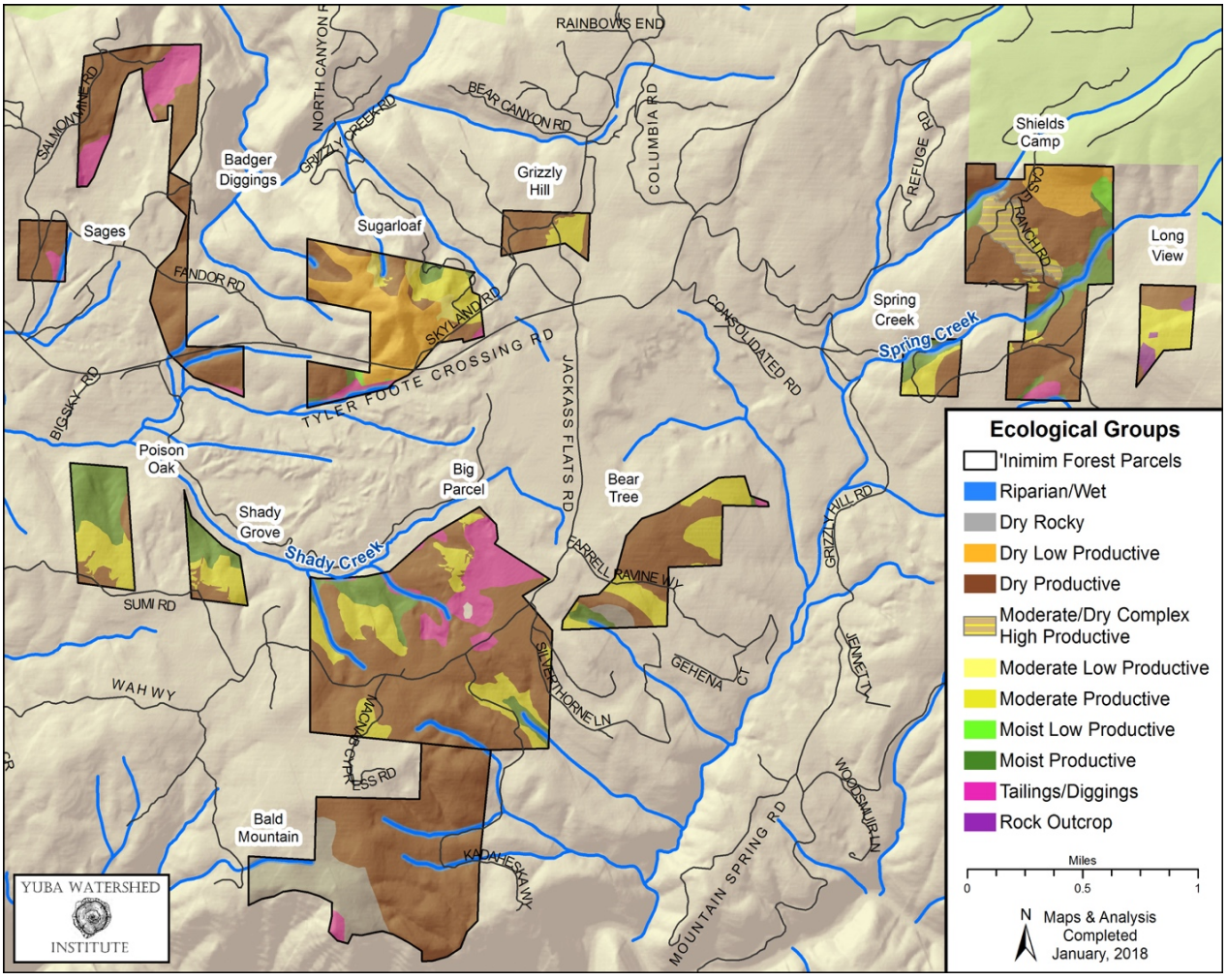
YUBA WATERSHED INSTITUTE



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ACRONYMS AND ABBREVIATIONS

ACEC	Area of Critical Environmental Concern
BLM	Bureau of Land Management
CALFIRE	California Department of Forestry and Fire Protection
CEHC	California Essential Habitat Connectivity Project
CMA	cooperative management agreement
GTR	General Technical Report
HRV	historical range of variation
NRV	natural range of variability
SRMP	Sierra Resource Management Plan and Record of Decision
USDA	U.S. Department of Agriculture
USDI	U.S. Department of Interior
YWI	Yuba Watershed Institute

1 Introduction

The ‘Inimim Forest is approximately 2,000 acres of U. S. Department of the Interior Bureau of Land Management (BLM) land, consisting of 12 non-contiguous parcels and located north of the South Yuba River in northwest Nevada County, California. ‘Inimim means ponderosa pine (*Pinus ponderosa*) in Nisenan, the language of the Native American people that live in this region of the western slopes of the Sierra Nevada mountain range. The area is about 80 miles northeast of Sacramento (**Figure 1**). The purpose of this document is to update the original *‘Inimim Forest Management Plan* (Yuba Watershed Institute [YWI] 1996) and associated implementation plan (YWI 2000). The focus of this revised plan is on sustainable vegetation restoration and management, and improved fire safety for the local community.

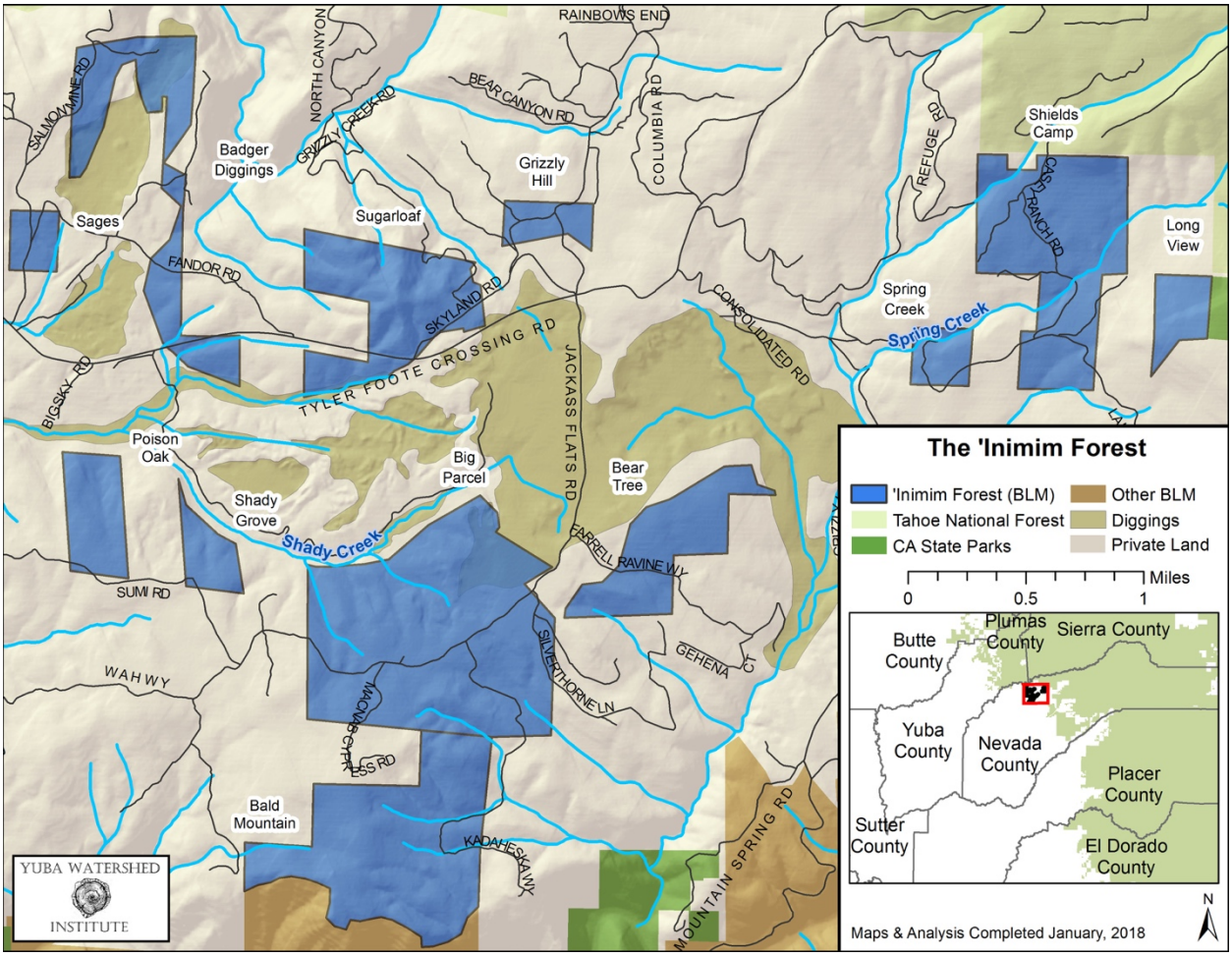

Figure 1. Map of ‘Inimim Forest parcels in relation to other federal, state, and private lands (including hydraulic mining “diggings”).

1.1 BACKGROUND

In 1990, the Yuba Watershed Institute (YWI) and the Timber Framers Guild of North America entered into a cooperative management agreement (CMA) with the BLM to collaborate in the

planning and management of the ‘Inimim Forest (Boyd & Greensfelder 2010). In 1991, a group of YWI volunteers, including residents of the San Juan Ridge, began drafting a management plan for the forest, with input from the BLM. This plan was to serve as a model for community-based sustainable forest management. A draft of this plan was finalized and adopted by the BLM in 1995 (U.S. Department of Interior [USDI] 1995). The community completed its own, more detailed version of the management plan (YWI 2006).

During a review of the *‘Inimim Forest Management Plan* for compliance with and certification of international standards for sustainable forest management, it was determined that further work was needed. In May of 1998 the YWI was awarded a grant by the U. S. Environmental Protection Agency to complete a detailed implementation plan, which would describe how the management plan actions would be applied on each parcel. The implementation plan was completed in 2000 (YWI 2000).

Since 1995, about 640 acres of forest treatments have been implemented in the ‘Inimim Forest, including commercial thinning, understory fuels reduction, and prescribed fire. Treatments were concentrated on four parcels: Big Parcel, Bald Mountain, Shield’s Camp, and Grizzly Hill. The emphasis was on fuel hazard reduction, particularly understory fuels. The primary treatments were mastication in dense manzanita (*Arctostaphylos* sp.) patches and hand cutting/piling where small trees were dense. A 35-acre prescribed fire was conducted on the Shield’s Camp parcel in 1996 to reduce surface fuels and restore fire as an ecological process. Other restoration treatments conducted by YWI volunteers have included meadow restoration, removal of non-native invasive plants, and reduction of surface fuels around legacy old and/or large trees on the Bear Tree and Big Parcels. Meadow restoration work involved removal of invasive plants and encroaching small conifers from a 1.5-acre meadow on the Bald Mountain parcel along Kadaheska Way (Boes & Nicholson 2010, Nicholson 2010).

Since most of the fuel reduction treatments were conducted 10 to 20 years ago, vegetation has grown and fuels have increased. Research in the Sierra Nevada on the effects of varied fuel treatments indicate that fuel treatments last between 7 to 15 years (Vaillant et al. 2015). The ‘Inimim Forest parcels are due for reentry for fuels reduction. Areas treated for fuels are also in need of ecological restoration, as are other areas not previously treated.

Since the time the last treatments were applied, new science has emerged on the importance of restoring “heterogeneity,” or a patchwork pattern of different tree densities, sizes, and openings that occurred historically (North et al. 2009). Other research on Sierra Nevada forests prior to Euro-American settlement and fire suppression has shown that forests were more open than previously thought (Safford & Stevens 2017). This more recent research has been incorporated into this revision of the management plan for the ‘Inimim Forest.

In the original *‘Inimim Forest Management Plan*, there were five goals (USDI 1995):

1. Conserve and re-establish old growth forest.
2. Reduce the potential for a catastrophic wildfire.
3. Maintain biodiversity.
4. Protect soils and soil productivity.
5. Provide commercial forest products on a sustainable basis.

6. Obtain Area of Critical Environmental Concern (ACEC) status for the ‘Inimim Forest.

This revised management plan continues the first four goals but with a more integrated emphasis on overall ecological restoration. The sale of timber or biomass (Goal 5) may be a by-product of some of the treatment types but it is not a primary emphasis of the revised plan. The effort to obtain ACEC status for the ‘Inimim Forest is no longer a priority, mostly due to political opposition to this action in the past.

1.2 PLAN OVERVIEW

This document is a revision of the original management and implementation plans for the ‘Inimim Forest, completed in 1995 and 2000 respectively. Since that time, the Mother Lode District of BLM has developed and revised a strategic plan for this and similar areas along the lower west slopes of the Sierra Nevada. The *Sierra Resource Management Plan and Record of Decision* (SRMP) (USDI 2008) contains goals, objectives, and management actions applicable across the area. Here, the SRMP is applied with additional site-specific direction on management and restoration of the BLM parcels that comprise the ‘Inimim Forest.

This plan is organized into four main sections and several appendices, with the content and purpose of each described in **Table 1** and **Table 2** below.

Table 1. List of titles, content, and purpose of major sections of the *Revised ‘Inimim Forest Management Plan*.

Section	Content and Purpose
Ecological Framework	Description of foundational ecological sustainability concepts and application to the plan, including landscape ecology and natural range of variability.
Environmental Setting	Brief description of the geology, soil groups, landforms, and dominant vegetation.
Goals and Objectives	What is the plan intended to do? What are the desired outcomes?
Management Approaches	What mix of management practices and activities will be used to achieve the goals and objectives?
Monitoring	Monitoring approach and questions.

Table 2. List of the appendices (with their content and purpose) supporting the *Revised ʻInimim Forest Management Plan*.

Appendices	Content and Purpose
Appendix A: Ecological Groups	Description and maps of ecological groups within each parcel.
Appendix B: Ecological Desired Conditions	Specific desired conditions for vegetation and fire ecology.
Appendix C: Marking Guidelines for Heterogeneity	Specific criteria and approaches for determining which trees or clumps of trees to retain to restore heterogeneity or patchiness, old forest structure, wildlife habitat, and ecological resilience.
Appendix D: Recommended Priority Treatments	Maps and descriptions of different areas in each parcel. Priorities for restoration and types of recommended restoration and maintenance actions.
Appendix E: Parcel Descriptions	General description of individual parcels, with size (acres), overall condition and notable features. Based largely on descriptions in original plan.
Appendix F: Soil Survey Information	Detailed information on soil types found in the ʻInimim Forest.

Supporting analyses and a summary of field plot data are included in a separate document, titled *Revised ʻInimim Forest Management Plan Analysis Report* (Analysis Report) (YWI 2018). This includes summaries of representative vegetation structure and composition, old forest structure, fuels, and potential fire behavior (intensity and crown vs. surface fire behavior).

2. Ecological Framework

This plan revision is based upon an ecological framework. The essential parts of the framework include:

- ecological sustainability;
- the natural range of variability;
- biodiversity;
- landscape ecology; and
- role of indigenous peoples in shaping the ecosystems of the area.

These concepts are introduced here and have been incorporated throughout this management plan.

Ecosystems include all of the living things, their environment, and their interactions in an area. This includes vegetation, animals, fungi, food webs, and cycles of water, carbon, and nutrients. The emphasis of this plan revision, however, is on vegetation and fire management. This is not to dismiss the importance of the other ecosystem elements. The focus is on vegetation and fire since these are where most of the restoration and maintenance activities are needed. The revised management plan also includes a consideration of the maintenance of soils and soil productivity, outlined in Section 5.2 (Treatment Types and Limitations by Vegetation Type and Environmental Setting).

2.1 ECOLOGICAL SUSTAINABILITY

Sustainability of the soils, forests, water, and biodiversity of the ‘Inimim Forest landscape was central to the vision of the original *‘Inimim Forest Management Plan* (USDI 1995, YWI 1996). The term *sustainability* is used most often in the context of human use or development. This is important because we, as humans, are economically and socially dependent upon ecosystems. Sustainability in this sense is the “achievement of a balance between human impacts and the capacity of the natural world that can be sustained indefinitely” (Boyd 2010). The original *‘Inimim Forest Management Plan* also encompassed practices to contribute to the social and economic sustainability of the surrounding community. Newer science emphasizes the importance of first ensuring ecological sustainability, since social and economic systems depend upon this foundation for their own sustainability (Thomas 2012). Therefore, *ecological sustainability* underlies the vegetation and fire restoration and maintenance goals outlined in this document.

The terms *ecology* and *ecosystem* are often used interchangeably, or in subtly different ways. For purposes of this plan, they are used as follows. *Ecology* is a general term that refers to the interaction of living things and their environment. *Ecosystem* is more specific and addresses the living components, non-living environment, and interactions between the two for a specific place or type of ecological system. Ecosystems that occur in the ‘Inimim Forest include forests, oak woodlands, meadows, ponds, chaparral, and other non-forested areas.

Ecological sustainability is a term that has been variously defined. Here it refers to the continuation of biodiversity and ecological integrity over time (Callicott & Mumford 1997). *Ecological integrity* includes the natural range of biodiversity, food webs, ecosystem cycles (i.e. water, nutrient, and carbon), and resilience. *Resilience* refers to the "elasticity" of ecosystems – in other words, their ability to absorb disturbances or stresses such as severe droughts, insect outbreaks, high intensity fires, and climate change, and to maintain or quickly recover certain ecological characteristics (e.g., composition, structure, and cycles) and ecosystem services (e.g., water quality, habitat, soil protection). Ecosystem sustainability and resilience are more likely if ecosystems are within the bounds of natural variability (see below), rather than targeting fixed conditions from some point in the past (Safford & Weins 2012).

2.2 NATURAL RANGE OF VARIABILITY

The *natural range of variability* (NRV) refers to the range of vegetation species, structures, and ecosystem processes (e.g., fire) found in an ecosystem in its "natural" state, relatively unaffected by human activities (Landres et al. 1999, Wong & Iverson 2004). Some definitions explicitly incorporate indigenous human activities, using instead the term *historical range of variation* (HRV) (e.g., Wiens et al. 2012). Here, we use the term NRV to broadly include both the HRV and the NRV as in Safford and Stevens (2017). In this document, traditional indigenous land management practices are considered part of the NRV. In California, the NRV is typically defined by the period 100 to 200 years before Euro-American settlement. This plan revision is based on the premise that management towards the NRV will move the 'Inimim Forest towards ecological sustainability. Recent research into historical vegetation structure, composition, fire regimes, and levels of insect-related mortality in the Sierra Nevada is the basis for many of the management goals, objectives, and desired conditions in this plan revision. There are several key scientific publications that form the basis for characterizing and managing towards ecological sustainability and the NRV in this revised plan:

- *An ecosystem management strategy for Sierran mixed-conifer forests* (North et al. 2009). Referred to in this report as General Technical Report 220 (GTR 220);
- *Managing Sierra Nevada forests* (North 2012). Referred to in this document as General Technical Report 237 (GTR 237);
- *Science synthesis to support socioecological resilience in the Sierra Nevada and Southern Cascade Range* (Long et al. 2014);
- *Natural range of variation for yellow pine and mixed conifer forests in the Sierra Nevada, southern Cascades, and Modoc and Inyo National Forests, California, USA* (Safford & Stevens 2017).

Common themes in these scientific publications are management towards the NRV and management at the landscape scale. This is a broad, or "coarse-filter," approach to conserving biodiversity.

GTR 220 and GTR 237 recommend restoration and management strategies to move vegetation toward the NRV conditions. In particular, these reports emphasize the NRV in vegetation and fire conditions within patches and the landscape. This is defined as heterogeneity. It describes the complex patchwork of tree spacing, sizes, species, and vegetation type (i.e., shrub or forest) that was common historically but uncommon now.

2.3 BIODIVERSITY

Biodiversity is commonly defined as the suite of species occurring in an area. A broader definition includes the range of vegetation types, animal communities, and ecosystems in an area, in addition to species. These two definitions are referred to as "fine-filter" and "coarse-filter" biodiversity, respectively. In this plan, the emphasis is on providing management direction for conserving and restoring coarse-filter biodiversity.

Conservation of biodiversity was an important part of the original *'Inimim Forest Management Plan* (USDI 1995, YWI 1996). This emphasis is carried over into this management plan revision and is addressed through the objectives (Section 4) and desired conditions (Appendix B). It is assumed that restoration of vegetation and fire conditions that more closely align with the NRV will restore and conserve biodiversity. Rather than manage the 'Inimim Forest for individual species, the approach is to restore the forest, oak woodland, chaparral, and meadow ecosystems by providing for long-term improvements in habitat for all species. Rare, threatened, and endangered species management is addressed in the SRMP (USDI 2008). This plan guides how rare and endangered species management will be addressed in individual projects.

There are some aspects of biodiversity that fall in between fine- and coarse-filter levels. This includes ecosystem components or habitat types that were once common, and now are rare, such as old forest. These ecosystem components often provide habitat for species that are less common than historically. Other ecosystem types, especially wetlands, have high biodiversity relative to their extent (Kondolf et al. 1996). Black oak habitat falls into both categories. Individual black oak trees and black oak stands support a high diversity of wildlife and are also less common than historically. The ecological conditions and management direction for old forest, wetlands, and black oak habitat are addressed below.

2.4 LANDSCAPE ECOLOGY

Landscapes are large areas, covering thousands to hundreds of thousands of acres. *Landscape ecology* consists of the patterns of living things and ecosystems over large areas. For the 'Inimim Forest, the landscape includes both the parcels and the surrounding areas on the San Juan Ridge.

Heterogeneity is an important concept that is referred to throughout this plan. It refers to variation in the arrangement of trees in a forest or different forest patches in a landscape (North et al. 2009). Heterogeneity of forest ecosystems and landscapes has been reduced over the past 200 years. Forests and landscapes have become more uniform, reducing forest ecological functions, including wildlife habitat quality and resilience.

2.5 TRADITIONAL NATIVE AMERICAN USE

The Nisenan people lived on, used, and actively managed the lands in the 'Inimim Forest and surrounding area for at least several thousand years prior to Euro-American settlement (Beals 1933, Heizer 1966, Meriam 1967, Merriam & Talbot 1974, Johnson & Theodoratus 1978, Wilson & Towne 1978, Anderson & Moratto 1996, Slater 2010). They used active land management, including cultivation practices and, especially, fire, to sustain and improve hunting grounds, food supplies, traditional medicines, basketry materials, and other household items

(Anderson 2006, Lake & Long 2014). These practices helped shape vegetation composition and structure, and animal habitats. Fire regimes were also influenced. Researchers differ in their opinion on the degree of influence of Native American burning on fire regimes (Anderson 2006). Here, it is assumed that the historic range of fire was influenced by Native Americans. In particular, fire in riparian areas and wetlands was likely more frequent, occurred during a wider range of seasons, and was associated with Native American burning to improve the quality of basketry materials and other vegetation characteristics.

Oak trees, especially black oak, have particular importance for the Nisenan and other tribes of the Sierra Nevada. Oak acorns provided a large portion of the diet of these peoples prior to Euro-American settlement. Black oaks were actively tended to promote the growth of mature trees (80 to 100 years old) with high acorn production and high-quality acorns; broad crowns and low branches were also valued (Long et al. 2016). Tending practices included understory burning, branch pruning, knocking on the trees, and selective weeding to promote the growth of desired understory plants for food, fiber, and medicine (Long et al. 2016).

During the Gold Rush, Native Americans in the Sierra Nevada were often killed or forcibly removed from their land (Greensfelder 2010). Present-day Nisenan tribal members living in the surrounding area are increasingly working to restore traditional practices and uses where possible. The ‘Inimim Forest is one such area. This plan revision recognizes the historical role the Nisenan people played in shaping the ecosystems of the ‘Inimim Forest landscape. Revival of traditional ecological management practices can play a role in both ecological restoration and tribal cultural restoration. These practices are described in the management plan goals, objectives, and approaches below.

3. Environmental Setting

The ‘Inimim Forest is located in the mid-elevation section of the San Juan Ridge, a broad, gently sloping, landform between the South and Middle Yuba Rivers (**Figure 2**). Geology (and, as a result, soil composition) is diverse, from sedimentary, volcanic, granitic, and ancient riverbed origins. Soils vary from deep (>40 inches rooting depth) to shallow (<10 inches), but most areas are moderately deep (20 to 40 inches). Several highly eroded hydraulic mining “diggings,” with stunted vegetation, occur on the San Juan Ridge (**Figure 1**). Most of the area slopes in a westerly direction.

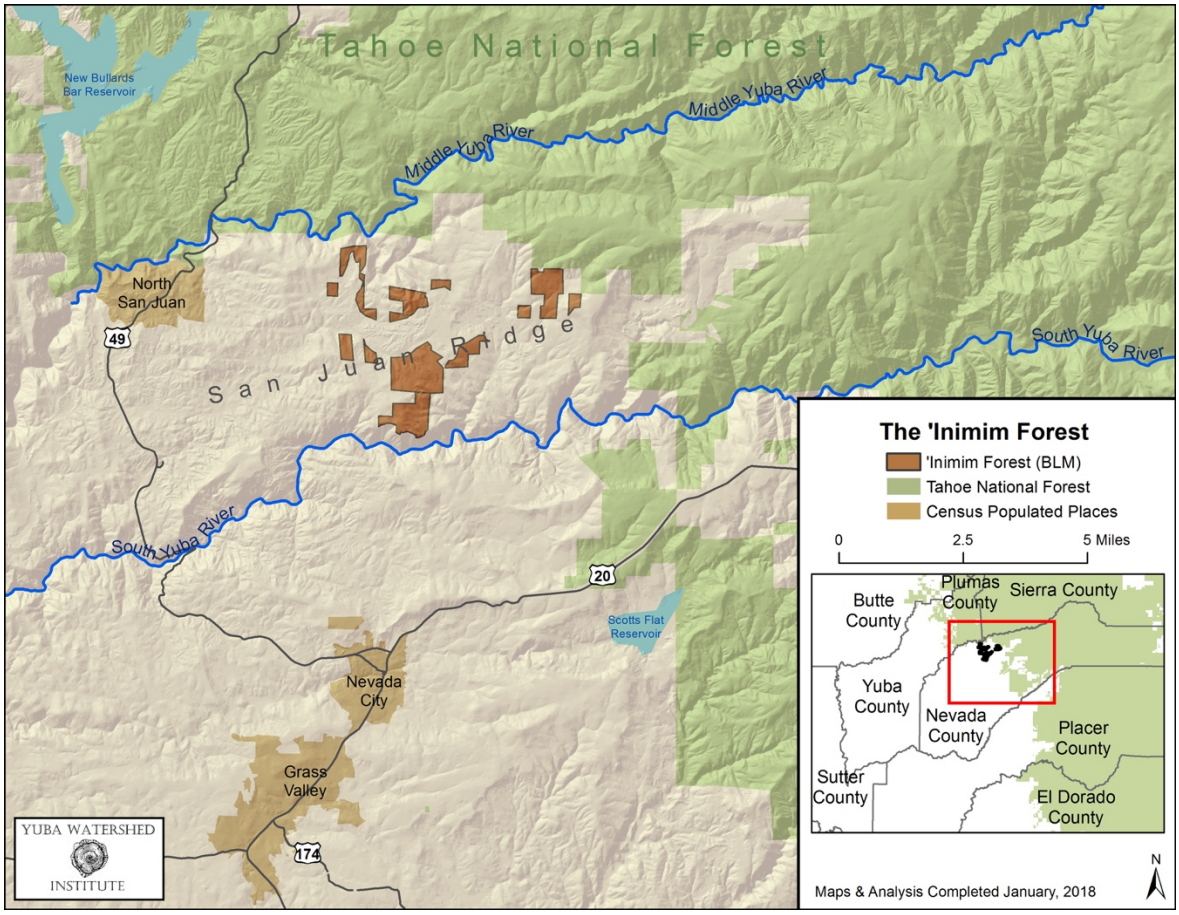

Figure 2. The location of the ‘Inimim Forest in relation to nearby features such as the San Juan Ridge, South Yuba River, and Middle Yuba River.

The ‘Inimim Forest contains a diverse array of vegetation types since it occurs at the boundary between the foothill and montane ecological zones of the Sierra Nevada range. These zones are roughly bounded by elevation and reflect changes in climate and dominant plants and animals. Elevations in the ‘Inimim Forest range from 2,340 to 3,860 feet above sea level, at the lower reaches of the montane ecological zone and upper reaches of the foothill zone.

Montane zone vegetation is dominated by ponderosa pine and Douglas-fir (*Pseudotsuga menziesii*) mixed conifer forests, with black oak (*Quercus kelloggii*) and madrone (*Arbutus*

menziesii) common throughout. There are several meadows, which are relatively uncommon in the Sierra Nevada montane zone. Foothill zone vegetation includes blue oak (*Quercus douglasii*), gray pine (*Pinus sabiniana*), and chaparral. The boundary between the montane and foothill zones is gradual and diffuse, with some mixing of small patches of foothill vegetation in the montane zone.

There are several perennial creeks and numerous intermittent and ephemeral drainages and draws that dissect the landscape (**Figure 1**). Shady Creek is the largest creek, draining the center of the San Juan Ridge. Spring Creek runs through the Shield's Camp and Spring Creek Parcels. A tributary to Grizzly Creek runs through the Badger Diggings Parcel.

3.1 ECOLOGICAL GROUPS: VEGETATION, TOPOGRAPHY, AND SOILS

The mosaic of vegetation and soil types across the 'Inimim Forest landscape have been mapped and classified for this management plan revision. The maps include broad categories, called *ecological groups* (**Figure 3**). Ecological groups are areas in the landscape that contain similar soil characteristics, topography, and vegetation. The different ecological groups correspond to different NRVs and management directions (including goals, objectives, and management limitations), and vary according to each group. This is similar to the way vegetation and soil groups were used in the original *'Inimim Forest Management Plan*, but with additional emphasis on variability in topography and soil moisture.

Soil moisture and topography influence natural variability in forest composition, structure, and heterogeneity, as described in GTR 220 and GTR 237 (North et al. 2009, North 2012). They also influence non-forest vegetation types, such as chaparral and oak woodlands. Soil maps for the 'Inimim Forest landscape are general (Brittan 1975) and do not provide the necessary detail to map vegetation that is restricted to smaller areas, such as blue oak woodlands. As a result, the ecological groups may encompass more than one soil or vegetation type if the type occupies small areas. For more widespread vegetation types, such as mixed conifer forests, the ecological groups represent subdivisions of that vegetation type. Moist mixed conifer forests are distinguished from dry mixed conifer forests, corresponding to the differences in management described in GTR 220 for different areas of the landscape. The ecological groups of the 'Inimim Forest are described briefly here and in detail in Appendix A (which also includes details of how they were mapped). Here, the ecological groups are described in general with an emphasis on how they differ from the NRV. Before describing the groups, some basic underlying concepts of productivity, soil moisture, and topography are outlined.

The size of patches mapped are large, corresponding to the extent of soil type maps. Both soil and ecological vegetation maps typically include mosaics of two different types and inclusions. *Inclusions* are smaller areas with different soil or vegetation characteristics. The map of ecological groups reflects this level of detail in mapping. That is, each polygon may represent more than one ecological group. The dominant group is what is mapped. Small areas with distinctly different soils or vegetation types, such as blue oak, are important ecologically and are addressed in this plan, but are not included in the ecological group map. Most of the ecological groups are comprised of different variations of mixed conifer forests as described in Fites (1993).

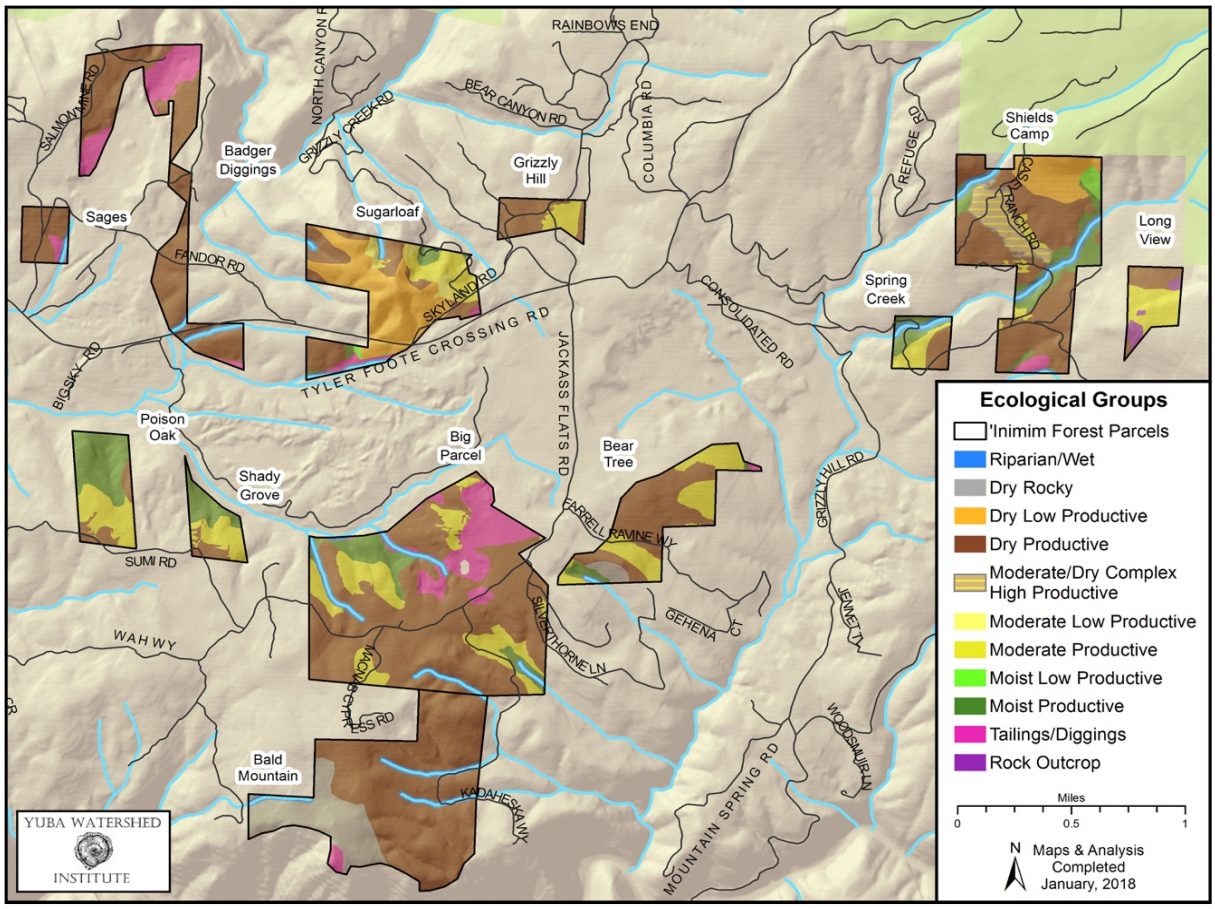

Figure 3. Map of the ecological groups in the 'Inimim Forest parcels. Description of the vegetation and soil conditions that each ecological group represent are described in the sections that follow.

3.1.1 Productivity

In the 'Inimim Forest, the NRV varies with ecological productivity. *Productivity* refers to how fast, tall, or large individual plants or vegetation grows. Different levels of productivity were mapped based on soil types (Brittan 1975) and the ecological classification of mixed conifer forests (Fites 1993). The categories of productivity were defined using soil depth as follows:

- High Productive: soils greater than 40 inches deep;
- Moderate Productive: soils between 20 and 40 inches deep;
- Low Productive: soils between 10 and 20 inches deep;
- Rocky: soils less than 10 inches deep;
- Rock Outcrop: no measurable soil depth;
- Diggings or Mine Tailings: soils shallow or highly altered by hydraulic mining.

These categories were used to map groups of mixed conifer forest types (i.e. moist and dry) and define different types of mixed conifer old growth forests (**Figure 3**) (Fites et al. 1992).

3.1.2 Topography

Variation in NRV of mixed conifer forests with topography is a central idea in GTR 220 and GTR 327 (North et al. 2009, North 2012). *Topography* refers to relative locations in a landscape, such as ridges or valley bottoms. Different topographic categories, or positions, influence the amount of soil moisture and sunlight. These environmental conditions in turn influence vegetation composition and structure.

Topographic positions used here include: ridge, upper-slope, mid-slope, lower-slope or bottom, and drainages with perennial or intermittent streams. An additional topographic characteristic used was *aspect*, or the direction a slope faces. These were combined to classify the landscape into dry, moderate, moist, or riparian/wet areas. These correspond with different groups of mixed conifer forest types described in Fites (1993) and summarized below. The combined categories include:

- Moist: mid and lower areas on north- and east-facing slopes;
- Moderate: upper slopes on north- and east-facing slopes;
- Dry: ridges on all aspects, and mid- and upper slopes on south and west aspects.

Soil moisture is also determined by the presence of *geologic contacts*, that is, boundaries between different bedrock types. Water often rises closer to the surface in these areas. An example is in the Long View parcel, where soil moisture is high on the upper slope below the volcanic cliffs. This is evident from the presence of big-leaf maple, a tree found where soil moisture is high (Fites 1993). Some of the boundaries of moist or moderate ecological groups were modified based on field surveys to ground-truth the ecological group maps.

3.1.3 Ecological Group Descriptions

Each ecological group is described briefly in **Table 3**, except for the Riparian/Wet Group. This group is described in the Wetland Section that follows. More detail on the ecological groups is included in Appendix A. Descriptions here include: dominant vegetation type, such as mixed conifer forest or chaparral; dominant plant species; and indicator plants.

Dominant vegetation type refers to the primary dominant species for forest types. Most of the forests in the ‘Inimim Forest are considered “mixed conifer”. This means that they are often co-dominated by several primary species, namely ponderosa pine, Douglas-fir, sugar pine (*Pinus lambertiana*), and incense cedar (*Calocedrus decurrens*). The mixed conifer forest types are named according to Fites (1993) and include ponderosa pine-mixed conifer, and Douglas-fir – mixed conifer. Forests that are dominated by single species such as ponderosa pine or black oak, are described based on these individual primary species. For non-forest vegetation types, more general names are applied such as chaparral, shrubs, herbs or grasses. More general names are used either because the dominant species varies, or the dominant species changes at a fine scale that is not addressed in this plan.

Indicator plants are those associated with environmental factors that influence the NRV, such as soil moisture, sunlight levels, soil depth, and rock content. The descriptions are based on Fites (1993), Barbour et al. (2007), and Safford & Stevens (2017).

Terms used to describe vegetation density correspond to categories from the California Wildlife Habitat Relationship (CWHR) system (California Department of Fish and Game 2014):

- Dense - vegetation canopy cover greater than 60 percent;
- Moderate - vegetation canopy cover generally between 40 and 60 percent;
- Open – vegetation canopy cover generally between 25 and 40 percent;
- Very Open – vegetation canopy cover generally between 5 and 25 percent;
- Sparse – vegetation canopy cover less than 5 percent.

The comparisons with the NRV below are for areas that have not had restoration in the last 20 years. Areas that have had restoration are more similar to the NRV in at least some aspects. The condition of treated areas is described in Appendix D.

The scientific names of the plants referred to in **Table 3**, that have not been identified previously, are listed below.

Common	**Scientific**
bearclover	*Chamaebatia foliosa*
big-leaf maple	*Acer macrophyllum*
birch-leaf mountain-mahogany	*Cercocarpus betuloides*
Bolander's bedstraw	*Galium bolanderi*
California hazelnut	*Corylus cornuta*
canyon live oak	*Quercus chrysolepis*
hairy honeysuckle	*Lonicera hispidula*
harebell	*Campanula prenanthoides*
Hartweg's iris	*Iris hartwegii*
MacNab Cypress	*Hesperocyparis macnabiana*
milkwort	*Polygala cornuta*
mountain dogwood	*Cornus nuttallii*
red fescue	*Festuca rubra*
starflower	*Trientalis latifolia*
trailplant	*Adenocaulon bicolor*
wedgeleaf ceanothus	*Ceanothus cuneatus*
western fescue	*Festuca occidentalis*
white-flowered hawkweed	*Hieracium albiflorum*
whiteleaf manzanita	*Arctostaphylos viscida*

Table 3. Summary of characteristics of ecological groups in the ‘Inimim Forest. Primarily based on Fites (1993).

Ecological Group	Dominant Vegetation	Dominant Species	Indicator Plants	Existing condition versus the NRV
Dry Productive	Ponderosa pine-mixed conifer forests and black oak woodlands.	Ponderosa pine, black oak, sugar pine. Whiteleaf manzanita where disturbed.	Bearclover, Hartweg’s iris, Bolander’s bedstraw, and milkwort.	Forests are denser, more uniform, trees are smaller. Forest cover has increased from very open or open to moderate or dense. Large trees are rare, formerly common. Douglas-fir and incense cedar have increased. Black oak is less common. Fuel levels 2 to 10 times historic levels. Understory plants are sparser.
Dry Low Productive	Same as Dry Productive, plus canyon live oak woodlands.	Ponderosa pine, black oak, canyon live oak. Whiteleaf manzanita.	Same as above, plus whiteleaf manzanita.	Similar to Dry Productive but with less change in fuels.
Moist Productive	Douglas-fir mixed conifer forests.	Douglas-fir, incense cedar, sugar pine, madrone.	Mountain dogwood, big-leaf maple, California hazelnut, trailplant, and starflower.	Similar to Dry Moderate/High Productive Group. Tree canopy cover is dense, compared to moderate with small patches of dense cover historically.
Moist Low Productive	Douglas-fir mixed conifer forests.	Douglas-fir, incense cedar, sugar pine, madrone, canyon live oak.	Same as above, plus canyon live oak, mock orange, and sword fern.	Similar to Moist Productive Group but with less increase in fuels.
Moderate Productive	Douglas-fir mixed conifer forests.	Douglas-fir, ponderosa pine, sugar pine, black oak, madrone.	Starflower, harebell, western or red fescue, and hairy honeysuckle. Or mixtures of moist and dry indicators.	Similar to Dry Productive except canopy cover. Canopy cover was low to moderate historically but is now mostly high. Where black oak was dominant, canopy cover was moderate to high historically. Black oak is less common now.
Moderate Low Productive	Douglas-fir mixed conifer forests. Douglas-fir – ponderosa pine forests.	Douglas-fir, ponderosa pine, sugar pine, black oak, madrone.	Same as above, plus harebell, western or red fescue, white-flowered hawkweed.	Similar to Moderate Productive but with less increase in fuels.
Dry Rocky	Chaparral	Whiteleaf manzanita, wedgeleaf ceanothus, MacNab cypress, gray pine.	See dominant species.	Some of these areas occur on eroded soils that have lost topsoil compared to NRV. Vegetation in other areas is similar to NRV overall. Chaparral patches are more uniform in age and shrub condition than historically.
Mined Areas	Pine and shrub.	Ponderosa pine, whiteleaf manzanita.	See dominant species.	Highly altered from NRV, with most or all of the soil removed. Some areas are mine tailings with forests similar to productive forests described above. These have not been mapped or inventoried in detail.
Rock Outcrops	Shrub, herbs, grasses.	Birch-leaf mountain-mahogany, ceanothus.	Unknown, detailed surveys have not been conducted.	Non-native annual grasses have become established and dominate the understory in some areas.

3.2 OLD FORESTS

Old forests are characterized by the presence of large and old trees (Franklin & Fites-Kaufman 1996, Spies 2004). Large tree size and age vary depending on tree species and site productivity. Old forests vary widely based on forest type, soil condition, topography, and fire history. For ponderosa pine or mixed conifer forests, trees greater than 30 or 40 inches in diameter contribute to old forest structure. Historically, trees more than 50 or 60 inches in diameter were not uncommon (Fites-Kaufman et al. 2007). Prior to Euro-American settlement, old forest structure was common across most of the western slopes of the Sierra Nevada (Franklin & Fites-Kaufman 1996). Early mining, settlement, and logging throughout the 19th and 20th centuries removed much of the old forest, and the largest trees were selectively harvested. Now, most of the remaining or recently grown large trees are found on public lands.

The parcels of the ‘Inimim Forest are particularly important since they contain remnants of old forest structure and productive soils that are rapidly growing large trees. Since the original *‘Inimim Forest Management Plan* was written, it appears that the number of trees greater than 30 or 40 inches in diameter has increased but still remains low compared to historic levels. Protecting old forests was one of the early motivations for the formation of the YWI and the original *‘Inimim Forest Management Plan* (USDI 1995, YWI 1996, Greensfelder & Erickson 2010, Snyder 2010). The importance of old forests remains in this management plan revision but is expanded to include new science that recognizes the importance of active restoration of old forests, in particular, the restoration of heterogeneity in old forest patches.

Old forests within montane mixed conifer (ponderosa pine and Douglas-fir mixed conifer) and pine (ponderosa and Jeffrey pine) vegetation types are currently more uniformly dense than they were in the past, resulting in increased rates of old growth tree mortality from competition with younger trees, climate change, insect-related mortality, and increased high-intensity fire (Safford & Stevens 2017). At the same time, the denser forests with old growth trees are favored habitat of the California spotted owl (*Strix occidentalis occidentalis*) and the Pacific fisher (*Martes pennant*) (Keane 2014, Zielinski 2014). The California spotted owl is considered a species of special concern by the California Department of Fish and Wildlife (CDFW), and a sensitive species by BLM. The Pacific fisher is a candidate species for listing as threatened or endangered under the federal Endangered Species Act and the southern Sierra Nevada population considered threatened by CDFW. Recent research demonstrates that canopy cover of large trees is more important than that of small trees for California spotted owl habitat (North et al. 2017).

For old forest, management direction is focused on:

- restoring resilience around large trees;
- increasing numbers of large trees;
- restoring heterogeneity of the forest patches that contain old forest.

3.3 HABITAT CONNECTIVITY

The ‘Inimim Forest parcels occur within the San Juan Ridge landscape, which extends from the western boundary of the South Yuba River State Park up towards Graniteville and the Sierra Nevada crest (**Figure 2**). The western portion of this landscape is almost all private land, with

the ‘Inimim Forest in the central portion, in a patchwork of private and public lands (**Figure 1**). The eastern portion of the San Juan Ridge is largely public land managed by the Tahoe National Forest. The ‘Inimim Forest parcels likely play an important role in connecting natural forest lands; providing *habitat connectivity*, or corridors of movement, for animals that rely upon less-managed lands (Snyder 2010). This importance was noted in the California Essential Habitat Connectivity Project (CEHC) (**Figure 4**) (Spencer et al. 2010). The CEHC identifies corridors across private lands that connect separate public land parcels. Private lands are more likely to be managed in a way that makes them less suitable for wildlife movement. Houses, vegetation clearing, and frequently used roads are common features on private lands that can impede wildlife movement. The importance of public lands to biodiversity at low elevations in the northern the Sierra Nevada has been noted (Davis & Stoms 1996). Consequently, the ‘Inimim Forest parcels are important to habitat connectivity in the northern Sierra Nevada.

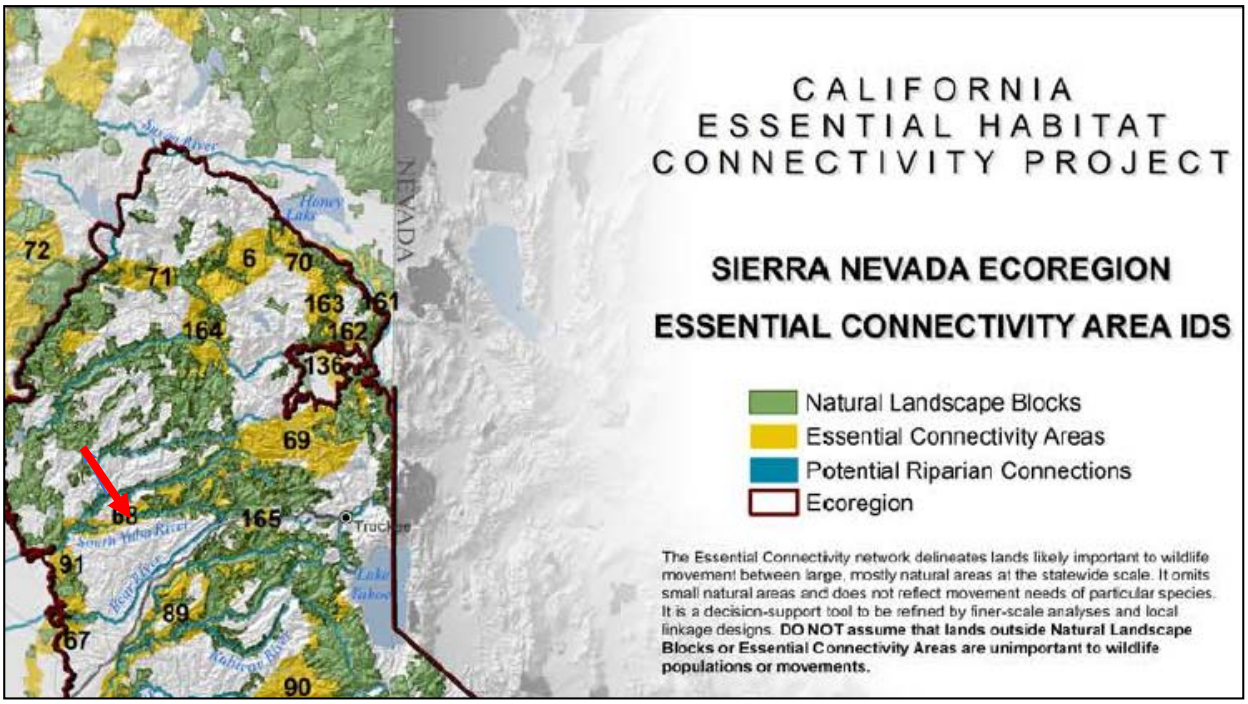

Figure 4. Northern portion of the Sierra Nevada Ecoregion Essential Connectivity Area map. Copied with permission from Spencer et al. (2010). The red arrow indicates the approximate location of the ‘Inimim Forest.

The ‘Inimim Forest parcels also provide a network of forests with old forest structure or large trees, snags and logs, that some animals require or prefer (Erickson 2010). Old forests are particularly fragmented and uncommon on the western slopes of the Sierra Nevada (Franklin & Fites-Kaufman 1996).

Connectivity is addressed in this plan through objectives and desired conditions for vegetation structure, composition, and old forest at the landscape scale.

3.4 WETLANDS

Wetlands have biodiversity that is disproportionate to their area (Kondolf et al. 1996). That is, they contain a high level of biodiversity in a small area. The ‘Inimim Forest contains several

types of wetlands including meadows, seeps or springs, and streamside riparian areas (**Figure 5**). Detailed classifications and inventories for wetlands in this area are not available. The descriptions below are based on cursory field surveys.

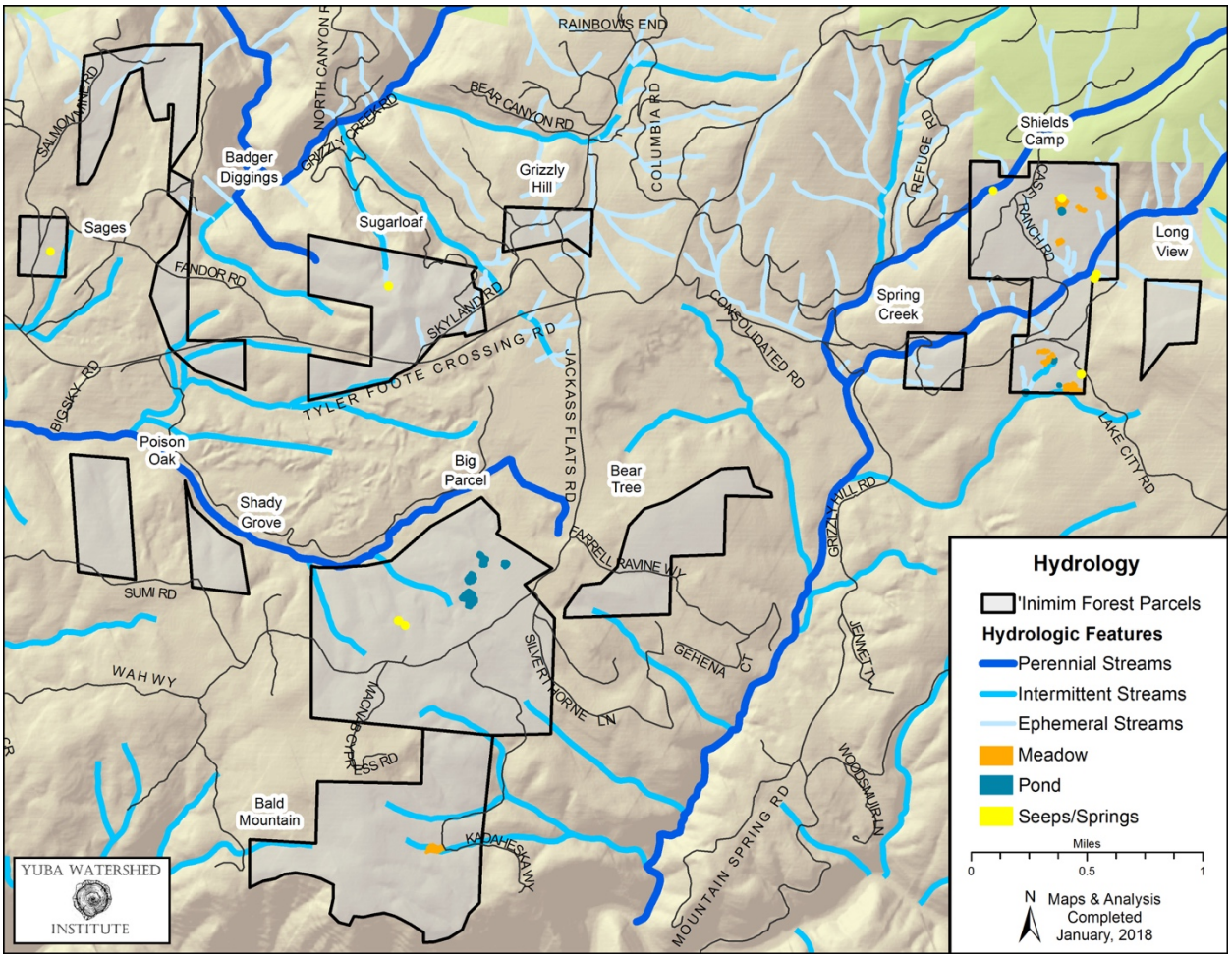

Figure 5. Hydrologic features of the 'Inimim Forest.

3.4.1 Meadows

Several meadows occur in the Shield's Camp and Big Parcels. Similar to montane meadows elsewhere in the Sierra Nevada, the 'Inimim Forest meadows have likely been reduced in size due to the encroachment of conifers from surrounding forest. The reduction of historical grazing pressure and/or reduction or elimination of regular fires has allowed conifer seedlings to become established. Non-native plants, including Himalayan blackberry (*Rubus armeniacus*) and dog rose (*Rosa canina*), have become established in patches, displacing native plants (Nicholson 2010). Ditches run through some meadows, changing water flows and reducing soil moisture. Overall, meadows in the 'Inimim Forest are in moderate to poor condition, outside the NRV.

3.4.2 Seeps and Springs

Partly because of the diverse geology underlying the ‘Inimim Forest, there are a number of small seeps and springs scattered throughout the parcels. Many of these have been disrupted by roads, past logging, and forest densification. The pre-disturbance attributes of these hydrologic features are unknown. Examples include a spring that is bisected by Lake City Road in the Shield’s Camp Parcel and a seep along a road in the northeast portion of the Big Parcel. The Grizzly Hill and Sages Parcels also have seeps that have been disrupted. Himalayan blackberries are common, taking water from and displacing native plants. In general, many of the seeps and springs in the ‘Inimim Forest are in poor condition.

3.4.3 Riparian Areas

Riparian vegetation along perennial and intermittent streams is varied. Dominant plant species are often similar to those of adjacent moist mixed conifer forests. Big-leaf maple, mountain dogwood, and California hazelnut are common. White alder (*Alnus rhombifolia)* is sometimes present. Pacific yew (*Taxus brevifolia*) was found in one location on the Spring Creek Parcel. Historically, the structure and composition of riparian vegetation was shaped by both the streams and fire. When fires occurred in adjacent uplands, they often reached down into adjacent riparian areas (Van de Water and North 2010). With the absence of fire, conifers have become denser in riparian areas and have displaced or reduced the vigor of these primary riparian hardwood trees and shrubs. Dead fuels have accumulated to high levels, increasing the likelihood of high severity effects after large, uncharacteristic wildfires (Van de Water & North 2011).

3.4.4 Ponds

Large bodies of perennial standing water are not a natural, historical feature of the ‘Inimim Forest landscape. Several ponds were created intentionally or unintentionally since Euro-American settlement of the area. However, these newer landscape features offer important wildlife habitat, especially during dry summer months. The Shield’s Camp Parcel contains four ponds that were created by the impoundment of seasonal streams with earthen dams. On the Big Parcel, about seven ponds of various sizes occur in association with hydraulic mining diggings. The largest of these, Lonesome Lake, hosts several types of uncommon plant species, including cranberry (*Vaccinium macrocarpon*), which is native to the eastern U.S. (Tecklin 2010), lodgepole pine (*Pinus contorta*), sundew (*Drosera sp.*, a carnivorous plant), Labrador tea (*Ledum glandulosum*), and Douglas’ spirea (*Spirea douglasii*) (Cathcart & Lukas 1997). Western pond turtles (*Actinemys marmorata*) have been observed at one of the ponds in the past (Cathcart & Lukas 1997) but no surveys have been conducted recently. The condition of the ponds varies. There has been some disruption from off-road vehicles driving near or in the ponds.

3.5 FIRE

Fire has shaped the forests and other vegetation in the Sierra Nevada for thousands of years (van Wagtendonk & Fites-Kaufman 2006). Before Euro-American settlement and fire suppression, fires swept through stands of trees on the western slopes of the Sierra approximately every 11 to 16 years (Safford & Stevens 2017), both started by lightning and indigenous peoples. These fires kept forest densities low, heterogeneity high, and understory flowering plants, grasses, and

shrubs vigorous and healthy. Fires moved through all parts of the landscape, from the ridges and dry slopes to the drainages and moist swales. While fire is often called a "disturbance," it is better considered an "ecological process" because it is a natural part of the landscape when it is similar to historic patterns. Native Americans in the Sierra Nevada have used and still consider fire as an important tool (Anderson & Moratto 1996, Anderson 2006, Lake & Long 2014). They used fire to create open forest understories that facilitated hunting, and to influence the growth of plants important for food, building materials, medicine, and religious purposes.

With the lack of fire in forests, oak woodlands, riparian areas, chaparral, and meadows, they have changed grown denser and more uniform. Flowering plants that are adapted to fire and sunny openings have diminished in numbers, locations, and health. Flowers are sparser. The condition and amount of plants important for Native Americans have declined as a result. Restoration of fire as an ecological process is an important goal and objective of this revised plan. The plan also describes traditional ecological management practices to improve the condition of culturally important plants for use by the Nisenan tribe and others (see Section 4.4).

The current residents of the San Juan Ridge and neighbors of the 'Inimim Forest both influence and are affected by the type of fire in the landscape. Fires tend to be started by humans, especially along roads. With high fuel levels in most parts of the Sierra Nevada, these human-ignited fires can start unwanted, high-intensity fires. This is in contrast to carefully planned, prescribed fires that BLM, California Department of Forestry and Fire Protection (CALFIRE), and the U. S. Forest Service use. The 'Inimim Forest parcels have a high likelihood of unplanned, high intensity, human-ignited fires because they are bounded and crossed by roads and fuel loading is high. Likewise, there is a high likelihood of unwanted fires moving from the 'Inimim Forest onto adjacent private lands. A key emphasis of the original *'Inimim Forest Management Plan* was fuel hazard reduction. This continues in this plan revision but with an additional emphasis on restoring fire as an ecological process. Planned or prescribed fire is an important tool in reducing fuel hazard (Vaillant et al. 2009) that can also restore forests (North et al. 2009, North 2012, Collins & Skinner 2014).

4. Goals and Objectives

A *goal* is a broad primary outcome. The goals in the BLM's *Sierra Resource Management Plan* (USDI 2008) apply to the 'Inimim Forest. Below are more specific goals for the 'Inimim Forest. These include goals related to ecological sustainability, fire safety and fuels, sustainable forest uses and products, and adaptive management. *Objectives* are more specific than goals. They outline specific conditions that will move the 'Inimim Forest landscape and vegetation toward the goals. Objectives are nested within each goal as bullets.

Some of the goals and objectives were adapted from the *Draft Revised Land Management Plan for the Sierra National Forest* (U.S. Department of Agriculture (USDA) 2016a) and the *Draft Revised Land Management Plan for the Sequoia National Forest* (USDA 2016b). Like this *Revised 'Inimim Forest Management Plan*, these plans are based on based on the ecological management concepts described in GTR 220 and GTR 237.

4.1 ECOLOGICAL GOALS AND OBJECTIVES

An overall goal for the 'Inimim Forest is that the landscape has vegetation conditions, ecological processes and functions trending toward NRV levels. Below are listed some more specific ecological goals. For vegetation, additional detail on objectives can be found in Appendix B, where they are framed as desired conditions. The desired conditions provide more specific guidance on vegetation structure and composition to restore the NRV and heterogeneity.

4.1.1 Ecological Resilience

Forests are resilient to high intensity fire, drought, climate change, and insect and pathogen outbreaks.

- At a landscape scale (see subsection 4.1.2.1) less than 1/3 to 1/2 high-severity fire across the 'Inimim Forest and individual parcels.
- Insect and pathogen mortality is within the NRV.
- Vegetation composition and structure change little under severe drought.
- Resilient conditions are maintained through regular forest and fire management treatments.

4.1.2 Vegetation Composition and Structure

Vegetation composition and structure are trending toward desired conditions at patch, within-patch, and landscape scales (see Appendix B for details).

4.1.2.1 Landscape Scale

At the *landscape scale* (hundreds to thousands of acres), montane vegetation occurs in a complex mosaic of different forest densities, sizes, and species mixes across large landscapes (**Figure 6**), varying with topography, soil type, and soil moisture.

- Forests are more open on dry sites, with ponderosa pine and black oak prevalent and dominant.
- Forests are denser on moist sites, with Douglas-fir dominant or co-dominant with sugar pine.
- On moderate sites, ponderosa pine and Douglas-fir co-dominate forests that are moderately open. Black oak is common in large patches.
- Forest density is within the NRV.
- Old forest structure, especially the presence of large or old trees, is common throughout most of the forest.
- Vegetation is restored to the NRV across 1/2 to 2/3 of the area.

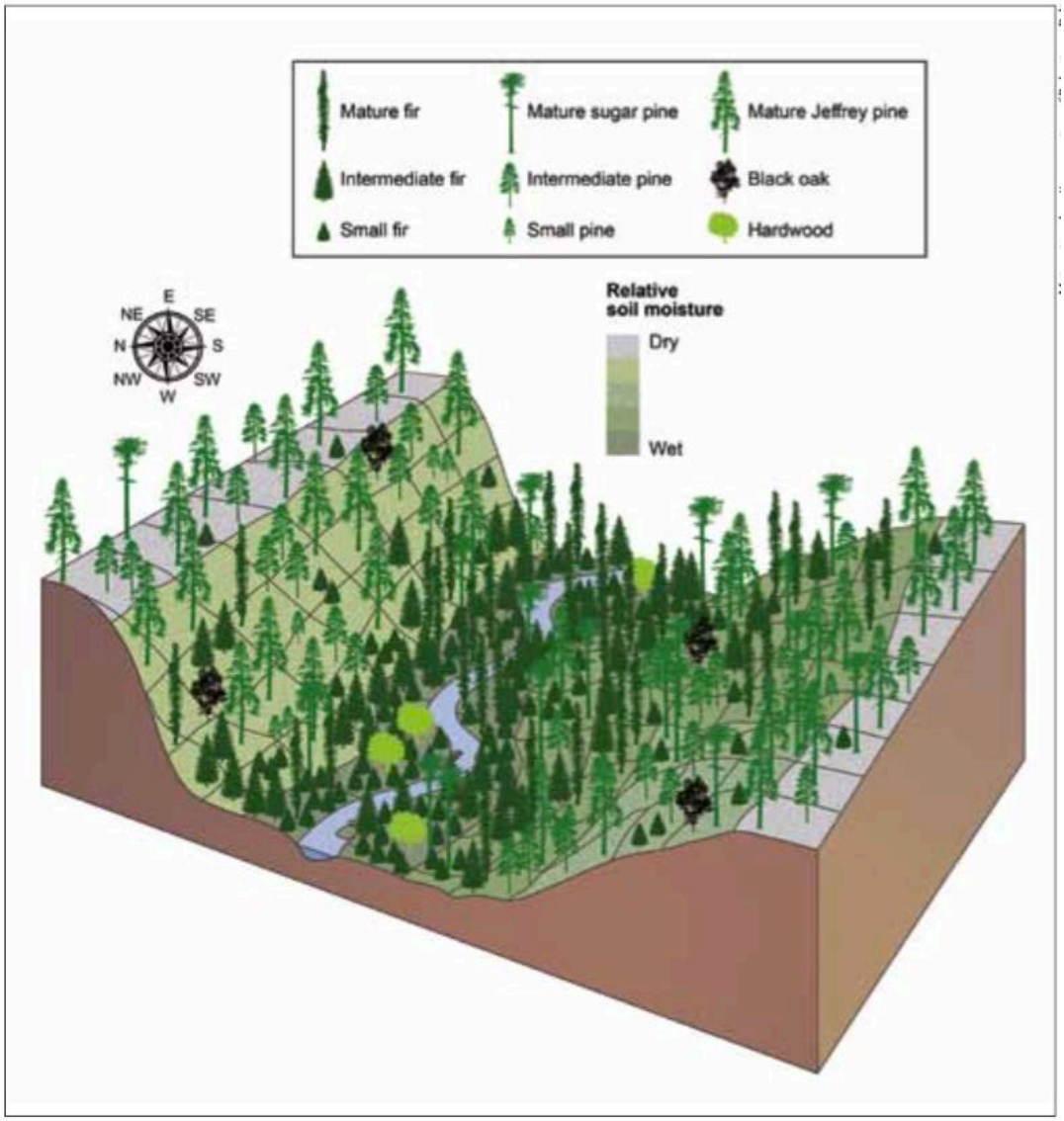

Figure 6. Landscape schematic of variable forest conditions produced by management treatments that differ by topographic factors such as slope, aspect, and slope position. Ridgetops have the lowest stem density and highest percentage of pine in contrast to riparian areas. Mid-slope forest density and composition varies with aspect. Density and composition increase on more northern aspects and flatter slope angles. From North et al. (2009). Reproduced with permission from the author.

4.1.2.2 Patch and Within-Patch Scales

At the *patch scale* (tens of acres), a complex mosaic of groups of trees, shrubs, and herbaceous plants provide diverse habitat for a wide variety of wildlife species, including old forest associated species. Within forest patches, forests are heterogeneous. Trees are highly irregular in spacing and size.

- Individual trees, small clumps, and groups of trees are interspersed with grasses, herbaceous plants, and shrubs, in variably sized openings that vary by forest type (**Figure 7**).
- A mosaic of moderate to dense shrubs, tree litter, down wood and bare ground occurs between groups of trees.
- Vigorous understories of heterogeneous, patchy, and diverse native shrubs, herbs, and grass species support small mammal, bird, insect, and fungal communities, as well as providing pollinator and herbivore forage.
- Oak trees of varied ages are present, with wide spacing providing full sunlight around the large, old oak trees, enhancing their ability to produce abundant acorn crops. Black oak is reproducing successfully. Sufficient numbers of mid-age black oaks have enough canopy space to form full crowns to replace old oaks that eventually die. Black oak snags, and live oak trees with dead limbs, hollow boles and cavities provide shelter, resting, and nesting habitat for wildlife.

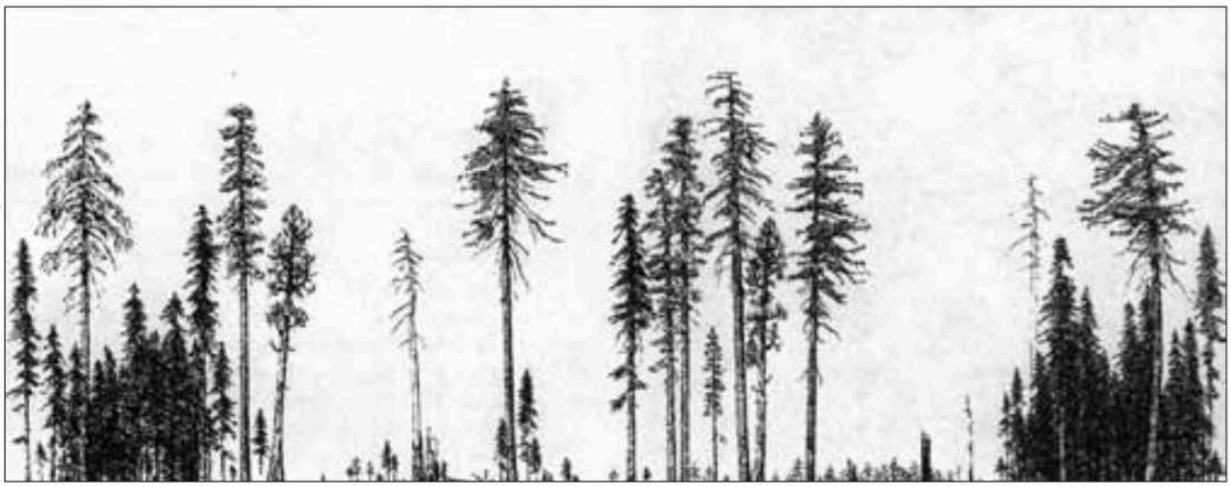

Figure 7. Diagram of heterogeneous forests, within patches. From North et al. (2009). Reproduced with permission from the author.

4.1.2.3 Invasive Species

The number of invasive species occurrences and their extent are trending down.

- Invasive plant occurrences are noted and mapped where possible.
- Invasive species removal is incorporated into forest and wetland restoration projects.
- Best practices are used in all management activities, including restoration projects and fire suppression, to reduce the spread of invasive plants.

4.1.2.4 Uncommon Plants and Communities

The ecological integrity (measured by composition, diversity and structure) of uncommon plants and their habitat, along with other special habitats, is maintained or improved.

- **MacNab cypress**: the population of MacNab cypress (*Hesperocyparis macnabiana*) located on the Bald Mountain Parcel is comprised of a range of ages, including seedlings and saplings, to ensure perpetuation of the population. Younger individuals are healthy with well-developed crowns.
- **Indian manzanita**: there are varied ages of Indian manzanita (*Arctostaphylos mewukka*) individuals in clumps or patches, to ensure perpetuation of the occurrences. The ability of shrubs to re-sprout vigorously after planned or unplanned fires is maintained.
- **Oregon white oak**: there are varied ages of Oregon white oak (*Quercus garryana* var. *semota*) individuals in clumps or patches to ensure perpetuation of the occurrences. The ability of individuals to re-sprout vigorously after planned or unplanned fires is maintained.

4.1.3 Old Forest

The majority of the forested landscape contains old forest structure, and the proportion of forest with old forest structure is trending up towards desired levels (see Appendix B for details). Forests that contain large trees are resilient, with conditions trending towards the NRV.

- Old forest structure includes large or old trees, snags, and large downed logs. These often occur in clumps or small groups. These areas are irregularly distributed across the landscape and interspersed with stands of younger trees, shrubs, meadows, other herbaceous vegetation and non-vegetated patches.
- Old forests are composed of both vigorous and decadent trees. Decadent trees with broken tops, multiple tops, cavities and deformities provide wildlife nesting and denning habitat and contribute to the future production of snags, downed logs, and other coarse woody debris.
- Sufficient numbers of younger trees are present to provide for recruitment of old trees over time.
- Coarse woody debris, including large downed logs in varying states of decay, provides important wildlife habitat. Surface dead wood levels are sufficient to provide for legacy soil microbial populations.
- Competition from surrounding small trees is reduced, especially in the area immediately surrounding individual and clumps of large trees.
- Accumulated litter and sloughed bark around the bases of large trees are reduced, with limited to no impact to feeder roots.
- Habitat for old forest associated species is trending up toward desired levels.

4.1.4 Fire as an Ecosystem Process

Fire plays a natural role in the landscape where possible, primarily through the application of prescribed fire.

- Fire burns primarily with low to moderate intensity in a mosaic pattern. Heat and litter consumption are sufficient to reinvigorate fire-adapted flowering plants, grasses, and shrubs. Prescribed fire is used as a restoration tool wherever feasible to restore fire as an ecological process.

4.1.5 Habitat Connectivity

The ‘Inimim Forest provides for the movement of different species of animals between habitats. Movement for home-range use (i.e., food) and migration occur freely. Migration includes movement for food and cover with changing seasons and long-term shifts in distribution with climate change.

- Wide-ranging habitat generalist species, such as mountain lion (*Puma concolor*), bear (*Ursus americanus)*, and white-tailed deer (*Odocoileus virginianus)*, are able to move freely throughout the ‘Inimim Forest and to habitat on adjacent public lands or other areas of suitable habitat.
- Species associated with specialized habitats, including old forest, riparian, meadow, and rock outcrop habitat are able to move across parcels, between them, and to adjacent suitable habitat.
- The ability of rare or uncommon species to move or expand in the landscape is trending up.

4.1.6 Wetlands and Special Habitats

Wetland conditions are trending towards the NRV. Wetland conditions include the amount and flow of water and habitat for plants and animals.

- Several meadows are restored and trending toward the NRV. Restoration includes removal of encroaching conifers and non-native invasive plants.
- Restoration of riparian forests and vegetation occurs along perennial and intermittent streams, especially in areas adjacent to upland forest treatments.

4.1.7 Animal and Plant Species

Sustainable populations of native plant and animal species are supported by healthy ecosystems, essential ecological processes, and land stewardship activities. These healthy ecosystems are resilient to high intensity and uncharacteristic wildfires, climate change, drought, and other stressors in order to support the long-term sustainability of plant and animal communities.

4.2 FIRE SAFETY AND FUELS

4.2.1 Fuels

The threat to human inhabited areas and communities from wildfires starting within the ‘Inimim Forest is minimal. This is achieved through restoring and maintaining vegetation desired conditions.

- Fuels and potential fire behavior in the ‘Inimim Forest is reduced so that the likelihood of large, high intensity, and high severity fires is reduced.

4.2.2 Safety

The ‘Inimim Forest contributes to fire safety of neighbors and the community.

- Major evacuation routes and neighborhood evacuation routes that pass through the ‘Inimim Forest are managed as shaded fuel breaks, which can slow or reduce fire behavior in the event of a wildfire.
- Fuels along evacuation routes are at levels suitable for safe evacuations of residents during a wildfire, while allowing for safe use by fire personnel.

4.2.3 Prevention and Education

Education and fire prevention enforcement have reduced the likelihood of human ignited wildfire.

- YWI contributes to the education of residents and visitors, in coordination with the North San Juan Fire Protection District and Fire Safe Council of Nevada County.

4.3 SUSTAINABLE USES AND MANAGEMENT

The ‘Inimim Forest provides forest products sustainably.

- Wood and vegetation removed for ecological restoration are utilized where possible, including biomass. Forest restoration promotes carbon stability, through resilience goals, by promoting long-term forest sustainability.

4.4 TRADITIONAL NATIVE AMERICAN USES

The previous occupation and use by the Nisenan tribe is recognized and incorporated into management of the ‘Inimim Forest. The knowledge of traditional gatherers in managing lands is recognized.

- Native American gatherers have access to use ‘Inimim Forest.
- Local Native American groups, especially the Nisenan tribe, are able to cooperatively manage areas of importance, with the potential to designate some “gathering areas.”
- Restoration incorporates fire and other culturally important practices to improve traditionally used plant materials.

4.5 ADAPTIVE MANAGEMENT

‘Inimim Forest lands are managed under a philosophy of adaptive management. Management practices are modified based on new science and experience in different approaches to achieve desired outcomes.

- Management practices, goals, and objectives are adapted to new science and monitoring findings.
- Management is collaborative.
- Citizen scientists and other volunteers are utilized.

5. Management Approaches

5.1 PRACTICES

A set of guiding principles for restoration and management was developed based on the original *'Inimim Forest Management Plan* (USDI 1995), SRMP (USDI 2008), GTR 220 and 237 (North et al. 2009, North 2012), and *Fire in California Ecosystems* (Sugihara et al. 2006). Together, they emphasize active management of landscapes to restore the NRV, including fire as an ecological process. Below are guiding principles for treatment emphasis, approach, priority, and extent. Treatment types referred to in the practices below are described in more detail in Section 5.2.

5.1.1 Emphasis

- Restore ecological conditions to within the NRV.
- Focus on restoration of vegetation composition and structure, fuels, and ecological processes (i.e., fire).

5.1.2 Burning

- Wherever feasible, apply prescribed fire treatments.
- On larger parcels previously burned, retreat with understory burning.
- Where levels of understory dead and live fuels are high, but the overstory is open, burn where possible.
- Near homes or difficult-to-burn areas, apply pile and burn treatments.
- Include old forest and riparian areas in understory burning as these areas burned historically as well.

5.1.3 Thinning

- Apply strategies in GTR 220 and GTR 237 to increase heterogeneity. Create clumps and gaps.
- Remove thinned material in excess of desired conditions, including the use of biomass harvest for small diameter trees and shrubs, along with variable density and diameter thinning for medium diameter trees.
- Apply mechanical thinning where accessible on existing roads or skid trails.
- Hand-thin in sensitive areas, such as streamside riparian areas or around meadows.

5.1.4 Invasive Plants

- Prevent invasion and spread with integrated methods.
- Pulling/digging is primary method of invasive plant removal.
- Equipment used for mechanical treatments will follow best practices for wildland fire vehicles, described in the Interagency Fire Handbook. Utilize existing weed wash facilities nearby (i.e., Grass Valley).

5.1.5 Special Habitats

- Monitoring is the emphasis across all special habitats.
- Actively restore meadows (remove invasive plants, thin encroaching conifers, adjust hydrology).
- Evaluate the ecological role of and resilience to fire within these habitats. Restore fire when used in adjacent areas or with specific fires for the special habitat type.

5.1.6 Prioritization

- Along major evacuation routes identified in the community fire protection plans: Jackass Flats, Lake City, Old Mill, Sages/Salmon Mine Roads.
- Where maintenance treatment is needed (e.g., a recent previous treatment).
- Areas surrounding special habitats.
- Where large trees are more frequent.
- In headwaters of drainages where surrounding forests have high fuel loading.
- Around mature or extensive oak stands and clumps.
- Areas with non-native invasive plants established.
- Where collaborative opportunities exist (e.g., with USFS, PG&E, or adjacent landowners).

5.1.7 Extent of Treatments

- Restore between 1/2 to 2/3 of each parcel to increase resilience to high-intensity fire.
- Treat approximately half of the ‘Inimim Forest area in the next 5 years.

5.1.8 Traditional Ecological Management

- Incorporate input from the Nisenan tribe in designing and implementing projects to incorporate uses of culturally important plants.
- Incorporate traditional practices, such as prescribed burning, where possible, to improve the condition and quantity of culturally important plants.

5.1.9 Heterogeneity and Marking Guidelines

- Apply the concepts described in GTR 220 and GTR 237 to determine tree species and size retention, and spatial patterns (gaps and clumps).
- Vary stand density and habitat conditions by topographic features, including: drainage bottoms, north and east-facing slopes compared to drier ridges, south- and west-facing slopes.
- Tree diameter distributions will trend toward nearly equal numbers in all diameter size classes. Treatments will significantly reduce the proportion of small trees and increase the proportion of large trees.
- Identify and retain some trees with “defects” (i.e., broken tops, cavities, platforms, “witch’s brooms”) that create structure for wildlife nests and dens.
- Retain most or all large trees and clumps of trees unless in excess of desired conditions.

- Remove small or medium trees growing under and near the dripline of large or old conifer trees.
- Preferentially retain medium and large black oaks and madrones. Thin around large oaks to provide open canopies with adequate sunlight.
- Create small gaps consistent with science on NRV under natural fire regimes and endemic insect and pathogen levels.
- Retain all sugar pine, except for in dense, even-aged regeneration clumps.

5.2 TREATMENT TYPES AND LIMITATIONS BY VEGETATION TYPE AND ENVIRONMENTAL SETTING

A wide range of restoration treatment types are appropriate for restoring most of the 'Inimim Forest landscape. This includes mechanical and hand tree thinning, hand cutting (shrubs), mastication, pile burning and prescribed fire, and invasive plant removal. Unless stated specifically otherwise, the terms thin or thinning refer to mechanical thinning. A detailed list of treatment types and descriptions are included in Appendix D. The general treatment types are defined in the list below. The descriptions are general, allowing for modification or development of new treatment types based on new science or technology in the future.

- **Thin (mechanical or hand)** – cut and reduce density of trees or shrubs;
- **Mechanical thin** – use of mechanical equipment (i.e. chainsaws, feller-bunchers, skidders, and tractors) to cut and usually remove trees, and sometimes shrubs;
- **Variable diameter and density thin** – mechanical tree thinning of small, medium and large trees to achieve heterogeneity and desired forest densities and species composition described in the desired conditions (Appendix B), may also include some hand thinning of smaller trees;
- **Mastication** – use of mechanical equipment to chop up understory shrubs or small diameter trees;
- **Hand thin** -- shrubs and/or small diameter trees using chainsaws or hand tools (i.e. saw, loppers)
- **Hand cut** – cutting shrubs using chainsaws, handsaws or axes or pulling out;
- **Pile and burn** –piling cut trees or shrubs, and sometimes dead surface fuels (small logs or large branches) and planned burn of the piles in accordance with BLM fire policies;
- **Prescribed burn** – pile burn or a planned fire across an area (area fire), in accordance with BLM fire policies, term used primarily for area fire;
- **Invasive plant removal** – hand pull invasive plants from the ground, including the roots by hand or using hand-tools such as weed-wrenches, pulled material is piled and burned or removed offsite so seeds do not spread;
- **Cut and remove hazard or dead trees** – cut with chainsaws, and remove using mechanical equipment;
- **Cut and leave hazard or dead trees** – cut with chainsaws and leave or pile by hand or mechanical equipment.

For all treatment types where vegetation is cut or pulled, the vegetation may be left, piled or removed depending upon the site-specific prescription.

This list includes the suite of likely treatments. They may be used in combination with each other or singly. For example, prescribed burning may occur on its own or in combination with either mechanical thinning or hand thinning. The specific combinations will be determined during site-specific project planning. In addition, the types of equipment that would be used in mechanical treatments will be determined during project planning.

The range of treatments recommended varies by vegetation type and environmental setting as described in **Table 4**. On more productive and less erosion-prone forest areas, a wide variety of treatment types are applicable, including mechanical thinning, hand thinning, and prescribed fire. On low productivity and more erosion-prone slopes and away from existing roads and skid trails, hand treatment and prescribed fire are emphasized. The use of mastication should be limited, unless there will be low accumulations of decay-resistant surface fuels and it is the only available and feasible option in areas of priority fuel reduction along primary fire evacuation and access routes (e.g., when pile burning is too costly or time consuming).

Table 4. Potential restoration and fuel treatments by vegetation type and setting.

Vegetation Types & Environmental Setting	Mechanical thin (all kinds)	Mas-tication	Hand thin or hand cut (trees or shrubs)	Prescribed area burn or pile and burn	Invasive plant removal	Cut and remove hazard or dead trees	Cut and leave hazard or dead trees
Productive forests < 1,000 feet of roads or existing skid trails.	x	x	x	x	x	x	x
Productive forests >1,000 feet from existing roads or skid trails.			x	x	x		x
Forests on shallow, rocky soils or steep slopes (>45% slope)			x	x	x		x
Chaparral			x	x	x	x	x
Meadow			x	x	x	x	x
Riparian			x	x	x	x	x

A generalized map of treatment limitations is shown below (**Figure 8**). It was based on criteria including: potential soil erosion, soil productivity, and distance from existing roads or skid trails. These criteria were combined to create a single map of treatment limitations with categories of low, medium, and high. In general, all treatment types would be applicable to areas with low limitations. All treatment options are also appropriate on areas designated as moderate limitations, but site-specific considerations to limit soil erosion should be applied. Most of these areas have low slope, reducing the likelihood of equipment-generated erosion. Greater consideration of best practices to maintain soil cover is appropriate. In areas of high limitations,

the primary recommended treatments are hand thinning and prescribed fire. These areas are steep and/or have eroded or highly altered soils.

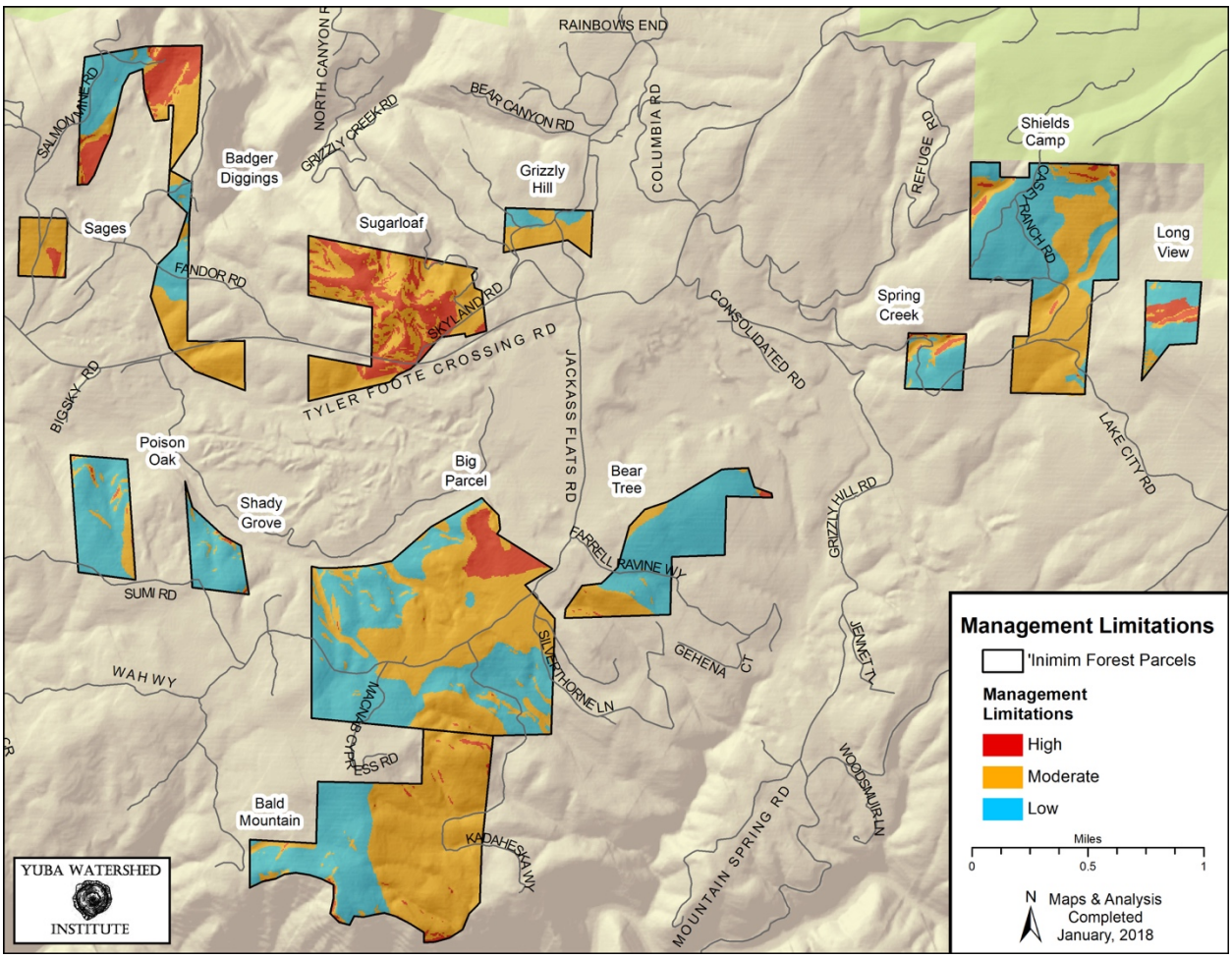

Figure 8. Map of treatment limitation categories (low, moderate, high) across the ‘Inimim Forest.

5.3 PRIORITIZING TREATMENTS

The priorities for restoration treatments across the ‘Inimim Forest are similar to what they were in the original *‘Inimim Forest Management Plan* in part. The treatment emphasis has evolved with current science on forest restoration as well as the changing conditions from treatments and uses that have occurred in the past 20 years. The original and revised plan priorities are summarized and compared in **Table 5** below.

Table 5. Crosswalk of original and revised management plan priorities. New priorities incorporate applicable goals and objectives from the SRMP and current science.

Original Plan Priorities	Revised Plan Priorities
Improve fire safety along major evacuation/access routes	Improve fire safety along major evacuation/access routes (Jackass Flats Road, Lake City Hwy, Old Mill Road, Tyler Foote Road, Sages/Salmon Mine Roads)
Reduce fuel hazard	Restore ecological resilience to high intensity fire, drought, insect/pathogen outbreaks (beyond NRV) and climate change. Includes restoration of heterogeneity.
Protect old growth forests and larger mature trees	Restore ecological fire resilience, and improve resilience to drought, insects/pathogens and climate change in patches with large or old trees. Target restoration around individual legacy trees with thinning and pulling back accumulated litter/bark around boles.
	Restore and enhance individual and stands of hardwoods, especially black oaks.
Produce a steady supply of high quality timber	Utilize vegetation byproducts from ecological restoration where possible
Protect biodiversity by limiting or not managing areas where rare or sensitive elements (i.e. old growth trees) occur.	Restore to conserve biodiversity, emphasizing movement toward the natural range of variability in structure, composition and process. Restore heterogeneity. Actively prevent invasion and spread, and removal of non-native invasive plants. Include hand treatments (targeted thin of understory conifers competing with hardwoods and mosaic burn) in riparian areas.
	Incorporate maintenance or second treatments in previously treated parcels. A dense layer of tree seedlings and shrubs has developed in many of these areas, which will result in increased forest density and fuel loading in the near future. Address remaining masticated fuels in treatments. Areas that have had mastication have extensive remaining surface fuels because of the low decomposition rates in the dry climate. These should be pulled back from large or surviving trees.

Appendix D summarizes the recommended priority treatments that have been developed to restore and manage the ‘Inimim Forest parcels according to the management direction in this document. Appendix E includes descriptions of each of the parcels, including a general description of the history of management in the last 20 years since the original ‘*Inimim Forest Management Plan* was written.

6. Monitoring

Monitoring of the plan implementation is an important aspect of adaptive management. *Adaptive management* is the process of periodically or continually updating management practices to incorporate information and findings from new science, changes in conditions, resource uses, and trends that are the result of management and other outside factors. The monitoring approach described in the BLM's SRMP (USDI 2008) is directly applicable to the *Revised 'Inimim Forest Management Plan*. Importantly, the SRMP recognizes that it is not necessary to monitor every management action, plan goal, objective, or approach. The monitoring for this plan will develop and evolve over time based on a series of general questions. These questions include, but are not limited to:

1. Is forest heterogeneity increasing and trending toward desired conditions?
2. Is forest resilience in treatment areas increasing, in reference to desired vegetation composition, structure, and fuel conditions?
3. Are occurrences of Scotch broom (*Cytisus scoparius*) decreasing in size and number?
4. Are fuel conditions along major fire evacuation/access routes trending towards desired conditions for fire safety?
5. Are conditions around large trees increasing their resilience to fire, drought, bark beetles, and climate change?
6. Are conditions around black oaks in treatment areas increasing available light to the crowns?
7. Is prescribed fire being applied extensively?
8. Are Nisenan tribal members able to utilize areas in the 'Inimim Forest for traditional gathering activities? Are the culturally important plants increasing in number and/or health?
9. Is biodiversity being conserved by ecological restoration of vegetation towards desired conditions across large areas of the 'Inimim Forest?

The approaches to measure these monitoring questions may range from qualitative to quantitative. An emphasis will be on citizen science to accomplish at least some of the monitoring. Specific metrics and approaches will be designed in a collaborative manner with BLM and other stakeholders and users.

7. Commonly Used Terms

Ecology

The interaction of living things and their environment.

Ecological Integrity

Includes the natural range of biodiversity, food webs, ecosystem cycles (i.e., water, nutrient, and carbon), and resilience.

Ecological Sustainability

The continuation of biodiversity and ecological integrity over time (Callicott & Mumford 1997).

Ecosystem

Ecosystems include all of the living things and their interactions in an area. This includes plants, animals, fungi, food webs, and cycles of water, carbon, and nutrients.

Ecosystem Processes

Ecosystem processes include the cycles of non-living things, such as water, carbon, and nutrients between living things and their environment. It also includes fire as a recurrent process. As an ecosystem process, fire is described in terms of a fire regime.

Fire Regime

Repeated patterns of fire frequency, location, size, intensity, and severity.

Fire Severity

Fire severity refers to the level of impact on plants, soils, or other ecosystem components (Sugihara et al. 2006). For example, low severity fire impacts to vegetation means that low numbers of plants are killed or top-killed. High severity impacts to vegetation means that high to very numbers of plants are killed or top-killed. Top-killed applies to sprouting plants that regrow from underground bulbs, tubers, roots, or burls (Fites-Kaufman et al. 2006).

Heterogeneity

Variation in arrangement of trees in a forest patch or different forest patches in a landscape (North et al. 2009). This is one of the aspects of forest ecosystems and landscapes that has changed the most over time. Forests and landscapes have become more uniform. This has reduced forest functions including wildlife habitat quality and resilience.

Landscape

Landscapes are large areas, typically covering thousands to hundreds of thousands of acres.

Landscape Ecology

Landscape ecology consists of the patterns and function of ecosystems over large areas. In the western slopes of the Sierra Nevada, this includes the types and arrangements (i.e. mosaic) of different vegetation patches across landscapes.

Natural Range of Variability

Natural range of variability (NRV) refers to the range of vegetation, species, structure, and processes found in an ecosystem in its "natural" state, relatively unaffected by human activities (i.e., Landres et al. 1999, Wong & Iverson 2004). Many definitions incorporate indigenous human activities as part of NRV. In this document, indigenous tribal communities, their uses, and management practices are considered part of the natural range of variability. It is typically defined by the period 100 to 200 years before Euro-American settlement.

Patch

Term applied to vegetation. Refers to a relatively homogenous area that differs from its surroundings in dominant vegetation type (i.e. forest or chaparral), species, density of trees or plants, age of trees, or height of trees.

Ecological Resilience

The "elasticity" or ability of ecosystems to absorb disturbances or stresses such as severe droughts, insect outbreaks, high intensity fires, and climate change and to maintain or quickly recover the ecological characteristics (composition, structure, and cycles) and ecosystem services (e.g. provide habitat, soil protection).

Vegetation Composition

The mix of plant species in a given area, such as a patch, stand, or ecosystem.

Vegetation Structure

The size, density, and arrangement of plant types and sizes, such as trees and shrubs. Also, the size and arrangement of patches of different vegetation types, and structure (i.e. old forest or young forest) across a landscape.

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Appendix A. Ecological Groups

A.1 INTRODUCTION

Ecological groups are an important aspect of the *Revised 'Inimim Forest Management Plan*. They are defined as areas in the landscape that contain similar soil characteristics, topography, and vegetation. These groups reflect areas with different natural ranges of variability (NRV) for vegetation and fire ecology. They are a refinement of the soil/plant association management groups defined in the original *'Inimim Forest Management Plan*, which distinguished areas with different slope steepness. Here, slope steepness is incorporated into the management limitations map (see revised plan, **Figure 8**). The ecological groups are broken out in more detail than the soil/plant association management groups to reflect differences in topography, soil moisture, and soil productivity. These characteristics are key drivers of the NRV in forest composition, structure, and fire ecology (Fites 1993, North et al. 2009).

This appendix contains descriptions of the ecological groups. The methodology for mapping the ecological groups is described in the accompanying Analysis Document.

A.1.1 Classifications and Terminology used to Describe Vegetation

Before describing the ecological groups, it is useful to define commonly used terminology along with the classification approach used to describe vegetation, which differs from other commonly used classification schemes. Some of the terminology was defined in the Revised 'Inimim Forest Management Plan and is repeated here for clarity.

For purposes of describing ecological groups, an emphasis was placed on plant associations (Fites 1993). *Plant associations* are areas with similar suites of indicator plants. *Indicator plants* are those plants affiliated with certain environmental conditions, such as moist or dry soils. They are typically present whether the vegetation is young or old. Indicator plants are useful for distinguishing areas with different NRVs. This is in contrast to classifications or groupings based on existing, dominant plant species, or *alliances*.

For example, an area may be currently dominated by Douglas-fir (*Pseudotsuga menziesii*) but previously dominated by ponderosa pine under a natural fire regime. This would be characterized previously as a ponderosa pine type but is now a Douglas-fir type. Here, using plant associations and indicator plants, the important consideration would be what indicator plants are present. If bearclover (*Chamaebatia foliolosa*) was present in the understory, then it would be inferred that it is a dry mixed conifer type. Historically, dry mixed conifer types were dominated by ponderosa pine *(Pinus ponderosa)* but currently may have a high proportion Douglas-fir, outside of the NRV. Since the NRV is the basis for much of this plan revision, the plant association classification was used the basis for ecological groups.

The ecological groups are comprised of one or more plant associations, as described in Fites (1993). There are two types of mixed conifer plant associations:

- *Ponderosa pine – mixed conifer – historically dominated by ponderosa pine;*
- *Douglas-fir – mixed conifer – historically dominated or co-dominated by Douglas-fir.*

The plant associations described in Fites (1993) were based on statistical analysis of data from hundreds of plots. This analysis was used to identify indicator plants and groups of plant associations affiliated with different soil and topographic conditions.

Mixed conifer forests dominate the ‘Inimim Forest and are comprised of various mixtures of ponderosa pine, Douglas-fir, sugar pine, incense cedar (*Calocedrus decurrens*), black oak (*Quercus kelloggii*), and madrone (*Arbutus menziesii*). Mixed conifer forests, in the ‘Inimim Forest, often contain vegetation types that are not included in the mixed conifer classification (Fites 1993), such as less common or non-mixed conifer vegetation. Less information is available on plant associations for these types, or it is less important to distinguish them to this level of detail. For the ‘Inimim Forest these include: blue oak (*Quercus douglasii*) woodlands, chaparral, meadows, seeps/springs, and non-forested rock outcrops. These vegetation types will either have less of an emphasis on management or they require more site-specific management evaluation than the mixed conifer types.

A.2 Ecological Group Descriptions

The descriptions of each ecological group include characteristic vegetation composition and structure. These are described for current conditions in representative areas and in relation to the NRV. Vegetation composition includes dominant tree or shrub species and indicator plants. Structure includes general levels of forest density, canopy cover, tree sizes, and heterogeneity. The amount and size of old forest structure (i.e., large trees) is also characterized.

The descriptions are based on Fites (1993), Barbour et al. (2007), Fites-Kaufman et al. (2007), Safford and Stevens (2017), and field surveys conducted for this plan. Details of the field survey are described in the Analysis Report.

The terms used to describe vegetation canopy cover were defined in the *Revised ‘Inimim Forest Management Plan*. They are repeated here for readability of the descriptions. They roughly correspond to canopy closure classes from the California Wildlife Habitat Relationship (CWHR) system (California Department of Fish and Wildlife 2014), and are defined as follows:

- Dense - vegetation canopy cover greater than 60 percent;
- Moderate - vegetation canopy cover generally between 40 and 60 percent;
- Open – vegetation canopy cover generally between 25 and 40 percent;
- Very Open – vegetation canopy cover generally between 5 and 25 percent;
- Sparse – vegetation canopy cover less than 5 percent.

Tree density can vary widely within a category of canopy cover. For example, a dense canopy cover can result from many small trees or a few large trees. There are no good categories of tree densities to use, nor maps available. It is an important characteristic, though, and general

descriptions are included. More details on the NRV of mid-story and overstory trees for the ecological groups comprised of mixed conifer forests are included in the desired conditions appendix (Appendix B).

There are two sets of descriptions below. The first set includes the ecological groups that were mapped. The second set is for vegetation types that are not included in the ecological groups and were not mapped. All indicator plant references for ecological groups containing mixed conifer forests come from Fites (1993).

A.3 MAPPED ECOLOGICAL GROUPS

The mapped ecological groups are shown in **Figure 3** in the *Revised 'Inimim Forest Management Plan*. Old forests were prevalent in all of the ecological groups dominated by mixed conifer forests. The historic and current condition of old forests was described in the revised plan and won't be repeated entirely here.

A.3.1 Dry Productive

This ecological group is the most prevalent in the 'Inimim Forest landscape, covering more than half of the area. Ponderosa pine-mixed conifer forests dominate these areas. Black oak often dominates the overstory or co-dominates with ponderosa pine. Sugar pine (*Pinus lambertiana*) and incense cedar are often present in low amounts. Indicator plants include bearclover, Hartweg's iris (*Iris hartwegii*), Bolander's bedstraw (*Galium bolanderi*), and milkwort (*Polygala cornuta*). Whiteleaf manzanita (*Arctostaphylos viscida*) sometimes occurs at high levels, associated with previous disturbance, such as logging or high intensity fire. Douglas-fir has become more prevalent since fire suppression and early logging, often dominating in dense mid- or understory layers.

Historically, these forests were open to very open, with high variation in tree spacing. Old forest structure and understory flowering plants and/or grasses were more common. Currently, the forests are dense and more uniform in tree size and spacing. Large trees are rare. Douglas-fir is more prevalent, especially as dense, small trees. Ponderosa pine regeneration is sparse. Large black oaks are uncommon and most have small crowns, shaded out by surrounding conifers. Surface fuels are double to ten-fold what they were historically.

Most of the fuel reduction treatments conducted over the last 20 years in the 'Inimim Forest have occurred in these areas. In treated areas, overstory tree cover is moderate but the understory is usually a dense layer of incense cedar and Douglas-fir seedlings and saplings. Surface fuels remain high in these treated areas. This is because the primary treatment was mastication, which reduces live understory vegetation by changing it to dead surface fuels on the ground.

A.3.2 Dry Low Productive

Similar to the dry productive group, ponderosa pine typically dominates the overstory, with black oak common. Canyon live oak (*Quercus chrysolepis*) may be present in varying amounts, indicating rocky or shallow soils. Forests and vegetation grow slower than on the more productive sites. Large trees are less likely to reach 40 inches in diameter. Old trees are more

commonly 30 inches or less in diameter. Indicator plants include bearclover, whiteleaf manzanita, Hartweg's Iris, Bolander's bedstraw, and milkwort.

Historically, these forests were similar to the dry productive forests except the size and height of the older trees was less because of the harsher environment. Similar changes to forests have occurred here as well. Forests are denser, more uniform in size and spacing, and large trees are uncommon. Douglas-fir is more common and ponderosa pine less dominant. Surface fuels have increased, but not as dramatically as the dry productive group because vegetation growth is slower.

Some areas mapped in this ecological group contain large, continuous patches of whiteleaf manzanita. This includes a large, south-facing area on Sugarloaf Mountain. This area may have the potential to grow at least scattered conifers and oak woodland based on soil depths. However, in the *Soil Survey of Nevada County* (Britan 1993), the soils are described as eroded and it is unclear whether they have the potential to grow a forest. The surface soil layer has been lost in many areas, making tree establishment less likely. Patches of manzanita are thought to have occurred historically in this ecological group, but in smaller areas.

A.3.3 Moist Productive

Douglas-fir-mixed conifer forests represent this ecological group. Douglas-fir is the dominant or co-dominant tree, with varying amounts of incense cedar, sugar pine, and madrone. Black oak and ponderosa pine may be present but usually in low amounts. Mountain dogwood (*Cornus nuttallii*), big-leaf maple (*Acer macrophyllum*), California hazelnut (*Corylus cornuta*), trailplant (*Adenocaulon bicolor*), and starflower (*Trientalis latifolia*) are indicator plants on these moist sites. They are associated with higher soil moisture.

Historically, these forests had open to moderate canopy cover, with small tree clumps or patches of dense canopy cover. Similar to the dry ecological groups, large trees were common but now are rare. Forest structure was heterogeneous and now is more uniformly dense. Sugar pine was common or co-dominant but is less prevalent now because it was selectively logged in the past. Surface fuels are more than double historic levels, and more uniform across patches.

A.3.4 Moist Low Productive

Douglas-fir-mixed conifer forests dominate this ecological group. Douglas-fir dominates or co-dominates the overstory with varied amounts of incense cedar, sugar pine, madrone, and canyon live oak. Black oak and ponderosa pine may be present but usually in low amounts. Indicator plants include: mountain dogwood, big-leaf maple, canyon live oak, hazel, trailplant, mock orange (*Philadelphus lewisii*), and sword fern (*Polystichum munitum*). Some of these areas occur where the sedimentary bedrock is tilted on end, resulting in deep fractures that the tree roots are able grow down into. The result is that they look lush and productive but are growing on a relatively harsh site with soils that are easily eroded.

Historically, these forests had moderate to open canopy cover and heterogeneous structure. Large trees were common, but usually not as large as on the productive sites. Tree composition is likely

little changed. Surface fuels are greater than historic levels but have not changed as much because of lower productivity levels.

A.3.5 Moderate Productive

This ecological group contains forests intermediate between moist and dry mixed conifer forests. Douglas-fir and ponderosa pine typically co-dominate the overstory. Black oak and sugar pine are often co-dominants. Madrone is commonly present. Indicator plants include starflower, harebell (*Campanula prenthanthiodes*), and hairy honeysuckle (*Lonicera hispidula*). This group may occur in a broad transition between moist Douglas-fir and dry ponderosa pine mixed conifer forests. The mix of dry and moist indictor plants reflect this broad transition. For example, both trailplant and bearclover may be found in the same area. The soils may be seasonally moist or a mosaic of moist and dry soils.

Forest canopy cover was open to moderate historically, with high heterogeneity. Large trees were common historically but are rare now. Large areas dominated by black oak were common. Where black oak was prevalent, overstory tree cover was high. Ponderosa pine was more prevalent historically, often co-dominant with Douglas-fir. Surface fuels have increased similar to the dry productive group.

A.3.6 Moderate Low Productive

Mixed conifer forests co-dominated by varying amounts of Douglas-fir and ponderosa pine are typical of this group (Fites 1993). Forest structure is similar to forests in the moist low productive group, while composition is similar to the moderate productive group. Patches of understory vegetation tend to be more prominent than in the moderate productive group. This is often associated with high grass and herb cover on small rock outcrops interspersed in the forest. Common indicator plants include red fescue (*Festuca occidentalis*) or western fescue (*Festuca occidentalis*), white-flowered hawkweed (*Hieracium albiflorum*), harebell, and hairy honeysuckle.

Historically, these forests were similar to the moderate productive group but with the old trees reaching smaller maximum diameters and heights (Fites 1993). Like the moist low productive group, surface fuels have not accumulated to the same degree as the moderate productive group because of slower vegetation growth.

A.3.7 Moderate/Dry Complex High Productive

A mosaic of Douglas–fir and ponderosa pine mixed conifer forests characterize this ecological group. It occurs where there is a broad transition between, or a fine-scale mosaic of, dry and moist soils. Although this mosaic is often mapped as the moderate ecological group, it was mapped as a complex because the intermixed patches with moist and dry indicator plants were relatively large. It was only mapped in one parcel, Shield's Camp. Indicator plants include both dry and moist affiliated species. Trailplant, starflower, bearclover, Bolander's bedstraw, and Hartweg's iris co-occur in varied mixtures. Historically, the forests were similar to those described for the moderate productive ecological group above.

A.3.8 Dry rocky

Areas mapped in this ecological group contain chaparral, MacNab cypress (*Hesperocyparis macnabiana*), and/or gray pine. The largest area is on the Bald Mountain Parcel. Whiteleaf manzanita is the dominant chaparral species. Shrubby Oregon white oak (*Quercus garryana* var. *semota*), uncommon in the Sierra Nevada, is found in small amounts in limited areas. Gray pine (*Pinus sabiniana*) is scattered in low amounts in several areas. Other prevalent chaparral species include wedgeleaf ceanothus (*Ceanothus cuneatus*) and yerba santa (*Eriodictyon californicum*). MacNab cypress is described in more detail below under unmapped vegetation types because it is ecologically important, found in only a few locations in California (Merriam 2011).

Shrub cover and density is high to very high. Currently shrub age and structure are uniform. Historically fires were not frequent in chaparral and burned primarily as high intensity crown fires (Keeley 2006). Currently, there may be some departure in the amount and pattern in fire. Although fire has been suppressed from these areas, historically they did not burn as frequently as the conifer forests and therefore are considered mostly within the NRV.

It is uncertain how much change to composition and structure there has been. Historically, there may have been a more diverse mosaic of different shrub ages and sizes. There is less scientific certainty on historical chaparral than on mixed conifer forests because they lack tree rings used to reconstruct forest ages and fire history.

A.3.9 Hydraulically Mined Areas

A.3.9.1 Diggings

Diggings refer to areas that have had the soil washed away during hydraulic mining. Sparse, stunted ponderosa pine and whiteleaf manzanita have become established and have regrown slowly in these areas. There are scattered seasonal wetlands and ponds in the diggings on the Big Parcel. These are described in the *Revised 'Inimim Forest Management Plan* in Section 3.4.4. The pines and manzanita here may contain genetic diversity that has allowed them to establish and survive in this very harsh environment.

A.3.9.2 Tailings

These areas have had changes in soils from hydraulic mining but not as severe as the diggings. There is still residual soil, but the surface is highly altered into numerous, small, dissected drainages. Mixed conifer forests with mostly ponderosa pine, incense cedar, and black oak occur now. Forest canopy cover is moderate to dense. Whiteleaf manzanita and non-native Himalayan blackberry (*Rubus armeniacus*) and/or Scotch broom (*Cytisus scoparius*) form a dense understory. It is unclear what the NRV is because these areas are highly altered. They appear at least moderately productive and similar to the dry and moderate ecological groups. Although soil productivity is moderate, they are highly susceptible to erosion because of the steep, dissected microtopography. At the bottom of the dissected areas, soil moisture may be high and wet site plant indicators were found, such as western azalea (*Rhododendron occidentale*).

A.3.10 Natural Rock Outcrops

There are small rock outcrops in several areas in the ‘Inimim Forest. However, only one outcrop is large enough to be mapped in the soil survey. This is the steep, volcanic rock outcrop and cliffs on the Long View Parcel. There is no detailed classification of vegetation types on rock outcrops for this area. Only a cursory field survey was conducted. The brief description below is based on the field visit.

A variety of shrubs typically found at lower elevation, foothill areas are found here. This includes birch-leaf mountain-mahogany (*Cercocarpus betuloides*). There are large areas with non-native, annual grasses that have become established.

A.3.11 Riparian

The riparian ecological group was mapped along perennial and major intermittent stream channels. Riparian vegetation along perennial and intermittent streams is varied. There are no ecological classifications of riparian vegetation like there is for adjacent, upland, mixed conifer dominated areas. The description is based on field observations.

Indicator plants include some of the same plants found in moist ecological groups. Big-leaf maple, mountain dogwood, and California hazelnut are common. White alder (*Alnus rhombifolia*) is sometimes present. Pacific yew (*Taxus brevifolia*) was found in one location.

Historically, riparian vegetation was shaped by both the streams and fire. When fires occurred in adjacent uplands, they often reached down into adjacent riparian areas (Van de Water & North 2010). With the absence of fire, conifers have become denser in riparian areas and have displaced or reduced the vigor of riparian hardwood trees and shrubs. Dead fuels (vegetation) and small conifers have accumulated to high levels, thereby increasing the likelihood of high severity effects after large, uncharacteristic wildfires (Van de Water & North 2011).

A.4 OTHER VEGETATION TYPES NOT INCLUDED IN THE ECOLOGICAL GROUP MAP

Several vegetation types that were not mapped but are notable and have different management direction are described here. These include blue oak woodlands, MacNab Cypress, Indian manzanita, and Oregon white oak. Wetlands are described in the *Revised ‘Inimim Forest Management Plan* in Section 3.4.

A.4.1 Blue Oak Woodlands

Blue oak occurs in small areas on shallow, rocky soils. The blue oak woodlands are limited to the Shield’s Camp Parcel. They are considered woodlands, rather than forest, because tree canopy cover is very low. The plants are more typical of foothill vegetation. Some of the blue oaks are very large and old.

Historically, these areas burned frequently, with the understory dominated by fire-adapted perennial bunch grasses. Currently, the blue oak woodland understory is dominated by non-native annual grasses. Shrubs found here, including wedgeleaf ceanothus, are almost all tall and old. These shrubs regenerate by seed. When they get very old, they may produce little to no seed.

A.4.2 MacNab Cypress

MacNab cypress is an uncommon tree, endemic to northern California (Mallek 2009). One of its occurrences is on Bald Mountain. The stand here is dominated by MacNab cypress and whiteleaf manzanita.

Historically, these sites burned infrequently at high intensity, as crown fires. MacNab cypress is adapted to these types of fires. Its cones are *serotinous*, meaning they open primarily with high intensity heat from fire. Mallek (2009) studied the current condition of numerous MacNab cypress groves, including on Bald Mountain. He found that most MacNab cypress locations were not in jeopardy from lack of fires. It appears that the Bald Mountain cypress may be regenerating without fire but it is not clear if it is sufficient for the population to persist over time. The saplings have sparse foliage however, and there are limited numbers of them. The condition of regeneration, especially of seedlings and saplings, warrants examination and advice from an expert.

A.4.3 Indian Manzanita

Indian manzanita (*Arctostaphylos mewukka*), also known as Miwok manzanita, looks similar to whiteleaf manzanita but it is a "sprouter." This means it regrows stems and leaves, or sprouts following fire or other means of top-kill. It is uncommon and occurs in a few known locations in the 'Inimim Forest. Most often it is found within areas mapped as the dry productive group. There is one small patch where it is dominant on a granitic rock outcrop in the Shield's Camp Parcel. Here it covers approximately $1/10^{th}$ of an acre.

In the Shield's Camp patch, the shrubs are mostly old. This is indicated by the high proportion of dead branches. Several other locations where it has been found consist of one to several shrubs. These shrubs are young. In both situations, the sites are open with little to no shading from overstory trees.

It is unknown how the current distribution and condition compares with historic conditions. However, since it is adapted to fire with its ability to sprout, it is possible that it was more common in the past than now. Fire suppression may have restricted its growth and vigor, in part from development of a denser forest. As with most manzanita species, the Indian manzanita seems to be associated with full sunlight.

A.4.4 Oregon White Oak

Oregon white oak (mistakenly identified as Brewer's oak in past studies) is uncommon in the Sierra Nevada. In the 'Inimim Forest it occurs as a shrubby, low growing plant in chaparral in the Bald Mountain Parcel, or near the patch of Indian Manzanita in the Shield's Camp Parcel. It is a sprouting plant and as a result adapted to fire. It is unknown what its condition or distribution was historically.

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Appendix B. Ecological Desired Conditions

B.1 INTRODUCTION

The *Revised 'Inimim Forest Management Plan* contains goals and objectives for ecological and fire safety conditions. This appendix contains more detailed descriptions of the objectives for these two topics, which are referred to as desired conditions. These are more specific descriptions of the vegetation composition, structure, and landscape patterns that would achieve ecological sustainability and conditions within the natural range of variability (NRV). The desired conditions are not absolute templates but rather information to shape and guide restoration activities.

The desired conditions are focused on vegetation and fire, since these are the primary aspects of the 'Inimim Forest that are to be restored and managed. Where possible, desired conditions are described quantitatively. For example, desired forest densities are described in desired ranges of trees per acre. The desired conditions are based both on relevant science as well as practical experience of land managers.

As described in the *Revised 'Inimim Forest Management Plan*, the plan is based on the concept of the NRV. Science on the NRV for Sierra Nevada forests, fire, and other vegetation is the primary basis for the desired conditions described below. For some forest characteristics, such as large tree size and densities, there is quantitative scientific research. For other characteristics, such as meadow size, there is less definitive information. The level of detail of each desired condition reflects the available scientific information.

The primary research summaries used to develop the desired conditions for vegetation and fire are listed below. They include the following, listed in alphabetical order of lead author:

- Fites 1993. *Ecological guide to mixed conifer plant associations: Northern Sierra Nevada and Southern Cascades: Lassen, Plumas, Tahoe, and Eldorado National Forests*.
- Fites-Kaufman 2007. "Montane and subalpine vegetation of the Sierra Nevada and Cascade ranges." In *Terrestrial Vegetation of California*, pp. 456-501.
- Franklin & Fites-Kaufmann 1996. "Assessment of late-successional forests of the Sierra Nevada." In *Sierra Nevada ecosystem project, final report to Congress*, Vol. 2, pp. 627-662.
- Long et al. 2014. *Science synthesis to support socioecological resilience in the Sierra Nevada and southern Cascade Range* (PSW-GTR-247).
- North et al. 2009. *An ecosystem management strategy for Sierran mixed-conifer forests* (PSW-GTR-220).
- North 2012. *Managing Sierra Nevada forests* (PSW-GTR-237).
- Safford & Stevens 2017. *Natural range of variation for yellow pine and mixed-conifer forests in the Sierra Nevada, southern Cascades, and Modoc and Inyo National Forests, California, USA* (PSW-GTR-256).
- van Wagtendonk & Fites-Kaufman 2006. "Sierra Nevada bioregion." In *Fire in California's ecosystems*, pp. 264-294.

Two recent draft management plans for the Sequoia and Sierra National Forests were based on these scientific publications, especially North et al. (2009) and North (2012). These two scientific publications were foundational to the revised management plan. Therefore, the desired conditions described below draw heavily upon these two draft forest plans:

- *Draft Revised Management Plan for the Sequoia National Forest* (USDA 2016a);
- *Draft Revised Management Plan for the Sierra National Forest* (USDA 2016b).

The actual text and table structure are often the same. In some instances, the wording was changed to make it more concise or appropriate for the northern Sierra Nevada. Similar to these plans, the desired conditions are organized by spatial scale, vegetation characteristic, and vegetation or forest type.

B.1.1 Spatial Scale

The *spatial scale* is the extent of area. First are *landscape scale* desired conditions, which apply to larger areas ranging from across all of the ‘Inimim Forest parcels to entire parcels and surrounding similar slopes or sub-watersheds. The intent is to provide conditions that cover multiple small- or medium-sized vegetation management projects. Second are *mid-scale* desired conditions, which apply to areas in the tens to hundreds of acres. These desired conditions are applicable to smaller areas, such as a large single patch of vegetation or a mosaic of patches. Third are the *fine-scale* desired conditions, applying to the variation on the ground of smaller vegetation elements, such as understory shrubs, gaps or small openings, and litter cover.

Patches are areas where there are similar dominant species and vegetation structure. The term *patch* is similar to the term *forest stand* but encompasses a broader range of ecological aspects. Patches may not be uniform but they are different from the surrounding areas. One may have a “salt and pepper” look from above of heterogeneous tree clumps and gaps, while another may be a uniform sea of forest, shrub, or grass/grass-like cover. Some desired conditions include the term *within-patch*. This refers to changes at the fine-scale, like patches of shrubs or clumps of trees within patches.

B.1.2 Vegetation Characteristics

Desired conditions for forests was separated out into different characteristics, including:

- Composition – mix of plant communities, or vegetation types, and dominant tree species;
- Forest density – patch type mosaic, basal area, canopy cover, and/or tree density;
- Forest heterogeneity – opening size and area, tree spacing, tree sizes;
- Old forest – large tree size and densities;
- Snags and downed wood – density.

B.1.3 Vegetation or Forest Type

The *Revised ‘Inimim Forest Management Plan* is based largely on the concept of ecological groups. These were defined in the plan and are described in Appendix A.

In the *Draft Revised Management Plan for the Sequoia National Forest* (USDA 2016a) and *Draft Revised Management Plan for the Sierra National Forest* (USDA 2016b), mixed conifer forests were broken into moist and dry types. Here, forests are broken into moist, dry, and moderate forest types. In the Sierra and Sequoia draft revised plans, there was no distinction made for soil productivity. Here, soil productivity is separated out into productive and low productive ecological groups. These differences are reflected in the desired conditions below. In applying the desired conditions on productive sites, the full range of desired conditions would apply. For the low productivity ecological groups, the lower values in the range of the desired conditions would apply.

Mixed conifer forests that currently have, or have the potential to have, high black oak (*Quercus kelloggii*) cover are distinguished as a separate type in the desired conditions below. This is because these areas have a high ecological value and it is desirable to maintain or restore the black oak. Black oak provides high quality habitat to numerous wildlife species and is an important Native American cultural plant.

B.1.4 Terminology

Terminology is defined the same as that in the *Revised 'Inimim Forest Management Plan*. This includes terms such as *heterogeneity* and *old forest*. These definitions are not repeated here; refer to the Plan's glossary for definitions.

B.2 DESIRED CONDITIONS

The goals and objectives in this section are framed as desired conditions below.

B.2.1 Landscape Vegetation

B.2.1.1 Plant Community and Vegetation Type Diversity

- The variety of native plant communities, representing the natural diversity of the San Juan Ridge, includes: mixed conifer forests, black oak and madrone (*Arbutus menziesii*) woodlands, canyon live oak (*Quercus chrysolepis*) woodlands, blue oak (*Quercus douglasii*) woodlands, chaparral and MacNab (*Hesperocyparis macnabiana*) cypress, meadows, seeps and springs, ponds, and rock outcrops dominated by mixed shrubs.

B.2.1.2 Forest Patch Mosaics

- There is a mix of forest patch types, varying in tree canopy cover and average tree size across hundreds to thousands of acres. The mix for the most prevalent forest types are shown in Table 1. Patch types are based on the California Wildland Habitat Relations (Mayer & Laudenslayer 1988).

Table B-1. Percent of patch types (>10 acre) by ecological group/vegetation type at the landscape scale. The Black Oak/Mixed Conifer is a variant of the Dry Mixed Conifer Group that has more than 40% cover of black oak (from USDA 2016a, b). The mixed conifer type includes both productive and low productivity groups.

Ecological Group/ Forest Type	Early Seral or non-forest[1]	Small Tree[2]	Open Mature Forest[3]	Intermediate Mature Forest[4]	Dense Mature Forest[5]
Dry Mixed Conifer /Ponderosa Pine	10-20%	1-10%	60-90%	10-20%	<5%
Black Oak/Mixed Conifer	10-20%	1-10%	20-40%	40-60%	<10%
Moist Mixed Conifer	10-20%	2-15%	20-40%	20-40%	10-20%
Moderate Mixed Conifer	10-20%	2-15%	40-60%	10-20%	<10%

[1]Shrub, grass/herb, tree seedling/sapling on potentially forested areas
[2]California Wildland Habitat Relationship System (CWHR) tree size classes 2 & 3.
[3]CWHR 4 & 5; 10-40% tree cover.
[4]CWHR 4 & 5; 40-60% tree cover.
[5]CWHR 4, 5 & 6, >60% tree cover.

B.2.1.3 Old Forests

- Between 40 and 80 percent of the forested landscape contains old forest areas. Old forest areas are clumps and patches of old forest components such as old trees, snags, and large downed logs.
- The number and density of old trees vary by topographic position and soil moisture. In general, more large and old trees are found on moister sites, on lower slopes, bottoms, and north and east aspects, especially where soils are deeper. Large trees are well distributed but are often clumpy. The densities vary by forest type as shown in Table 2. Trees greater than 40 inches in diameter, generally over 150 years old, represent the oldest trees, and comprise a significant proportion of large and old trees. Some very large trees occur, greater than 50 or 60 inches in diameter. In many areas of high soil productivity, trees grow to large sizes (e.g., around 30 inches in diameter) in fewer than 100 years. On low and very low soil productivity sites, the oldest trees may be smaller in diameter. Sufficient numbers of younger trees are present to provide for recruitment of old trees over time.

Table B-2. Distribution of large/old trees at the landscape scale, measured across patches (versus plots) (modified from USDA 2016a, b). Productive mixed conifer would be managed using the full range of desired conditions. Low productive mixed conifer forests would have lower levels of the largest trees (>40" diameter). Densities of large trees on the low productive sites would mostly be at the median and lower levels.

Ecological Group/ Forest Type	>20"-diameter trees per acre	>30"-diameter trees per acre	>40"-diameter trees per acre
Dry Mixed Conifer & Black Oak/Mixed Conifer	4-32	5-20 (median of 12)	2-7 (median of 4)
Moist and Moderate Mixed Conifer	4-40	10-22 (median of 16)	4-12 (median of 6)

B.2.2 Dry Mixed Conifer and Black Oak Patches

Vegetation *patches* are areas with similar species mixes, sizes, and densities. Descriptions of the desired conditions for vegetation patches are organized by ecological groups with variants where key species dominate, such as black oak.

B.2.2.1 Species Composition

- The dry mixed conifer group includes a wide range of dominant tree mixes. Ponderosa pine and black oak are dominant or co-dominant on most sites. Native understory shrubs and plants are common.

B.2.2.2 Forest Structure and Heterogeneity

- Dry mixed conifer and black oak/mixed conifer patches consist of open forests with a mosaic of varied tree sizes, densities, and understory vegetation (Figure 1). Trees are widely-spaced overall, interspersed with clumps of trees and small gaps. Where black oak is dominant or co-dominant because of site history, desired canopy cover is higher than where absent (Table 3). Forest patches on moderately deep, rocky, or shallow soils have lower water holding capacity and should have tree density at the median or lower levels.

Figure B-1. Example of a dry mixed conifer patch, from Yosemite National Park. Trees spacing is widely varied, large trees are common and there is a dense understory of native bearclover. Photo credit: Malcolm North.

Table B-3. Structure within forest patches by ecological group/forest type (modified from USDA 2016a, b). Low productive sites would be managed for the lower ranges of tree densities and basal areas. Productive sites would be managed for the full range of levels of tree density, basal area and canopy cover.

Ecological Group/ Forest Type	Tree Density (Trees per acre >4" dbh)	Tree Basal Area (square feet per acre)	Tree Canopy cover (% cover overhead)	Shrubs
Dry Mixed Conifer	[1]16 – 263; mostly <60	20-200; mostly <100	10-50; median 30; highly variable	10-80% cover; highly variable; mixed ages
Black Oak/Dry Mixed Conifer	[1]16 – 263; mostly <60	20-200; mostly <100	10-80; median 50; highly variable	10-80% cover; highly variable; mixed ages
Moderate Mixed Conifer	16 – 263; mostly <85	50-220; mostly <120	10-60; median 40; highly variable	10-60% cover; highly variable; mixed ages
Moist Mixed Conifer	16 – 263; mostly <85	50-240; mostly <140	20-80; median 50; highly variable	10-60% cover; highly variable; mixed ages

[1]Scholl & Taylor 2010, Lydersen & North 2012, Safford & Stevens 2017

- At the mid- to fine-scale, vegetation within patches is highly variable (**Table B-3** and **Figure B-1**). Trees of different sizes and ages, variably spaced, comprise an irregular, uneven-aged forest. Individual trees are variably spaced with some denser groups. Groups mostly vary from 2 to 10 trees. Tree stocking (density and basal area) is highly variable within patches. Irregularly shaped openings with less than 10 percent tree cover make up from 10 to 50 percent of the area. The opening sizes are varied, mostly ranging from 0.05 to 0.12 acres in size, occasionally greater than 0.12 acres, and contain a mix of grasses, herbaceous plants, and shrubs, and young trees.

B.2.2.3 Black Oaks

- Where black oaks are prevalent, desired conditions include the following. Oak trees in varied ages are present, with wide spacing providing full sunlight around large old oak trees, enhancing their ability to produce abundant acorn crops. Black oak is reproducing successfully. Sufficient numbers of mid-age black oaks have enough canopy space to form full crowns to replace old oaks that eventually die. Black oak snags greater than 20 inches in diameter, and live oak trees with dead limbs, hollow boles and cavities provide shelter, resting and nesting habitat for wildlife.

B.2.2.4 Snags, Downed Logs and Litter

- At the mid- to fine- scale, snags greater than 20 inches in diameter are patchily distributed and highly irregular in spacing with 2 to 40 snags (median of 10) per 10 acres (**Table B-3**) providing for future downed logs. Coarse woody debris, including large downed logs in varying states of decay is patchily distributed and ranges from 1 to 10 tons per acre (**Table B-4**).

Table B-4. Snags and large logs across patches and mosaics of patches (modified from USDA 2016a, b). Low productive sites would be managed for lower levels of snags and logs. Productive sites would be managed for the full range of snags and logs.

Ecological Group/ Vegetation Type	Snags >20" diameter (per 10 acres)	Logs >15" diameter and >8' long (tons per acre)	Litter and Understory Dead Wood (tons per acre)
Dry Mixed Conifer & Black Oak Mixed Conifer	2-40; median 10	1-10; all decay classes	3-10; patchy
Moist and Moderate Mixed Conifer	5-60; median of 20	1-10; all decay classes	3-15; patchy

B.2.3 Special Habitats

Special habitats generally occur as small patches or have vegetation types that support unique assemblages of plants and animals, especially at-risk species. Special habitats typically include uncommon rock types, harsh soils or rock outcrops. Many uncommon plant and animal species are found in rocky or gravelly habitats. Given the localized nature of these special habitats, they are challenging to address comprehensively at the landscape scale since they may be uniquely

affected by different activities or trends in ecological conditions. Therefore, the desired conditions are more general.

B.2.3.1 Ecological Integrity

- The integrity of special habitats is maintained or improved. Composition, diversity and structure are maintained in all areas, including those with multiple use activities.

B.2.4 Fire Ecology

B.2.4.1 Fuels

- Within patches, litter and surface fuel is patchy with fewer than 5 to 15 tons per acre of dead surface fuels on average over 30 to 70 percent of the area. There are some small areas of up to 30 tons per acre and others with fewer than 5 tons per acre. Live understory shrubs and small trees are patchy and not continuous. Shrub decadence, or the proportion of dead branches or foliage is variable but generally less than 25 percent across large areas.

B.2.4.2 Fire Effects (Intensity, Mosaic, Severity) in Conifer and Hardwood Types

- Fires burn with low, moderate, or mixed intensity with minimal patches of resulting high severity (greater than 90 percent basal area mortality). The proportion of area burned at very high severity within a fire is generally less than 10 to 15 percent. Due to existing high levels of fuels and weather variability, greater proportions of areas burned at high severity (up to 40 percent) may be unavoidable during large landscape prescribed fires or wildfires managed to meet resource objectives.

B.2.5 Fire Safety and Fuels

B.2.5.1 Fire Safety

- Fuels along neighborhood and community fire access/evacuation routes are at levels suitable for safe evacuation and access, and fire suppression by engines and hand crews during high fire weather.
    a. Potential flame lengths during very high fire weather (97^{th} percentile) $\leq$ 4 feet.
    b. Likelihood of crown fire start or spread are very low.
    c. Snag and log levels should be very low within two and a half tree lengths of evacuation/access roads. Generally:
        i. Less than 1 large log per acre
        ii. No snags or less than 1 snag per 10 acres.
    d. The majority of these areas are in the dry productive ecological group, and are managed to the median or low range of desired conditions.
    e. In riparian areas along community fire access/evacuation routes, native hardwood shrubs and trees should be retained over conifers where fuel reduction is necessary to meet fire behavior objectives. These treatments take precedent over

general riparian conservation area guidelines. On a site-specific basis, higher levels of large logs may be retained in some areas.

- Education and enforcement (by CAL FIRE, local fire department, etc.) have reduced the likelihood of human ignited wildfire.
    - The YWI contributes to the education of residents and visitors, in coordination with the North San Juan Fire Department and Fire Safe Council of Nevada County.

B.2.5.2 Landscape Fuel Treatments

- Fuels are reduced in 1/2 to 2/3 of the landscape to NRV levels.
- Restoration treatments to reduce the spread rate and intensity of wildfires are located in more tactical opportunity areas like along ridges, roads, other natural or man-made features, and in areas that pose the greatest fire threat to communities. These include areas that increase opportunities for area prescribed fire.
- Treatments conform to the vegetation and desired conditions desired conditions.

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Appendix C. Marking Guidelines for Heterogeneity

These marking guidelines were adapted from those developed by the U.S. Forest Service, Tahoe National Forest, Yuba Ranger District for two forest restoration projects. The Yuba Ranger District shared the guidelines with the full knowledge that would be used in part or entirety by the Yuba Watershed Institute for the *Revised 'Inimim Forest Management Plan*.

C.1 OBJECTIVES

1. The primary objective is to *develop a forest structure that mimics natural fire with heterogeneous structure* as described in North et al. (2009) and North (2012). This includes stands that have varying tree density and sizes with clumps and gaps. Portions of the stands will be multi-storied, especially on moist north and east-facing slopes and bottoms. The stand will include a variety of sizes of tree clumps, retention patches, and canopy gaps. Gaps are intended to encourage the reproduction of various shrubs, trees, forbs, and grasses.
2. The second objective is to restore stand density, species mix, and diameter distribution that moves structure and composition towards desired conditions.

C.2 GUIDELINES IN ORDER OF PRIORITY

C.2.1 Priority 1 – Large (>24" dbh) and/or Old Conifer Release

- Remove small and medium conifers up to **10'** beyond the dripline or to crown spacing distance, whichever is greater, of large trees.
- **Retain natural clumps of large trees:** Leave clumps of **3 to 8** large (larger than 24" dbh) conifers when boles are within **10-12'** of each other. Thin to 10' beyond the outer dripline of the clump **or to crown spacing distance, whichever is greater**. Mark conifers 10-14" dbh within clumps if they can easily be removed. If two clumps are close together, they may be combined.
- Remove large trees (>24" up to 29" dbh) only when the number of trees >24" dbh is in excess of desired conditions for resilience and is adequate for recruitment of large tree (>29" dbh).
- Old trees (large limbs and bark plates or other visible features) are retained, even when smaller than 24" dbh.
- **Very large trees (>29" dbh) are retained, unless the desired densities are present across the parcel and landscape area.** Landscape areas are defined as areas that would serve as habitat or home ranges for wide-ranging old forest associated species such as northern goshawks (*Accipiter gentilis*) or California spotted owls (*Strix occidentalis var. occidental*). This includes adjacent public and private lands and are generally greater than 2,000-acre areas. Note, this is highly unlikely to occur within the next 20 years because of the very sparse number of large trees that currently occur.

C.2.2 Priority 2 – Black Oak (> 6" dbh) Release

Remove conifers whose crowns fall within 20' of the dripline of mature (generally greater than 10" dbh) black oak (*Quercus kelloggii*) and madrone (*Arbutus menziesii*) clumps of 3 or more stems and 5' beyond the dripline of individual oaks. On north slopes and lower slopes, leave some conifers (in excess of desired conditions) surrounding completely overtopped, visibly rotten, old, or suppressed oaks that are useful to wildlife.

C.2.3 Priority 3 – Gaps

- Create roughly circular, elliptical, or irregular-shaped openings ranging from 1/10 ac to 1/2 ac in size, averaging 1/4 ac in size (radius of 59' or 100' x 100') and/ or increase the size of **natural openings**, **insect and disease pockets**, and **oak patches**.
- Maximum size of openings should be no more than 1/2 acre (radius 83' or about 150' x 150').
- If possible, locate gaps where no trees are over 29" dbh

C.2.4 Priority 4 – Tree Spacing

When stand density and basal area described in the ecological desired conditions do not exist, the following guidelines should be used:

- Remove conifers with less than 30 percent live crown ratio.
- Remove trees based on species preference.
- **Leave defect trees (>14" dbh)** with multiple tops or platform like structures. Leave trees that provide shade to or whose branches overtop defect trees. Retain conifers within close proximity to snags within streamside zones.

C.2.5 Priority 5 -- Sugar Pine

Leave healthy sugar pine (*Pinus lambertiana*) trees, unless it meets one of the following criteria:

- It has major structural damage or defect or the tree is unhealthy (fading crown, < 30 percent live crown ratio (LCR), pouch fungus "conks") and there is a healthier tree nearby.
- It is in a dense thicket of sugar pine (intertwined branches), and all are equal in health.
- It has obvious signs of blister rust evidenced by recent dead branches (3 or more not restricted to the lower 1/3 of the crown) and either scattered older dead branches or an obvious thinning crown.
- It has been girdled by blister rust and has a dead top.

Appendix D. Recommended Priority Treatments

D.1 INTRODUCTION

This document contains recommended priorities for treatments in the 'Inimim Forest to increase ecological resilience. These areas were selected based upon the general treatment priorities described in the *Revised 'Inimim Forest Management Plan* (Section 5.3). Much of the 'Inimim Forest is in need of some level of ecological restoration. The forests and other vegetation types have been altered due to past uses and management, including fire suppression. In many areas, they are departed from the natural range of variability (NRV). Some areas were treated for fuels reduction in the last 20 years and are in need of follow-up maintenance treatments. These areas are less departed from the NRV but are trending away from the NRV and associated desired conditions.

It is not reasonable to treat all areas at once as this could cause undesirable cumulative effects. Therefore, a portion of the 'Inimim Forest was chosen as a priority for treatments at this time. This document contains the descriptions of these areas and recommendations for the types of treatments.

The purposes of the treatments are to:

1. Reduce fuel hazard. This includes:
    a. Create and maintain fire safe conditions along primary fire evacuation and access roads identified in the North San Juan Fire Department (2017) and Nevada County (2017) Community Fire Protection Plans.
    b. Restore ecological resilience.
2. Restore vegetation and fire to meet ecological desired conditions (*Revised 'Inimim Forest Management Plan* Section 4.1 and Appendix B).
3. Maintain fuels and ecological conditions in areas that have been treated previously within the last 20 years.

In the sections below, the criteria used to map recommended priority treatment areas and choose treatment types are described. First, these are described for forested areas; then, they are described for non-forest areas. This includes wetlands and special habitats, such as MacNab cypress (*Hesperocyparis macnabiana*).

D.2 FORESTED AREAS

Recommended treatment areas were identified by mapping areas meeting the priority criteria described in the *Revised 'Inimim Forest Management Plan*. Recommended treatment types were based on field visits and the treatment limitations map (see revised plan, **Figure 8**). These areas were then mapped digitally in a geographic information system (GIS).

Recommended treatment areas were mapped based on information including:

- previously treated areas;
- old forest maps from the original *'Inimim Forest Management Plan*;

- treatment limitation map;
- location of existing roads and skid trails.

The types of recommended treatments (see revised plan, Section 5.2) include those described in **Table D-1** below:

Table D-1. Description of suite of treatment types recommended for the 'Inimim Forest. Individual treatments may be used singly or in combination. The specific combination and type of equipment to be applied in any area recommended for treatment is to be determined based on site-specific conditions during project-level prescription planning. Recommended treatment units may include multiple treatment types depending upon location and conditions, such as distance from road, slope steepness, or occurrence of special habitats or uncommon species. It is assumed that all treatments are for the purpose of moving vegetation towards desired conditions.

Treatment Types and Terms	Description
Thin	General term referring to cutting to reduce density of trees or shrubs. Can be implemented with mechanical machinery or by hand using chainsaws, handsaws, or pruners. May be used to create heterogeneity, in addition to reducing tree density. Trees are generally removed but can also be piled or left as downed logs depending upon site-specific prescription. Removed trees and shrubs may be utilized for biomass, biochar, timber, or other uses.
Mechanical thin	Cut trees and/or shrubs using mechanical equipment such as chainsaws, feller-bunchers, skidders, and tractors.
Variable diameter and density thin	Mechanically thin small, medium and large trees to achieve heterogeneity and desired forest densities and species composition described in the desired conditions (Appendix II), may also include some hand thinning of smaller trees. May also be applied to shrubs but term most often applied to trees.
Mastication	Use of mechanical equipment (including grinder, mower, specialized masticator) to chop up shrubs and/or small diameter trees. Material may be incorporated into soil or left on top, depending upon the equipment and prescription.
Hand thin	Cut shrubs and/or small diameter trees using chainsaws, handsaws, axes, and or loppers.
Hand cut	Same as hand thin but applied to shrubs only. Can also include pulling manually.
Pile	Pile cut trees or shrubs, and sometimes surrounding dead surface fuels (small logs or large branches).
Pile and burn	Pile cut trees or shrubs, and sometimes surrounding dead surface fuels (small logs or large branches). Planned burn of piles in accordance with BLM fire policies.
Prescribed burn	A planned fire (pile or area), in accordance with BLM fire policies.
Area burn	A planned fire across an area (generally tens of acres or more), in accordance with BLM fire policies.
Hand pull, pile and burn remove invasive plants	Pull out invasive plants (i.e. scotch broom, Himalayan blackberry, star-thistle) from the ground, including the roots by hand or using hand-tools such as weed-wrenches. Pulled material is piled and burned or removed offsite so seeds do not spread. Removed vegetation may be utilized for biomass, biochar, timber, or other uses.

Cut hazard or dead trees	Cut hazard or dead trees with chainsaws or mechanical equipment. Trees may be left as downed trees or removed using mechanical equipment, depending upon site-specific prescription.
Cut remove hazard or dead trees	Cut hazard or dead trees with chainsaws or mechanical equipment and removed by burning pieces or using mechanical equipment. Removed trees and shrubs may be utilized for biomass, biochar, timber, or other uses.

This list includes the suite of likely treatments. They may be used in combination with each other or singly. For example, prescribed burning may occur on its own or in combination with either mechanical or hand thinning. The specific combinations of treatment types and specific mechanical equipment to be used will be determined during site-specific project planning. Unless stated specifically otherwise, the terms thin or thinning refer to mechanical thinning in the remaining document.

The recommended priority treatment areas are shown in the map below (**Figure D-1**). Treatment areas for each parcel are labeled in order of decreasing priority. For instance, for the Big Parcel, Area BP1 is the highest priority, Area BP2 the second highest priority, etc. The priority across all areas in the ‘Inimim Forest is identified in the following section (D.2.1).

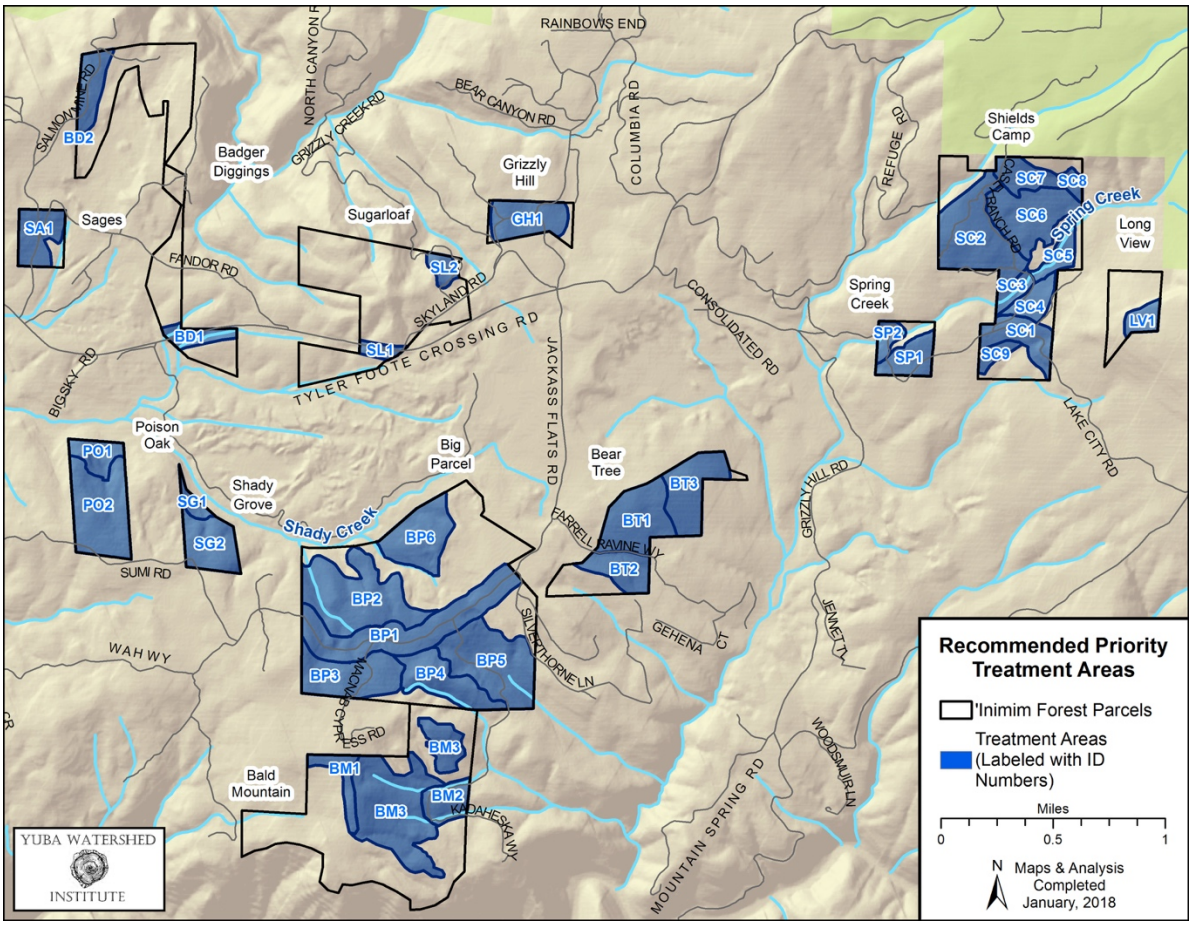

Figure D-1. Recommended priority treatment areas in the ‘Inimim Forest.

Each treatment area may have one to several recommended treatment types. It is assumed that all treatments will be guided by the desired conditions. This includes the numbers and sizes of trees and snags, or dead trees, cut and/or removed. Treatments will include removal of Scotch broom (*Cytisus scoparius*), wherever it occurs within a recommended priority treatment area. Scotch broom removal may also occur in other areas. The type of treatment recommended for each area varies with proximity to roads and the difference between the existing vegetation condition and desired conditions. For example, in an area with large trees away from a road, the recommended treatment would be hand-thinning and piling of small diameter trees from around the large trees. Conversely, along a primary fire evacuation/access road, mechanical thinning and prescribed area burn would be recommended treatments.

The mapped recommended treatment priority areas may not represent exactly where each particular treatment type would occur. This is because each of the recommended treatment types may be applied in only a portion of the treatment area. The selection of the actual location and type of treatments will occur when individual projects are planned and implemented. Consequently, the identified areas and by treatment types are approximate estimates.

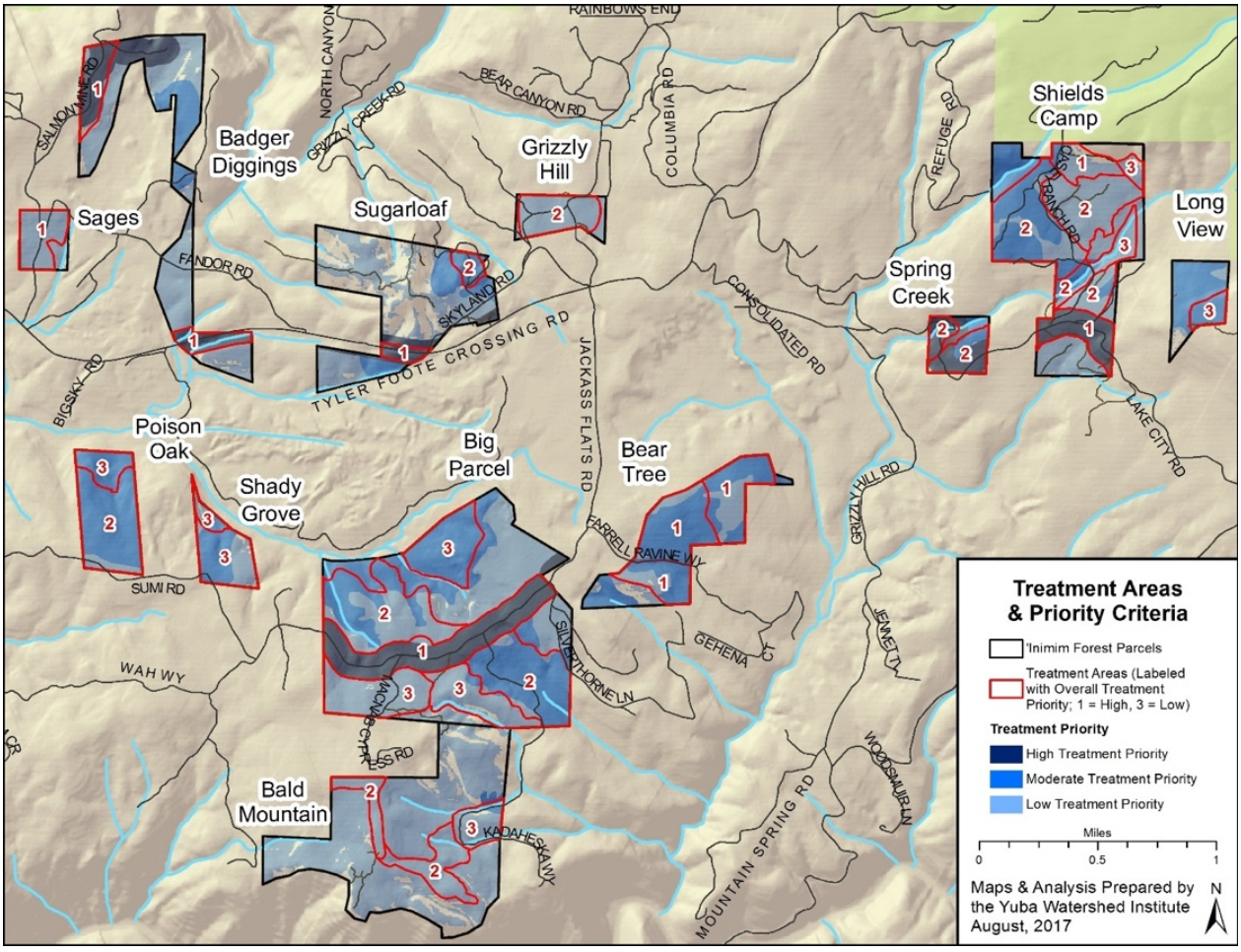

Figure D-2. Map of recommended priority treatment areas in red, with numeric labels from 1 to 3, representing the relative treatment priority across the 'Inimim Forest. The underlying layer in shades of blue are the results of the combined criteria layer, described above.

D.2.1 Recommended Priority Treatment Areas across all Parcels

The individual recommended priority treatment areas were ranked from low to high priority (**Figure D-2**). The priorities were based on the treatment priority criteria (see revised plan, Section 5.3). The first and second priorities roughly cover the same area. All areas could be treated as once or in stages based on funding.

D.2.2 Recommended Priority Treatment Areas by Parcel

This section contains descriptions of recommended treatment areas by parcel. They are in alphabetical order of parcel name.

In all parcels, there are several treatment types that are universally recommended and not repeated for each parcel. This includes:

- Around large trees, where feasible, hand thin small trees and tall shrubs around them (to a distance of at least 2 times the crown dripline) and pull back accumulated litter and duff (to a distance of at least ½ the crown dripline);
- Hand pull and pile scotch broom in areas treated and wherever else it occurs. Remove or burn piles to limit seed spread.

Throughout this section, the terms "*dog-hair*," or "*dog-hair thicket*," are used. These terms refer to areas that have very dense, small trees.

D.2.2.1 Badger Diggings Parcel

This is an odd shaped parcel. It is "u-shaped," mostly surrounding the Badger Diggings, a historical hydraulic mining area. It also crosses a small portion of the edge of the diggings. Two major fire evacuation/access routes cross through the parcel. The treatment areas are along these roads.

Area BD1: This area is along Tyler Foote Road, a primary wildland fire and other emergency evacuation/access route. Forest cover and fuel loading are dense. There are pockets of tree mortality. Recommended treatments include:

- Cut and remove dead trees and reduce associated fuels along Tyler Foote Road;
- Thin (mechanically or hand) small trees and pile and burn trees and other understory fuels.

Area BD2: This area is adjacent to and/or contains a major PG&E transmission line. PG&E has done treatment within the immediate transmission corridor. This included cutting medium and large trees within approximately thirty to fifty feet of the power line. High live surface fuel loading remains, especially Scotch broom. There is an opportunity to partner with PG&E on treatments within the corridor and adjacent areas. Recommended treatments include:

- Scotch broom removal;
- Hand cut, pile, and burn whiteleaf manzanita (*Arctostaphylos viscida*);
- Thin (mechanically and hand) small diameter trees;

- Cut and remove or pile and burn dead and/or hazard trees near roads and power transmission line corridors.

D.2.2.2 Bald Mountain Parcel

Over half of this parcel has been previously treated. Three areas are recommended for treatment. All of these have been previously treated. They are in need of maintenance treatments and further restoration to increase heterogeneity and reduce tree density.

Area BM1: This area is on a ridge that has been managed as a shaded fuel break both on BLM and on private lands. It has been previously treated. The forests are open, with some large black oaks (*Quercus kelloggii*). There are some pockets of pine mortality. Recommended treatments include:

- Cut and remove and/or pile and burn dead trees;
- Pile and burn or conduct area burn to reduce dense conifer regeneration and whiteleaf manzanita ingrowth.

Area BM2: A portion of this area has been previously treated with mastication. There are young conifers and manzanita that have since grown in, forming a dense, live fuel layer. Mature tree density is higher and more uniformly spaced than desired conditions. Other untreated areas have very dense forests with high surface fuels. There are several pockets of tree mortality. Recommended treatments include:

- Cut and remove and/or pile and burn dead trees;
- Area prescribed burn in previously treated areas;
- Variable diameter and density thin and area burn along Kadaheska Way.

Area BM3: Most of this area was masticated along an old road bordering the South Yuba River Canyon. It also contains a meadow that has had some restoration (Boes & Nicholson 2010). There is a dense forest surrounding the meadow. It is very likely that conifers have continued to encroach into the meadow. This has apparently shrunk the size and altered the hydrology of the meadow. There are pockets of tree mortality in the area, including near the meadow. Recommended treatments include:

- Cut and remove or pile and burn dead trees that are near the road or occur in larger pockets;
- Thin trees that have encroached into meadow, and surrounding trees that are likely affecting meadow hydrology, leave or burn trees that are cut depending upon conditions compared to desired levels of logs, snags, and surface fuels;
- Area prescribed burn in previously masticated forest.

D.2.2.3 Bear Tree Parcel

Throughout the parcel, there is evidence of past, selective logging of large trees. Despite this logging, here are still large trees in much of the area. It was noted as having one of the larger concentrations of large trees in the original ‘Inimim Forest Management Plan. Because of the old

forest structure and existing access on roads and skid trails, treatment is recommended throughout much of the parcel. The exception is on the ridge and south-facing slope to the south of Farrell Ravine Way. Here, young black oak and dense whiteleaf manzanita occur on eroded shallow soils.

Area BT1: This area contains large pockets of tree mortality. The surrounding area is a mosaic of open, mature, pine forest and dense pockets of dog-hair, small trees or tall manzanita. Live and dead surface fuel loading is high. There is tall, old bearclover throughout. Large pines and oaks occur throughout the area. There are roads or skid trails around at least three-quarters of the area. Recommended treatments include:

- Cut and remove dead trees near road;
- Thin (mechanical and hand) trees and cut shrubs from dense pockets of small trees and manzanita, especially around large pines and black oaks (hand thin around large pines and black oaks), remove cut or thinned vegetation or pile and burn;
- Variable diameter and density thin (not extensively needed);
- Prescribed area burns.

Area BT2: Dense, mature forest co-dominated by Douglas-fir (*Pseudotsuga menziesii*) and ponderosa pine (*Pinus ponderosa*) covers this area. Numerous large trees occur, especially on either side of Farrell Ravine. Dense young trees occur throughout. Along the north-facing slope, mature trees are moderately dense. Black oaks are being shaded out by young and mature conifers. Surface fuel loading is very high. Recommended treatments include:

- Thin, pile, and burn dense pockets of small trees, especially around large trees;
- Variable diameter and density thin of mature trees, especially around large black oaks and conifers.

Area BT3: This area is similar in condition to Area BT1 but there is less tree mortality. Density of mature trees is higher. There is less access by roads or skid trails, making treatment opportunities more limited. The recommended treatments include:

- Thin (hand or mechanical), pile, and burn dense pockets of small trees;
- Variable diameter and density thinning where in excess of desired condition forest densities.

D.2.2.4 Big Parcel

This parcel contains large forested areas that have been previously treated. Most of these areas are along Jackass Flats Road or in nearby, gently sloping areas. This road is a primary fire evacuation and access route. Some of these are in pine plantations from the mid-1960s. There is also a small area of hydraulic diggings. Most of the previously treated areas need follow-up or maintenance treatments to reduce surface fuels that have accumulated in the last 20 years, including both live and dead fuels. Dense conifer regeneration occurs throughout and will become dog-hair thickets in the near future without maintenance treatments. Tree density is higher and more uniform than desired conditions in most previously treated areas.

Area BP1: This area is along Jackass Flats Road and is part of previously established fuel break (the Montezuma Fuel Break) along this important evacuation/access road. In addition to the conditions described above, there are some pockets of tree mortality. Recommended treatments include:

- Thin (hand or mechanical) small trees;
- Variable diameter and density thin, where in excess of desired condition forest densities;
- Prescribed fire, primarily area burning or pile and burn where there are dense pockets of small trees.

Area BP2: This area is a mostly north and east-facing slope with scattered large trees throughout. Recommended treatments include:

- Thin small trees around large trees and in dense pockets;
- Variable diameter and density thin in dense stands of mature and small trees;
- Area prescribed fire.

Area BP3: This area is on a large slope between Jackass Flats Road and the Ananda Retreat Center and other private land. Some of it has been previously treated. Untreated portions include patches of dense, small trees. Recommended treatments include:

- Thin small trees, especially around large oaks and pines;
- Pile and burn near roads and adjacent to occupied private land to the south.

Area BP4: Most of this area has been previously treated. There are some large pockets of tree mortality and surface fuels are moderately high to high. Recommended treatments include:

- Cut and remove, or pile and burn, dead trees, particularly near roads and below occupied areas;
- Thin pockets of small diameter trees;
- Variable diameter and density thin in areas of dense, mature trees;
- Area prescribed fire.

Area BP5: There are large trees throughout much of this area. The forests along the intermittent stream running southeast through the area are in relatively good condition and represent moist, productive mixed-conifer forests. Moist forests are less common in the ‘Inimim Forest and have a high ecological value. In the original plan, treatment was avoided in these areas. Here, some treatment is recommended to reduce heavy pockets of surface fuels and some pockets of dense, small trees to restore ecological resilience. There are numerous plants that were traditionally used by Native Americans for basketry and other uses. There are other areas that would be suited for similar cultural management. This area provides an opportunity for trying traditional ecological management. Recommended treatments include:

- Hand thin, pile and area burn;
- Management of plants for traditional, cultural uses in collaboration with the Nisenan tribe and others.

D.2.2.5 Grizzly Hill Parcel

The Grizzly Hill Parcel is adjacent to Grizzly Hill School and is bisected by Old Mill Road. This road is a fire evacuation/access route. Most of the parcel was previously treated with mastication and selective tree harvest.

Area GH1: This area contains forests that are somewhat denser than desired conditions, with moderate surface fuel loading. Small conifers are starting to grow in and bearclover is becoming tall. There is moderate surface fuel loading from masticated fuels and litter. Recommended treatments include:

- Thin small diameter trees;
- Area prescribed fire.

D.2.2.6 Long View Parcel

The Long View parcel is a smaller parcel that is isolated, with relatively little access. Because of the limited access, there is only one recommended treatment area at this time. It has large trees throughout and would be important to consider for future treatment priorities, despite access limitations. Without restoration treatments, the old forest structure remains vulnerable to high intensity fire, drought, climate change, and insect population booms.

Area LV1: This area is relatively flat, above the steep volcanic rock outcrop that bisects the parcel. There are large areas with very dense, small and medium conifers. This includes dog-hair thickets around large pines and oaks. There is high surface fuel loading throughout this area. There is a small swale with a grove of large trees. This grove has fewer small trees but high surface fuel loading. Recommended treatments include:

- Thin small diameter trees;
- Variable diameter and density thin;
- Prescribed area burn and/or pile and burn.

D.2.2.7 Sages Road Parcel

Most of the parcel is relatively flat with mature ponderosa pine forests and dense patches of whiteleaf manzanita. There are large trees in several areas. The eastern portion consists of dissected hydraulic mine tailings. There are some large trees in this dissected area. Treatment is recommended for the flat area.

Area SA1: This area is bisected by Sages Road and a major PG&E transmission line. PG&E has done treatment within the immediate transmission corridor. This includes cutting live and dead trees within approximately thirty to fifty feet of the power line, which are considered at risk of falling onto the power line. A neighborhood volunteer group has pulled Scotch broom several times as part of the Fire Safe Council of Nevada County's Scotch Broom Challenge program. High live surface fuel loading remains, especially Scotch broom. There is an opportunity to partner with PG&E on treatments within corridor and adjacent areas. Recommended treatments include:

- Scotch broom removal;
- Hand cut, pile, and burn whiteleaf manzanita;
- Thin small diameter trees;
- Cut and remove or pile and burn dead trees along Salmon Mine Road.

D.2.2.8 Shady Grove and Poison Oak Parcels

The Shady Grove and Poison Oak Parcels are small, isolated parcels. They are described together here because the conditions, recommended restoration areas, and treatments are similar. Both contain old forest structure throughout. Dense forests occur throughout, with many small and medium-sized trees. Fuel loading is moderate to high.

Areas SG1 and PO1: These areas are steep and below roads that bisect the lower portion of these parcels. Little treatment is recommended below the road at this time because of limitations associated with the steep slopes. Recommended treatments include:

- Hand thin and pile small trees and heavy surface fuels near the road, especially around large trees.

Areas SG2 and PO2: These areas are gently to moderately sloping. There is road access around most sides. Recommended treatments include:

- Thin small diameter trees, especially around large trees;
- Variable diameter thin-of medium and small trees;
- Prescribed area burn and/or pile and burn.

D.2.2.9 Shield's Camp Parcel

This parcel is one of the larger and more ecologically diverse in the 'Inimim Forest. It also has been treated extensively in the last 20 years. Approximately 2/3 of the parcel has been treated, mostly with mastication but also with prescribed area burning. Lake City Road goes through the southern portion of the parcel and is identified as a major fire evacuation/access route. Spring Creek and one of its tributaries, Holden Spring Creek, cross the parcel along with their associated riparian forests. The northeast portion contains meadows and other special habitat types. There are roads and old skid trails throughout much of the parcel. Several large pockets of tree mortality have occurred, including along and near Lake City and Shield's Camp Roads.

Area SC1: A portion of this area has been treated but most has dense manzanita and pockets of tree mortality. Surface fuel loading is high. Recommended treatments include:

- Cut and remove dead trees, particularly those that are hazards to Shield's Camp and Lake City Roads;
- Cut, pile, and burn manzanita;
- Thin small and medium trees;
- Area burn along the road and in conjunction with prescribed fire in areas SC3 and SC4.

Area SC2: This area contains pockets of dense, small trees. Medium trees are uniformly spaced and at higher density than desired conditions. There are some pockets of tree mortality. Surface fuel loading is moderate to high, including dense conifer regeneration throughout. Recommend treatments include:

- Cut and remove dead trees near roads;
- Variable diameter and density thin;
- Prescribed area burn.

Area SC3: There has been some small tree thinning and piling in this area. The forests are more dense and uniform than desired conditions. Surface fuel loading is high. Himalayan blackberry (*Rubus armeniacus*) has become established in the riparian area where Shield's Camp Road crosses the creek. Recommended treatments include:

- Hand thin small diameter trees immediately adjacent to Spring Creek;
- Variable diameter and density thin to increase heterogeneity;
- Area prescribed burn, in mosaic near creek;
- Remove large patches of Himalayan blackberry next to creek.

Area SC4: Same conditions and treatments as Area SC2.

Area SC5: Same conditions and treatments as Area SC3.

Area SC6: This area contains a variety of vegetation conditions but would logically be treated at the same time. Mixed conifer forests cover most of the area. About half of the mixed conifer forests have been previously treated. In these treated areas, dense conifer regeneration is growing in. Tree density is moderately high in some areas, greater than desired conditions. There are small pockets of mortality. Other areas contain very dense small and medium conifers, often surrounding scattered large conifers and black oaks. There is a small patch of blue oak and mixed chaparral. At the old Shield's Camp, there is a meadow that has been highly modified. Recommended treatments include:

- Thin small trees;
- Variable diameter and density thin;
- Cut and remove, or pile and burn dead trees along roads;
- Prescribed area burn or pile and burn;
- Restore meadow (see Section D.3.1.1 below).

Area SC7: This area contains a relatively large stand of mature, large diameter hardwoods, including madrone (*Arbutus menziesii*), black oak, and live oak (*Quercus chrysolepis*) trees. There are scattered large conifers. These types of hardwood-conifer forests were more common historically than now, which makes this site ecologically valuable. There are a few small conifers growing. Recommended treatment includes:

- Prescribed area burn.

Area SC8: This area contains wetland and riparian vegetation. There are large areas invaded by Himalayan blackberry.

- Remove large patches of Himalayan blackberry.
- Cut and pile small diameter trees. Burn along with adjacent area or as piles.

D.2.2.10 Spring Creek Parcel

The Spring Creek parcel is a small area, bisected by Lake City Road. Riparian forests along Spring Creek are generally in good condition but have had ingrowth of small conifers, similar to most riparian areas in the Sierra Nevada. Above the riparian area, there is a large area that has been treated previously.

Area SP1: In this area there is dense conifer regeneration. Surface fuel loading, both live and dead, is moderate to high. Along Lake City Road to the south of this treated area, patches of very dense small diameter trees and high surface fuel loading occur. Recommended treatments include:

- In the riparian area, hand thin some small conifers and pile;
- Thin small trees;
- Variable diameter and density thin;
- Area burn and/or pile and burn, including in a mosaic in at least part of riparian area.

D.2.2.11 Sugar Loaf Parcel

Most of the Sugar Loaf Parcel has limited access, steep slopes, and shallow, eroded soils. As a result, there are few areas recommended for treatment. One area is along Tyler Foote Road. The other is in a patch with old forest structure.

Area SL1: This area is where Tyler Foote Road crosses through the southern portion of the parcel. Tyler Foote Road is a primary fire evacuation/access route for the entire North San Juan Ridge. There are dense young trees, some dead, and surface fuel loading is high. The Fire Safe Council of Nevada County and Nevada County Public Works Department has a grant to treat fuels along a segment of Tyler Foote Road, which includes this area. There is an opportunity to partner with them and extend their treatments farther from the road to make it more effective. Recommended treatments include:

- Cut and remove dead trees;
- Thin small trees;
- Cut and pile, and burn trees thinned but not removed, manzanita, and other fuels.

Area SL2: This area contains large trees and some very large, down logs. These areas also have dense, small trees and heavy surface fuels. Recommended treatments include:

- Hand thin small trees around and near large and/or old trees.
- Pile and burn small trees and accumulated fuels in patches with large trees. If feasible, area burn.

D.3 NON-FOREST AREAS

Recommendations for treatments in meadows and other special non-forest habitats are more general than for forested areas. This is for two reasons. First, the emphasis of field inventories for the *Revised 'Inimim Forest Management Plan* was forests. Secondly, restoration treatments in wetlands and other non-forested special habitats require site-specific evaluations. These were not conducted and would be part of future project planning.

This section includes general recommendations for restoration of wetlands meadows, and other special non-forest habitats. Wetlands include meadows, wetlands-road crossings, and ponds. Other non-forest special habitats are those with uncommon or unusual plants for the area. This includes blue oak (*Quercus douglasii*) woodlands, MacNab cypress, Indian manzanita (*Arctostaphylos mewukka*), and shrubby Oregon white oak (*Quercus garryana* var. *semota*). There are other plants that may be uncommon, rare, threatened, or endangered. The emphasis here was on plants that occurred in areas where restoration treatments would occur or would not be covered in management direction from California or federal laws on threatened and endangered species. Management for these species is covered in the *Sierra Resource Management Plan* (BLM 2008).

D.3.1 Wetlands

D.3.1.1 Meadows

Meadows are found on two parcels. Most occur in the Shield's Camp Parcel. Another meadow is located in the Bald Mountain Parcel. In general, meadows have been altered in the Sierra Nevada from water diversion, fire suppression, and overuse for intense grazing or agriculture. Many of the meadows have had invasion and establishment of non-native plant species. Recommended restoration treatments include:

- Removal of non-native invasive plants, especially Himalayan blackberry and Scotch broom;
- Cut conifers that have encroached, grown into and around the center edge of meadows;
- Evaluation of hydrologic condition and associated needed interventions to restore impacted water tables and flow.

D.3.1.2 Wetland - Road Crossings

Where roads cross wetlands, such as seeps, springs, or streams, there is often a disruption in water flow and hydrology. There is a higher likelihood of invasive plant establishment, especially Himalayan blackberry, which spreads rapidly, displacing native vegetation and changing hydrology. Similar to meadows, restoration treatments of road crossings that have bisected or impacted wetlands, requires site-specific evaluations. These were not conducted for this plan update. However, three road crossings that had obvious impacts on wetlands that warrant more site-specific evaluations were identified (see revised plan, **Figure 5**). These include:

- Spring/seep bisected by Lake City Road, in the Shield's Camp Parcel.

- Shield's Camp Road crossing Spring Creek, in the Shield's Camp Parcel.
- Springs and seeps along the BLM road (red gate) in the Big Parcel, north of Jackass Flats Road.

D.3.1.3 Ponds

There are several ponds that occur in the Big Parcel. These are in the hydraulically mined, "diggings" area. Recommended management for these ponds was included in the Revised 'Inimim Forest Management Plan. More important than restoration is protecting the ponds from vehicles that damage the wet areas. Other restoration activities would need to be determined with site-specific evaluations by hydrologists, botanists, and wildlife biologists.

D.3.2 Special Non-Forest Habitats

There are several different plants and/or plant communities in the 'Inimim Forest that are surrounded by areas recommended for restoration. These include: MacNab cypress, blue oak, manzanita, and Oregon white oak. The areas where these plants occur, or their habitat, also may be in need of restoration themselves. The plants may also need restoration to ensure that their occurrences persist.

D.3.2.1 MacNab Cypress

Research on the MacNab cypress stand on Bald Mountain indicates that it may be stable and not in need of restoration (Mallek 2009). There is some regeneration, indicating the population is perpetuating. However, the crowns are small on many of the saplings, suggesting they have low vigor. Recommended treatment includes:

- Monitor age structure, tree condition, and especially regeneration;
- Talk with researchers about potential restoration treatments that would improve regeneration and survival of younger trees.

D.3.2.2 Blue Oak

There are two small areas of blue oak woodlands, both located on the Shield's Camp Parcel. Like blue oak woodlands throughout most of California, the understory has been heavily modified (Allen-Diaz et al. 2007). Non-native annual grasses dominate the understory. There are also large, old wedgeleaf ceanothus (*Ceanothus cuneatus*) and other shrubs growing around them. The woodlands are surrounded by mixed conifer forests in areas identified as priorities for treatment. It is recommended that some limited restoration treatment also occur in the blue oak woodlands when the surrounding areas are treated.

The primary restoration approaches would be to do area burning and cut some of the decadent shrubs. Burning the area around the blue oaks would reduce the accumulation of non-native annual grasses but can also improve the vigor and amount of native perennial grasses and other plants (Wills 2006). Wedgeleaf ceanothus regenerates from seed and not sprouting. Older shrubs produce fewer seeds. When all shrubs are old, there is an increasing likelihood that the shrub will eventually be lost from the site. One restoration strategy is to keep some mature shrubs that are

still producing seeds and burn the remaining area to stimulate seed germination. Recommended treatments include:

- Cut some shrubs (approximately 1/2 to 2/3, pile and burn;
- Area burn (pulling back fuel accumulations around large blue oaks).

D.3.2.3 Indian Manzanita and Oregon White Oak

Indian manzanita and Oregon white oak occur in limited areas in the ‘Inimim Forest. They occur primarily within mixed conifer forest areas. There are also Oregon white oaks that were found along an old road in the Bald Mountain Parcel, amongst chaparral. They both sprout following fire or other activities or processes that result in top-kill of the plants. Recommended restoration treatments include:

- Monitoring regeneration and vigor of Indian manzanita;
- Including areas with these species in restoration of surrounding forest (thinning trees and area prescribed fire).

D.4 LITERATURE CITED

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Appendix E. Parcel Descriptions

E.1 INTRODUCTION

The ‘Inimim Forest is comprised of twelve different BLM parcels separated by private land on the San Juan Ridge. The *Revised ‘Inimim Forest Management Plan* is comprehensive, addressing all parcels as a whole, but there are distinct characteristics of each parcel that affect how the plan is applied to them individually. These include: historic uses, treatment history, remnant and new old forest structure, geology, uncommon plant species or communities, and access. This appendix contains a brief description of each parcel. The descriptions are based largely on those in the original *‘Inimim Forest Management Plan*. Information on treatments completed since that plan and changes in vegetation conditions have been added. The descriptions are in alphabetical order of the parcel names.

E.2 BALD MOUNTAIN

The Bald Mountain Parcel is one of the larger parcels, at 425 acres. It is dominated by Bald Mountain. The summit reaches 3,125 feet in elevation. The extensive dome of Bald Mountain is a dry, shallow, stony soil underlain by metabasic rocks. It supports the rare Macnab cypress (*Hesperocyparis macnabiana*), shrubby Oregon white oak (*Quercus garryana* var. *semota*), *Salvia sonomensis,* and very probably a number of serpentine endemics. The coastal horned lizard (*Phrynosoma coronatum*) and the California thrasher *(Toxostoma redivivum*) have also been found here.

Bald Mountain itself is accessible by an old logging/fire access road that passes through private property. A trail goes from the fire road to the summit. A broad swath on either side of the trail was thinned and burned in the late 1990’s. The mountain has a marvelous broad view, and is regularly visited by local people on foot or horseback. Mountain bikers occasionally try it. The trail, however, is eroding at a high rate, and seems to be turning itself into a drainage channel. Itis in need of restoration, and a new trail to the summit constructed.

Because of the dense chaparral and the proximity to the steep slopes of the South Yuba River canyon, the likelihood of high intensity fire is high. High intensity crown fire is natural in chaparral and canyons but can pose a threat to nearby occupied areas. Because of this threat, a large area was masticated along a road extending from the ridge down toward Kadaheska Way. The treated areas here and on the ridge above have accumulated moderate to high surface dead and live fuels. Dead surface fuels from mastication and new fallen litter and branches have accumulated. Bearclover (*Chamaebatia foliolosa*) has grown taller and older, and whiteleaf manzanita (*Arctostaphylos viscida*) and conifer seedings have become dense in areas.

East of the mountain is a bowl-shaped watershed whose gentle slopes drain east into Spring Creek. Soils here are deeper, finer in texture, moister and underlain by volcanic andesite and metamorphic sea sediments. Most of the area is covered with mixed conifer and hardwood forests, but there is also a large meadow along Kadaheska Way. The whole eastern end of the parcel was logged and/or burned in the thirties or forties. Some of this was masticated in the late 1990’s as described above. Older sugar (*Pinus lambertiana*) and ponderosa pines (*Pinus*

ponderosa) grow scattered throughout the land, much of which has been subject to severe sheet erosion as noted by the Soil Conservation Service. In the northwest corner of the parcel are a few very large ponderosa pines and black oaks (*Quercus kelloggii*) on the deeper soils of the ridge-top. In untreated areas, forests are dense to very dense, especially small trees. Surface fuels have accumulated similarly to the rest of the parcel.

The YWI undertook a volunteer meadow restoration in the last 10 years, removing non-native invasive plants and some of the small, encroaching conifers. Several long-term monitoring plots were installed.

E.3 BEAR TREE

The Bear Tree Parcel occupies approximately 147 acres northeast of the Big and Bald Mountain Parcels. The northern end of the Bear Tree Parcel is a peninsula surrounded on three sides by the diggings. There is one active mining claim. Farrell Ravie Way bisects the parcel to provide access to residents on private property. There are some signs of mining, but not many. The parcel has been logged in the past, before the original plan in 1990.

Most of the parcel is dominated by ponderosa pine and black oak with a bearclover understory. There is a manzanita shrub field on a south-facing slope in the southern portion of the parcel, on shallow, eroded soils. There is a wide diversity of forest canopy layers (three or four), tree species, and age classes. Species composition includes ponderosa pine, incense cedar (*Calocedrus decurrens*), whiteleaf manzanita, California hazelnut (*Coryls cornuta*), black oak, and Douglas-fir (*Pseudotsuga menziesii*).

The most noteworthy feature of the parcel is the impressive stand of large trees on the northern slope and bottom, just south of Farrell Ravine Way. These are among the largest trees of the 'Inimim Forest and are beginning to resemble an old growth forest.

The southwest corner contains the Azalea Grove, a very healthy forest patch, with diverse species, including Douglas-fir, sugar pine, ponderosa pine, incense cedar, canyon live oak (*Quercus chrysolepis*), black oak, and madrone. The understory consists of western azalea (*Rhododendron occidentale*), mountain dogwood (*Cornus nuttallii*), wood rose (*Rosa gymnocarpa*), hairy honeysuckle (*Lonicera hispidula*), and toyon (*Heteromeles arbutifolia*). This area is presently inaccessible by motor vehicle.

There are several large patches of pine tree mortality from bark beetle that have developed recently along the road. The north-facing slopes and bottom have dense, “dog-hair” thickets of pole and medium trees and are in need of thinning. On the south-facing slope, forests are more open but surface fuels are high and bearclover is tall and decadent. Surface fuel loads are high across parcel. The southwest portion has dense tree seedlings and dead surface fuels. The northeast portion has tall and decadent shrubs (bearclover and whiteleaf manzanita) and pockets of dead surface fuels.

There are heavy accumulated fuels and often dense small trees or shrubs surrounding most large trees throughout the parcel. Fuels have been removed around some large trees as part of a YWI volunteer project.

E.4 BIG PARCEL

The Big Parcel occupies 525 acres. Because of the size of this parcel, it is convenient to divide it into two separate areas, using Jackass Flat Road as a boundary. The northern portion will be known as Parcel 5A, "Headwaters;" while the southern portion is identified as Parcel 5B, "Long Ravine."

E.4.1 Headwaters

The Headwaters Parcel consists of 341 acres of public land, nearly all of which has been disturbed to some degree in the past. The northeast portion was subjected to hydraulic mining in the early 1880's. There is no original soil, and topography is highly irregular. Vegetation consists of a few stands of poorly developed ponderosa pine trees, and sparse whiteleaf manzanita shrubs. A combination of surface run-off and ground water seepage has fostered the evolution of a wetlands habitat, with ponds, and several cranberry (*Vaccinium macrocarpon*) bogs.

The remainder of the parcel contains some placer mining scars and tailings, but none to the extent of the northeast portion. Topography shows some variation. There are two intermittent streams, and one perennial. Vegetation on the non-hydraulically mined portion of the parcel consists of a mixed conifer forest dominated by ponderosa pine on ridgetop areas and by Douglas-fir on the north slopes. There is considerable incense cedar, black oak, and madrone (*Arbutus menziesii*) in the overstory, and an abundant ground cover of bearclover, whiteleaf manzanita, and California hazelnut. Near-old growth forest conditions exist in Rocky Raccoon Ravine.

Much of the parcel was logged in the early 1960's. A ponderosa pine plantation was established in 1964, adjacent to Jackass Flat Road. Between 2000 and 2004 several large areas were thinned or masticated as part of fuels reduction for the Montezuma Fuel Break.

Since these treatments, new manzanita has grown, there are dense patches of young conifers growing, bearclover has become tall and decadent, and heavy dead surface fuels accumulated. There are heavy accumulated fuels and often dense small trees or shrubs surrounding large trees throughout the parcel. There are some pockets of tree mortality, most in the old plantations.

E.4.2 Long Ravine

The Long Ravine Parcel contains 185 acres, most of which has been disturbed in the past. Much of the past disturbance was from timber harvest; the last was in the early sixties. This old harvest appears to have included selective removal of large trees. There is an old ponderosa pine plantation, an extension of the same one identified in the Headwaters Parcel. Very little hydraulic mining occurred on these lands.

The most striking feature of the Long Ravine Parcel is Long Ravine itself. It runs toward the southeast and contains large ponderosa pines and Douglas-fir trees. Deep soils with high soil moisture has resulted in a large patch of moist mixed conifer forests, multi-layered with abundant mountain dogwood, bigleaf maple (*Acer macrophyllum*), and California hazelnut. This is one of the few large areas of the moist mixed conifer ecological group in the 'Inimim Forest. There is a second southeast-running ravine to the south that also has some big trees but also extensive areas of very dense young trees. A notable group of large sugar pines is along the Fire Access Road. The central and western portions of the area contain scattered large and mature black oaks that are being suppressed by surrounding conifers. The area as a whole shows evidence of previous fires and logging, but with healthy trees of many species, and occasional manzanita fields. Much of the terrain is rugged, and apart from the few dirt roads, there are no trails and few places that are easy open walking.

Several large patches were treated with mastication in the last 15 years for fuels reduction. Pine mortality from bark beetles and drought has occurred in several large patches. The previously treated areas have developed dense conifer regeneration, in-growing manzanita density, and high surface fuel loads. There are heavy accumulated fuels and often dense small trees or shrubs surrounding large trees throughout the parcel.

E.5 GRIZZLY HILL

The Grizzly Hill School parcel is a small parcel at just under 19 acres. It is, relatively flat and located adjacent to Grizzly Hills School. Old Mill Road bisects the parcel and carries a significant portion of school-related traffic. Another road loops through the western portion. None of the roads have a right-of-way for access, but are informally maintained by a local property owners' association. Two rights-of-way, one for power and one for telephone service, cross the western portion of the parcel along the roads.

The land east of Old Mill Road contains a mixed coniferous/hardwood forest which contains mature pines, oaks and madrones, elements of a developing old growth structure. The understory is a dense carpet of bearclover. There is also a small meadow, and some riparian plants. This area is currently under a Recreation and Public Purposes Act lease to the San Juan Ridge Union School District. Some of the area was masticated in the last 15 years to reduce dense manzanita and small conifers.

The vegetation west of Old Mill Road is about 50% mature conifers with a continuous bearclover understory. In the last 15 years, most of this area was masticated (manzanita) and thinned (small trees) for fuels reduction.

These previously treated areas have moderate to high surface fuel loading and tall, decadent bearclover. There are some pockets of dense conifer regeneration.

E.6 LONG VIEW

The Long View Parcel is one of the smaller 'Inimim parcels, at nearly 43 acres. There are several habitat types divided diagonally by a steep 100-foot cliff, itself containing uncommon

vegetation and soils. To the south is a dry outcropping of volcanic composite rock covered with shrubby birch-leaf mountain mahogany (*Cercocarpus betuloides*) and other shrubs. The opening here affords a grand vista of the North Columbia Diggings, the lower 'Inimim Forest, and, at the horizon, the Coast Range—hence the name Long View.

The upper bench is covered with ponderosa pine, black oak, a few incense cedars, bearclover and whiteleaf manzanita. The older trees, mostly ponderosa pine, some quite large, show scars from wildfire. There are many patches of dense small and medium sized conifers, including around the large trees.

On the north side of the cliff is the lower level of the parcel. This contains a moister, cooler Douglas-fir, ponderosa pine, incense cedar, and bigleaf maple forest, with Hartweg's wild-ginger (*Asarum hartwegii*) and California hazelnut (*Corylus cornuta*) on the forest floor. Large 150 to 200-year old trees are scattered throughout. This area has been logged in the past.

The parcel is near large tracts of the Tahoe National Forest and Malakoff Diggings State Park. It is an important connection to these less managed forest areas. There is a private property to the north has a fence just inside the 'Inimim border and a Mormon gate which provides access from the property to a skid trail. There is also access to the parcel from the private property bordering the south edge of the parcel. Except for skid trails from the south and access through the private property to the north, the Long View Parcel is roadless.

On the southern, flat portion of the parcel, forests are very dense and surface fuels high to very high. The forests on the slopes below the cliff (north) are moderately dense and fuels moderate to high. There are heavy accumulated fuels and often dense small trees or shrubs surrounding large trees throughout the parcel.

E.7 POISON OAK

The Poison Oak Parcel got its name from very thick stands of poison oak (*Toxicodendron diversilobum*). It is 80 acres, on a gentle ridge and north facing slope above Shady Creek. A ravine with a perennial stream, "Slug Creek," enters the parcel from the hydraulically mined lands to the immediate east. There was a BLM timber sale in 1971, which selectively removed large and mature trees. Roads bound or cross much of the parcel. Shady Creek Road enters the parcel at the northeast end. An old logging road runs the length of the parcel. Sumi Road crosses the southern end.

The south-facing portion is dry, with scattered ponderosa pine, black oak, madrone, whiteleaf manzanita, and some Scotch broom (*Cytisus scoparius*). The majority of the parcel, which faces north, is a mixed coniferous forest dominated by Douglas-fir. There are scattered mature and large Douglas-fir and ponderosa pine throughout. The riparian area along Slug Creek contains bigleaf maple, mountain dogwood, several ferns, and other herbaceous plants.

Most of the forests contain patches of dense, conifer saplings and young trees. There are some large patches of Himalayan blackberry (*Rubus armeniacus*), particularly in the upper reaches of "Slug Creek" and along the roads. Surface fuel loading is moderate to high throughout the

parcel. There are heavy accumulated fuels and often dense small trees or shrubs surrounding large trees throughout the parcel.

E.8 SHADY GROVE

The Shady Grove Parcel is 53 acres, largely consists of a north slope which ends at Shady Creek. It is dominated by moist and moderate productive mixed conifer forests. The southern portion on the ridge and upper slopes has mostly dense ponderosa pine with a bearclover understory. This transitions into Douglas-fir dominated forest with hairy honeysuckle on the forest floor toward the north. There are large oaks and madrones, especially on the flat, southern area. A distinctive feature is a two-acre grove of very large trees used by local residents for picnics.

A BLM road traverses the northern portion of the parcel. Logging occurred in the early 1970's, and the parcel has experienced wildfire. There has been little or no mining activity.

The forests are dense and surface fuels are moderate to high throughout the parcel. There are heavy accumulated fuels and often dense small trees or shrubs surrounding large trees in the parcel.

E.9 SHIELD'S CAMP

The Shield's Camp parcel is probably the most ecologically varied parcel in the 'Inimim Forest and one of the largest at just under 285 acres. Geology and soils are diverse in this parcel, contributing to diverse vegetation and hydrology. Portions of the parcel are within the tertiary Yuba River channel, and show some signs of past placer mining activities. A mixed conifer forest with trees of varying ages covers most of the parcel, with ponderosa pine dominating the south-facing slopes and flat areas. There are also stands of hardwoods and a little white fir (*Abies concolor*). About 30 acres of a south-facing slope is a mixture of chaparral and oak trees. The parcel has been logged in the past, and old fire scars are common. There are ten mining claims, with three claimants.

Two perennial streams cross the property. One of them, Spring Creek, contains trout (*Oncorhynchus* sp.). Both streams have well-developed riparian communities.

The most prominent and frequent meadows in the 'Inimim Forest are found here. The Shield's Camp meadow was once the site of a mining operation which included a swimming pool. To the south of Shield's Camp, the Many Springs meadow has soil much too wet for trees or shrubs.

This is the only parcel with recognized archaeological resources. The Many Springs site, an occupation area, is eligible for the National Register of Historic Places. There are bedrock mortars and an overhanging ledge ancient campsite. An old mining camp, probably from the 1930's, is present along Spring Creek.

Several large areas have been treated in the past 20 years. This includes a large prescribed burn, understory thin and pile, and understory thin, pile and burn. In treated areas, small tree density is moderate to low but seedlings and medium trees are dense in many areas. The remaining forests

are mostly very dense, with numerous dog-hair thickets of small trees. Surface fuel loading in these areas are high to very high. There are heavy accumulated fuels and often dense small trees or shrubs surrounding large trees throughout the parcel.

E.10 SPRING CREEK

The Spring Creek parcels is small, at 40 acres, but contains high quality riparian and moist forests with old forest structure throughout. The parcel is mostly heavily wooded, but effectively cut into several pieces by Spring Creek and Lake City Road.

Spring Creek, a perennial stream, has a well-developed riparian community associated with it. Vegetation includes mountain dogwood, Pacific yew (*Taxus brevifolia*), bigleaf maple, tanoak (*Notholithocarpus densiflorus*), madrone, and Oregon grape (*Mahonia aquifolium*). Trout can be found in the creek.

The southern half of the parcel is broad, and relatively flat. There is a good stand of ponderosa pine, with incense cedar and black oaks mixed with the pines. The understory tends to be dense in places. There is a thicket of young Douglas-fir.

The southeast corner, isolated from the rest of the parcel by the road, is undistinguished. It contains very dense, younger forest.

A mastication treatment occurred in the flat portion of the parcel, in the ponderosa pine and bearclover dominated forests. There is dense regeneration in this treatment area, and dense small and medium trees throughout the parcel. Surface fuel loading is moderate to high, comprised mostly of down branches and small logs. There are heavy accumulated fuels and often dense small trees or shrubs surrounding large trees throughout the parcel, especially in riparian areas where the large trees are concentrated.

E.11 SUGARLOAF

The Sugarloaf Parcel is one of the larger parcels, at 195 acres. This parcel consists of a large hill. From the summit, there is a splendid view of several other 'Inimim Forest parcels. A portion of the old Tyler-Foote Road runs along the eastern portion of the parcel.

The south slope of Sugarloaf is mostly covered with manzanita, with a few conifers located in drainages. An old pine plantation is in the southeast portion, with what appears to be an old skid road leading to the top of the hill. Black oaks can be found in increasing numbers toward the west and north. Several abandoned cars and other trash items are at the base of the plantation. Whiteleaf manzanita and pine growth appears slow. But vegetation is dense throughout this slope.

The north slope contains two good conifer stands which show some characteristics of developing old growth structure. Ponderosa pine is dominant along the ridges with Douglas-fir dominant in the ravines.

Vegetation density is high throughout the parcel. The chaparral on the south slope of Sugarloaf has moderate to high fuel loading. The forests on the north slope of Sugarloaf have high to very high fuel loading. Forests are mostly dense to very dense.

E.12 BADGER DIGGINGS

The Badger Diggings is a narrow, u-shaped parcel, that mostly surrounds and crosses only a small portion of Badger Diggings. It is 186 acres. It contains a portion of the PG&E transmission line, as well as a portion of Tyler Foote Road. In addition to containing these key infrastructure areas, there are also large trees in several portions of the parcels. A tributary to Grizzly Creek crosses the road.

One area with large trees is in the eastern leg. Here the large trees are surrounded by dog-hair thicket of small Douglas-fir. The other area is near and under the PG&E transmission power line. This part of the parcel has had substantial thinning under the power line and has more open forest, with pines and large black oaks over dense bearclover. Outside of the power line corridor, a large patch with mature and large trees occurs. The forests are productive and rapidly increasing characteristics of old forest.

Forest density is moderate to high. Shrubs are tall and decadent throughout. Surface fuels are moderate to high.

E.13 SAGES

The Sages Parcels is small at 33 acres. It is bisected by the eastern end of Sages Road and the same PG&E power line. On the east side of the road, there are large pines and some Douglas-fir throughout. These occur both in the flat area near the road, and in the Badger Diggings mine tailings to the east.

In the tailings, there is evidence of a seep. Azalea is present in the bottom of the highly dissected area in some places. This area has soils that are sensitive to management.

The rest of the parcel is flat. There is a large patch of scotch broom below the power line and in an adjacent area that was used as an illegal living area that BLM removed about 5 years ago. A mosaic of large pines, small black oak, and manzanita dominate the remaining area. There is dense manzanita in the portion of the parcel to the west of the road. Several large black oaks, as well as multiple large pines occur to the west of the road as well. This is one of the few areas in the ‘Inimim Forest, where there are healthy pole-sized and small ponderosa pine trees as well as large ones.

Forest density and high surface fuel loading is prevalent throughout the parcel. High live surface fuels occur in dense patches of scotch broom and whiteleaf manzanita. There are a few large trees, and there are heavy accumulated fuels and often dense small trees or shrubs surrounding the large trees.

Appendix F. Soil Survey Information

F.1 INTRODUCTION

The Nevada County Soil Survey (Brittan 1975) was used for the analysis. A summary of the soil map units and key characteristics used to describe ecological groups and define management limitations are shown in Tables 1 and 2 below. The information from the soil survey is available in digital form in the Soil Survey Geographic Database (SSURGO), maintained by the US Department of Agriculture, Natural Resource Conservation Service. Information on the database is found on the following website:

https://catalog.data.gov/dataset/soil-survey-geographic-ssurgo-database-for-various-soil-survey-areas-in-the-united-states-

The SSURGO data used is described in the project geodatabase.

F.2 SOIL CHARACTERISTICS

There is a diversity of bedrock types in the northern Sierra Nevada, also present in the 'Inimim Forest (Table 1). This includes volcanic, granitic, metasedimentary, metamorphic, metabasic, and tertiary river deposits. The vertically tilted metasedimentary rock layers allow roots to penetrate down into bedrock to access water and nutrients. This was discussed in the description of the moist low productive ecological group (Appendix A).

Addition to this diversity, most of the soils in the 'Inimim Forest area have moderately deep to deep rooting depths. This is one of the main reasons that most of the forests are productive.

F.3 SOIL SENSITIVITY TO MANAGEMENT

There are different aspects of soils that make them sensitive to management. Most important are characteristics that make them sensitive to soil erosion. Previous systems did not incorporate infiltration rate and runoff rates and have been replaced by more encompassing evaluations (Nikos Hunner, US Forest Service, Yuba Ranger District Soil Scientist, personal communications 10/2017). Slope steepness is always important, with soil erosion more likely on higher slopes. But infiltration and runoff are also important. Soil parent material, or originating bedrock type, influences infiltration and runoff as well as other characteristics that make soils more erodible. In particular, granitic derived soils are usually more erodible. Finally, the depth of the A-horizon, or top layer of soil, is important. Soils with shallow A-horizons are more sensitive to management. This can include eroded soils.

Based on the soil descriptions and discussions with Hunner, three broad levels of sensitivity to management were assigned to the soil map units in the analysis area. These were used in the Management Limitations Layer, described in the 'Inimim Forest Plan Update and main body of the Analysis Report.

Table F-1. Soil properties used to model and characterize ecological groups.

Soil Map Unit Name	Bedrock Type	Effective Rooting Depth (inches)	Rock Outcrop (%)
Aiken loam, 2 to 9 % slopes	volcanic	48 to 60	
Aiken loam, 9 to 15 % slopes	volcanic	48 to 60	
Chaix-Rock outcrop complex, 30 to 75 % slopes	granite	20 to 40 (0)	
Cohasset-McCarthy cobbly loams, 50 to 75 % slopes	volcanic	42 to 60	
Cohasset cobbly loam, 15 to 50 % slopes, MLRA 22A	volcanic	42 to 60	
Cohasset cobbly loam, 5 to 30 % slopes	volcanic	42 to 60	
Hoda sandy loam, 9 to 15 % slopes	granite	> 60	
Horseshoe gravelly loam, 15 to 30 % slopes	tertiary river gravel	48 to 60	
Horseshoe gravelly loam, 9 to 15 % slopes	tertiary river gravel	48 to 60	
Iron Mountain cobbly loam, 2 to 50 % slopes	volcanic conglomerate	12 to 22	
Josephine-Mariposa complex, 15 to 50 % slopes, eroded	vertically tilted metasedimentary	55 to 60	
Josephine-Mariposa complex, 50 to 75 % slopes, eroded	vertically tilted metasedimentary	55 to 60	10 to 24
Josephine loam, 15 to 30 % slopes	vertically tilted metasedimentary	55 to 60	
Josephine loam, 30 to 50 % slopes	vertically tilted metasedimentary	55 to 60	
Josephine loam, 9 to 15 % slopes	vertically tilted metasedimentary	55 to 60	
Mariposa-Maymen complex, 50 to 75 % slopes, eroded	metasedimentary	15 to 31 (12 to 18)	2 to 25
Mariposa gravelly loam, 2 to 30 % slopes	metasedimentary	15 to 31	
McCarthy cobbly loam, 15 to 50 % slopes	volcanic	18 to 32	
Musick sandy loam, 15 to 50 % slopes	granitic	40 to 60	0 to 10
Placer diggings (eroded)	tertiary river deposits		
Rock land	metamorphic		50 to 90
Secca-Rock outcrop complex, 2 to 50 % slopes	metabasic	40 to 60 (0)	10 to 40
Sites loam, 15 to 30 % slopes	titled metamorphic rock	40 to 60	
Sites loam, 2 to 9 % slopes	titled metamorphic rock	41 to 60	
Sites loam, 9 to 15 % slopes	titled metamorphic rock	42 to 60	
Sites very stony loam, 15 to 50 % slopes	titled metamorphic rock	43 to 60	
Tailings (eroded)	tertiary river deposits		

Table F-2. Soil properties used to assign soil erosion hazard used in management limitations map. Percentages in right column refer to slope steepness. For any soil type, the slope steepness criteria used in the management limitations map was overlapping and also applied.

Soil Map Unit Name	Permeability	Runoff	Soil Sensitivity to Management
Aiken loam, 2 to 9 % slopes	mod slow to slow	medium	low
Aiken loam, 9 to 15 % slopes	mod slow to slow	medium	low
Chaix-Rock outcrop complex, 30 to 75 % slopes	moderately rapid	medium	moderate
Cohasset-McCarthy cobbly loams, 50 to 75 % slopes	moderate	rapid	high
Cohasset cobbly loam, 15 to 50 % slopes, MLRA 22A	moderate	rapid	low
Cohasset cobbly loam, 5 to 30 % slopes	moderate	rapid	low
Hoda sandy loam, 9 to 15 % slopes	moderately slow	medium	low
Horseshoe gravelly loam, 15 to 30 % slopes	moderately slow	medium to rapid	moderate
Horseshoe gravelly loam, 9 to 15 % slopes	moderately slow	medium to rapid	moderate
Iron Mountain cobbly loam, 2 to 50 % slopes	moderately rapid	medium to rapid	Mod >35%slope
Josephine-Mariposa complex, 15 to 50 % slopes, eroded	moderate	medium to rapid	mod < 35%, high >35%
Josephine-Mariposa complex, 50 to 75 % slopes, eroded	moderate	rapid	high
Josephine loam, 15 to 30 % slopes	moderate	medium	low
Josephine loam, 30 to 50 % slopes	moderate	medium to rapid	moderate
Josephine loam, 9 to 15 % slopes	moderate	medium	low
Mariposa-Maymen complex, 50 to 75 % slopes, eroded	moderate	rapid	high
Mariposa gravelly loam, 2 to 30 % slopes	moderate	medium	low
McCarthy cobbly loam, 15 to 50 % slopes	moderate	medium to rapid	low
Musick sandy loam, 15 to 50 % slopes	moderately slow	medium to rapid	low
Placer diggings (eroded)			low
Rock land			low
Secca-Rock outcrop complex, 2 to 50 % slopes	slow	medium to rapid	low
Sites loam, 15 to 30 % slopes	moderately slow	medium	low
Sites loam, 2 to 9 % slopes	moderately slow	medium	low
Sites loam, 9 to 15 % slopes	moderately slow	medium	low
Sites very stony loam, 15 to 50 % slopes	moderately slow	medium to rapid	low
Tailings (eroded)			high

F.4 LITERATURE CITED

Brittan, L. A. (1975). *Soil survey of Nevada County Area, California*. U.S. Department of Agriculture, Soil Conservation Service and Forest Service. Retrieved from https://www.nrcs.usda.gov/Internet/FSE_MANUSCRIPTS/california/CA619/0/nevada_a.pdf