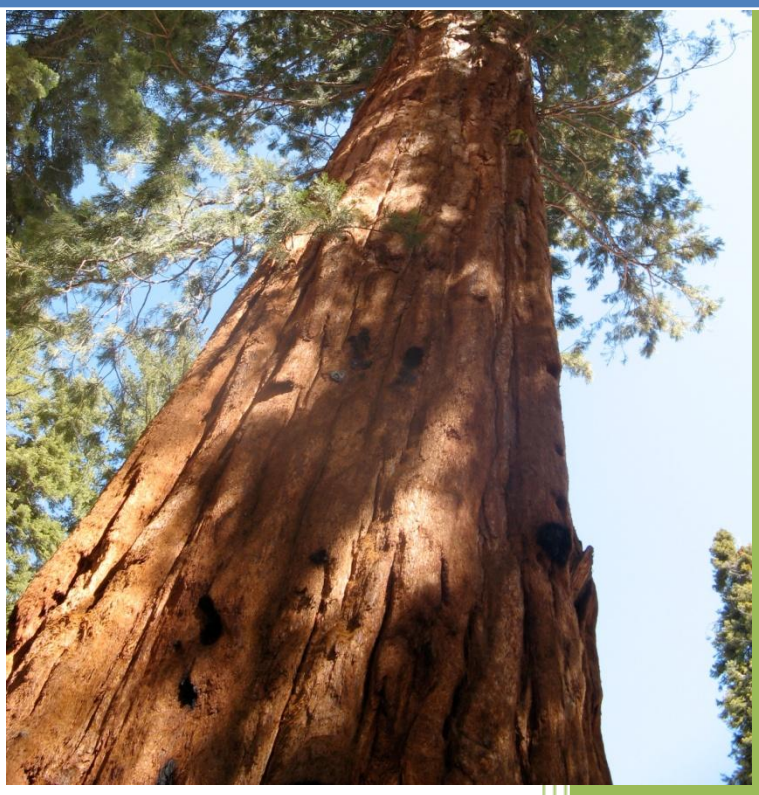
2010

# Dinkey Collaborative Landscape Restoration Strategy



Dinkey Collaborative Group

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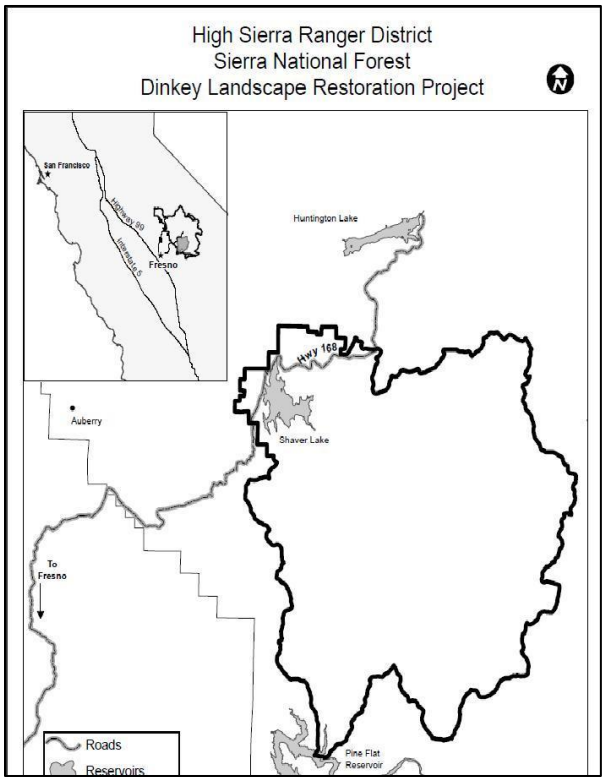
Cover picture: Giant Sequoia at McKinley Grove botanical area, Sierra National Forest, photo Ray Acker

## Executive Summary

The Dinkey Landscape Restoration Project (DLRP) is a science-based ecological restoration strategy that covers 154,000 acres in the southern Sierra Nevada within Fresno County California, Pacific Southwest Region, Sierra National Forest. The strategy is both a landscape- and stand-level approach that recognizes that fire is the dominant ecological process influencing ecosystem processes and vegetation dynamics. Coniferous forests, foothill hardwood forests, and meadows and riparian forests together create one integrated, fire-adapted landscape that requires a flexible and adaptive restoration strategy that promotes fire resiliency. Through the use of prescribed fire, mechanical thinning, watershed improvements and other restoration treatments, this project seeks to restore key features of diverse, fire-adapted forests, including heterogeneity at multiple scales, reduced surface and ladder fuels, and terrestrial and aquatic habitats for sensitive wildlife species. The strategy fosters a landscape that is resilient to uncharacteristic wildfire, insect and disease, climate change, drought, invasive species, and air pollution.




The DLRP strategy implements restoration treatments that are collaboratively developed to achieve multiple goals: reduce hazardous fuels, retain and promote large tree and denning/nesting structures needed by Pacific fisher and California spotted owl, promote stand and landscape heterogeneity, and provide sufficient natural regeneration of shade-intolerant tree species for the creation of future fire-adapted forests. The foundation of much of this restoration strategy rests upon a Pacific Southwest Research Station General Technical Report- PSW-GTR-220 (North et al. 2009), that provides the management direction for much of the DLRP landscape. A major goal of this restoration strategy is to provide current and future habitat for sensitive wildlife species by fostering ecosystem resilience, resistance, and adaptation to future wildfires and accelerated climate change impacts. The Pacific fisher and California spotted owl are two focal species of the DLRP. These sensitive species are dependent on late-seral conditions, especially within coniferous forests most susceptible to high-severity wildfire. The specialized habitat requirements of these sensitive species guide much of the ecological restoration strategies of the DLRP.

## 1. Introduction

The need to provide ecosystem resilience, public safety, wildlife habitat, and landscape diversity in the face of increasing fire severity (Miller et al. 2009) and climate change (Millar et al. 2007) presents a unique challenge for managing our natural landscapes. Ecological Restoration is a policy that requires diverse public values, collaborative effort, effective science integration, and a landscape-scale approach. The Forest Service is aware of the importance in managing entire landscapes rather than individual small-scale projects and has been improving its understanding of how our management practices could affect biological communities, fire behavior, insects and disease at many scales. Recently in 2009, the Chief of the Forest Service articulated:

> *The Forest Service focus on restoration will be closely tied to landscape-scale conservation. Especially in an era of climate change, we need to restore the resilience of America's forests to disturbances of all kinds. The treatments needed will improve watershed health, increase water quality, build community prosperity, and meet our shared vision of healthy sustainable forests (Tidwell 2009).*

The Dinkey Collaborative Planning forum adopted An Ecosystem Strategy for Sierran Mixed Conifer Forests (PSW-GTR-220 with addendum) as a science-based guide for developing the Dinkey Landscape Restoration Strategy. The ecological restoration strategy described in *PSW-GTR-220 fulfills* a four-part purpose:

- To provide scientific underpinning for our approach to restoring ecological systems across a fire-adapted landscape,
- To outline a process that enhances the use of scientific information in analysis, planning and decision-making,
- To describe a means of measuring our progress in achieving the objectives of ecological restoration, and
- To address how we can achieve ecosystem management objectives by increasing collaboration with the public, other agencies, academia, and local communities.

The Dinkey Landscape Restoration Strategy will be the link between the *Forest Plan* and project level analysis required by the *National Environmental Policy Act* (NEPA). It is a document that provides science-based direction and identifies potential projects that could initiate NEPA.

# 2. The Landscape: Existing Conditions

## 2.1. Landscape Description

The landscape is 154,000 acres made up of 130,000 acres of Forest Service land and 24,000 acres of private land, with 20,500 acres belonging to landscape partners. Current landscape partners include Southern California Edison, Grand Bluffs Forest Conservation Association, and Friends of Camp El-O-Win. There are 300 private residences scattered throughout the landscape and four communities identified as at risk to catastrophic fire adjacent or within the project boundary; as a result, the landscape includes 41,000 acres in the Wildland Urban Interface (WUI), with 10,000 acres of the Forest Service land in the Defense Zone and 31,000 acres in the Threat Zone. Communities at risk include Shaver Lake, Pineridge, Cressmans, and Dinkey.

The landscape is on the western slope of the Southern Sierra Nevada on the Sierra National Forest within Fresno County, California as shown on Figure 1. The elevation ranges from less than 1,000 feet in the southwestern corner of the landscape to greater 10,000 feet along the northeastern boundary.

### 2.1.1. Vegetation Types, Fuels, and Fire Regimes

The targeted landscape will encompass three broad vegetation types that are prioritized ecosystems within the Sierra Nevada bioregion: (1) coniferous forest, (2) foothill hardwood and chaparral vegetation, and (3) montane meadows and riparian forests (see Figure 2). Each of these general vegetation categories consist of several specific vegetation types and associated fire regimes (Table 1). The majority (>60%) of the vegetation in the project area is coniferous forests, and the bulk of these (45% of total) consist of mixed-conifer and ponderosa pine forests. All vegetation types in the project area have a unique fire regime, but many are outside their historic fire return interval. Most vegetation types are moderately to highly susceptible to future high-severity wildfire due to the extreme buildup of surface and ladder fuels from shade-tolerant species.

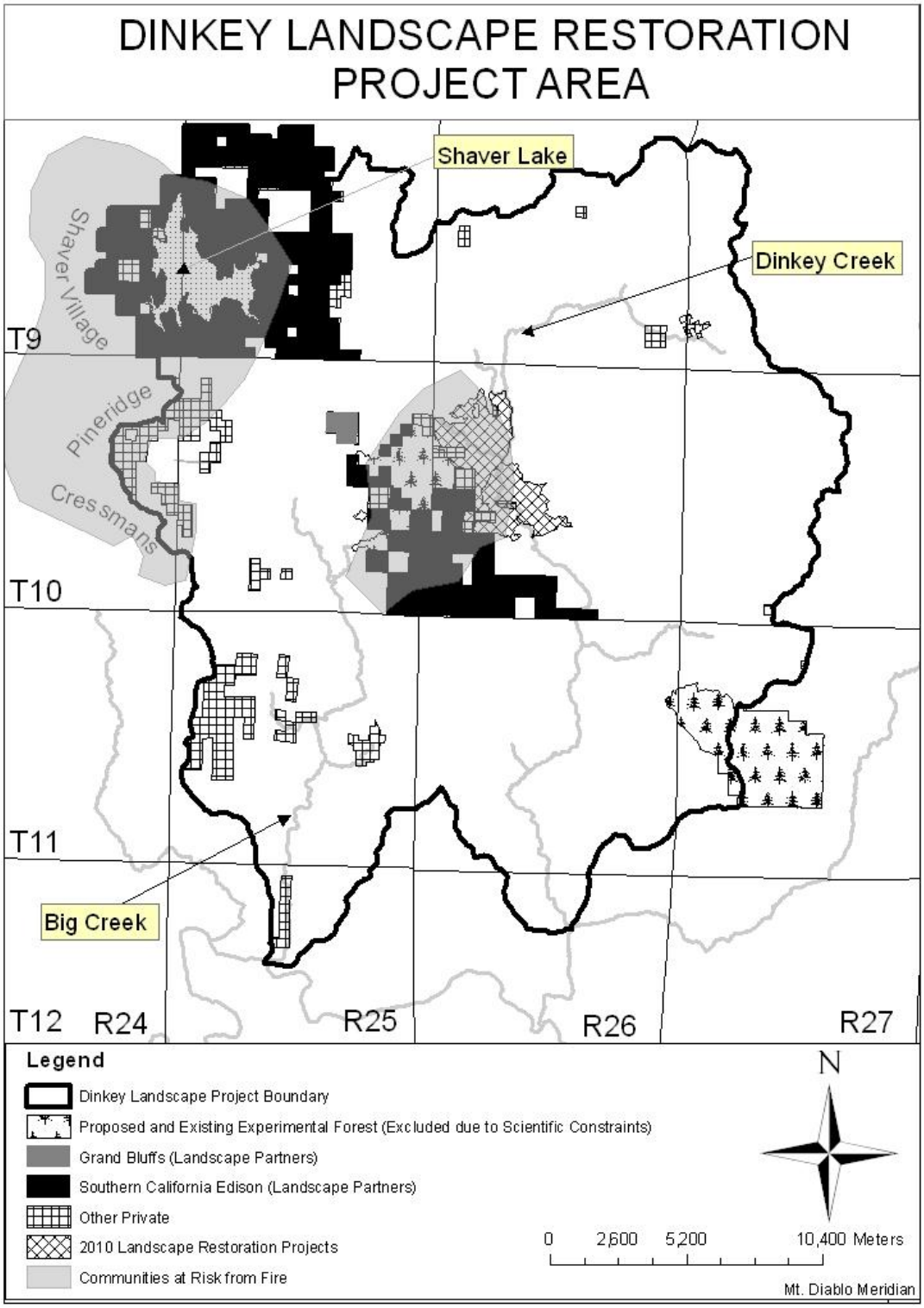



*Figure -1 map of the 154,000 acre Dinkey Landscape Restoration Project on the Sierra National Forest*

*Table 1. Vegetation types, dominant species, relative coverage, and associated fire regimes in the Dinkey Landscape Restoration Project Area. Vegetation types with a high Fire Return Interval Departure are considered to be at risk to high-severity fire and future climate stressors.*

| Vegetation Type | Dominant Species | % of Project Area | Fire Regime (Fire Return Interval[a]) | Fire Return Interval Departure |
|---|---|---|---|---|
| Sierra Nevada mixed-conifer forest | White fir, ponderosa pine, sugar pine, incense cedar, Jeffrey pine, black oak | 34% | Low severity, high frequency (8–18 years) | Moderate/High |
| Ponderosa pine forest | Ponderosa pine with incense cedar, black oak, canyon oak | 12% | Low severity, high frequency (5–11 years) | High |
| Montane hardwood | Canyon oak, black oak, interior live oak; scattered Ponderosa pine or gray pine | 6% | Low severity, high frequency (13–15 years) | Moderate/High |
| Montane chaparral | Green-leaf manzanita, mountain whitethorn, deerbrush, chinquapin, bitter cherry | 3% | High-severity, mixed frequency (16-45 years) | Moderate |
| Red fir forest | Red fir, often with white fir, western white pine, lodgepole pine, Jeffrey pine | 10% | Low to moderate severity, and mixed frequency (11–69 years) | Low/Moderate |
| Lodgepole pine forest | Lodgepole pine in pure stands or with red fir | 1% | Mixed severity, low frequency (25–83 years) | Low |
| Foothill hardwood | Blue oak, gray pine, interior live oak, California buckeye, Valley oak | 6% | Low severity, high frequency (7–17 years) | Low/Moderate |
| Mixed chaparral (foothills) | Whiteleaf manzanita, wedgeleaf ceanothus, mountain mahogany, yerba santa, scrub oak, toyon | 6% | Low severity, high frequency (8–70 years) | Variable |
| Montane meadow | Sedge, rush, and bulrush species | 1% | Low severity, high frequency | Variable |
| Riparian | Quaking aspen, white alder, cottonwood, willow spp., Pacific and redosier dogwood, western azalea | >1% | Mixed severity and frequency (31 years) | Variable |
| lakes, rivers, urban, subalpine, and barren | Water, rock, thin soils, less than 10% tree/shrub cover | 21% | No or very long fire return intervals | none |

[a] Median Fire Return Intervals were obtained from Skinner and Chang (1996), Nagel and Taylor (2005), and Sugihara et al. (2006).

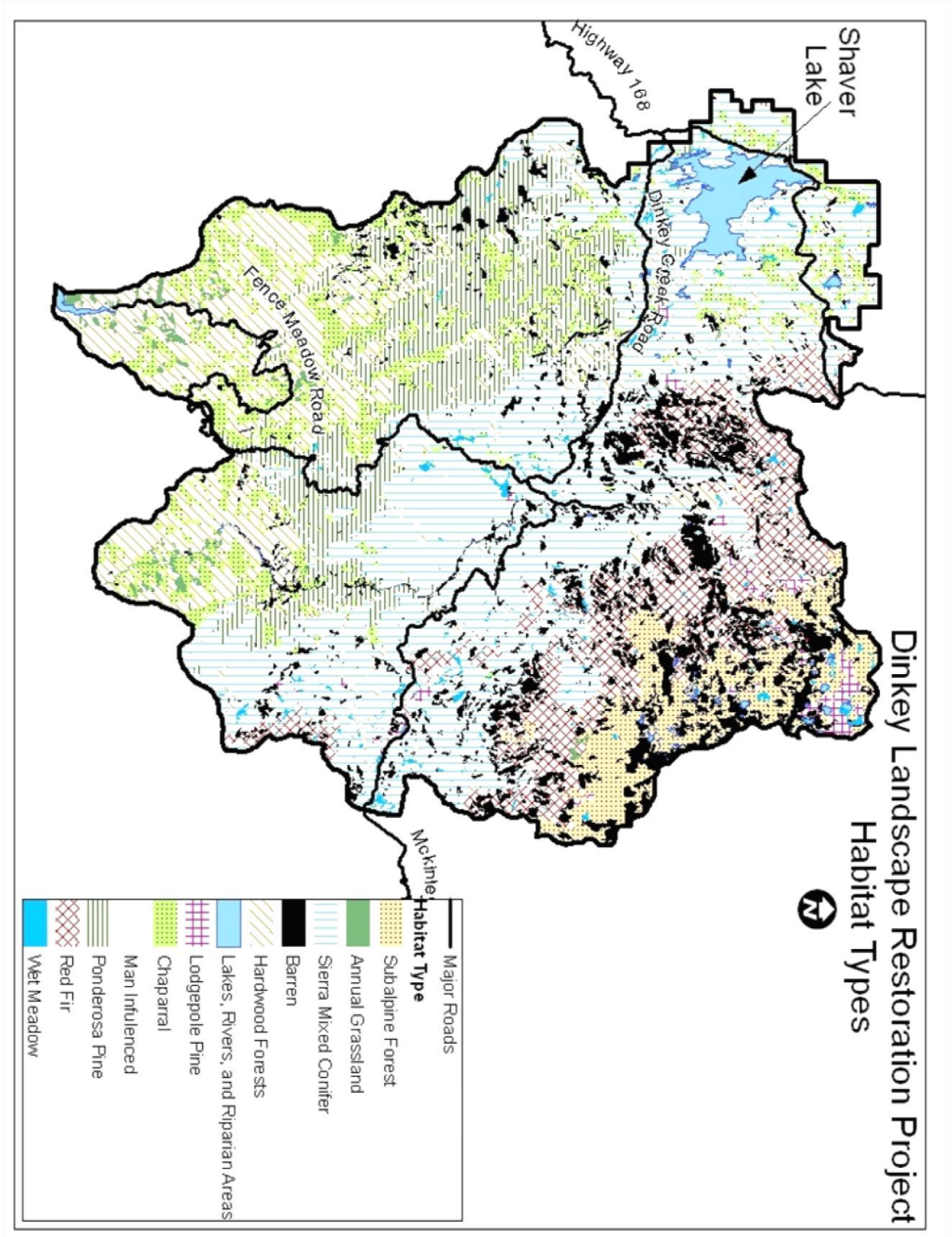



Figure 2: Habitat Types Across the Dinkey

#### *2.1.1.1. Coniferous Forest*

*Sierra Mixed Conifer within the Dinkey Landscape*

Heavy surface fuels (16 to 50+ tons per acre) coupled with thick shrub growth ranging from moderate **in Sierra mixed conifer** to high in **ponderosa pine** and the dense patches of small white fir and incense cedar create continuous surface and ladder fuels. The base of the crowns of this vegetation ranges from 0 to 5 feet in most stands creating a continuous ladder of fuels into the crowns of the moderate and large size trees. Surface fuel loading is light (0-15 tons per acre) in the **montane hardwood stands**, but shrubs are tall and dense both within and immediately adjacent to hardwood stands. The combination of continuous ladder and crown fuels promotes high intensity crown fire behavior in this vegetation type. Within **red fir** and **lodgepole pine** forests, moderate to heavy surface fuels (16 to 34+ tons per acre) exist, but the shrub understory is light and the crown base height is greater (4- 40 feet for red fir) than other conifer forest types. The Rock Creek fire (1981) in the upper Dinkey Creek drainage of the DLRP area represents an example of extreme fire behavior and severe fire effects, especially in the mixed conifer, ponderosa pine, and montane hardwood vegetation types. Under 97$^{th}$ percentile weather conditions, this fire burned approximately 1,000 acres on the first day, was controlled at 1,155 acres, and resulted in high-severity fire effects (i.e., 100% tree mortality) over 90% of the fire area.

*Ponderosa Pine within the Dinkey Landscape*

#### *2.1.1.2. Foothill Hardwood Woodland and Mixed Chaparral*

Foothill hardwood and mixed chaparral vegetation in the Dinkey landscape remains largely un-fragmented by residential development but homogenized due to fire exclusion. Fire exclusion has resulted in dense, homogenous stands that are prone to extreme fire behavior and high severity fire. Heterogeneity within these vegetation types is limited to small patches of open-canopy habitats created from fire breaks and small-scale range projects. The substantial increase in understory shrubs and tree density has also reduced understory herbaceous plant diversity and abundance, resulting in reduced wildlife habitat diversity and forage quality. Foothill vegetation types exhibiting the greatest decline in the Sierra Nevada include blue oak and valley oak woodlands.

Wildfire in these vegetation types will likely result in mixed to high mortality of vegetation in both moderate and severe fire conditions. Passive crown fire is possible during severe fire weather. Moderate and severe fire behavior is likely to occur >90% of the time during the summer months.

*Montane Meadow Sierra Nevada Mts.*

#### *2.1.1.3. Montane Meadows and Riparian Forests*

Montane meadows and riparian vegetation are focal points for sensitive plant and wildlife species. Several sensitive wildlife species (Table 2) and a suite of migratory songbird species (e.g., Warbling Vireo, White-crowned Sparrow, Wilson's warbler, and Yellow Warbler) use meadow or riparian habitats for foraging or breeding habitat. These species depend on healthy meadow or riparian ecosystems with intact hydrologic function, suitable native vegetation cover, low percentages of fine material or sediment, and an absence of noxious weed infestations. These indicators of health influence the viability of sensitive wildlife species dependent on these susceptible ecosystems.

Fire behavior in the riparian and meadow habitats is strongly influenced by the surrounding upland forest and extent of aquatic vegetation. The greater soil and fuel moistures in riparian and meadow habitats relative to upland forests may buffer these ecosystems from wildfire effects. However, increased fuel conditions within or adjacent to meadows and riparian areas and increase in noxious weed infestations (e.g., bull thistle, *Cirsium vulgare*; Himalayan blackberry, *Rubus discolor*) in the DLRP area may have increased the wildfire risk in these sensitive ecosystems.

### 2.1.2. Watersheds

DLRP area is located in the Big Creek and Dinkey Creek watersheds, which are tributary channels to the Kings River; and the Stevenson watershed which is tributary to the San Joaquin River. Big Creek is approximately 46,500 acres, Dinkey Creek is approximately 87, 500 acres and Stevenson Creek is approximately 20,000 acres. This area drains into Pine Flat Reservoir and Shaver Lake. The major beneficial uses of the area are irrigation, hydropower generation, water contact recreation, non-contact water recreation, warm freshwater habitat (including reproduction and early development), cold freshwater habitat, wildlife habitat, rare, threatened, or endangered species, spawning, reproduction, and/or early development (cold water), and freshwater replenishment.

The elevation range of the Big Creek watershed is between 780' and 7720' above sea level. Summers are dry with low humidity and winters are cold and wet. Temperature averages 42 to

60º F. Precipitation ranges from 25 to 45 inches and occurs during the fall, winter and spring. Precipitation occurs mostly as rain below 6000 ft. and rain on snow is common. Above 6000' elevation most of the precipitation falls as snow. The rain-snow transition zone fluctuates from storm to storm and within storms. The elevation range of the Dinkey Creek watershed is between 1250' and approximately 10000' above sea level. Precipitation ranges from 20 to 80 inches during the fall, winter and spring. It occurs mostly as snow above 6000 ft. Rain on snow is common. Summers are dry with low humidity. Temperature averages 42 to 60º F.

Watershed conditions in Big Creek have been altered from past and current management activities and have resulted in alterations to stream flow, erosion and sedimentation. Stream flow has been altered from increases in runoff and has resulted in increased channel erosion and unstable channel banks. Accelerated erosion has occurred from past soil disturbances in logged areas, existing roads, and dispersed recreation. Several soils in the Big Creek and Dinkey Creek watersheds are sensitive to soil disturbance including the Holland family of soils. There are many areas in Holland soils where accelerated erosion has resulted in excessive sedimentation into several channels in Big Creek and Dinkey Creek watersheds. Several smaller subwatersheds are in a deteriorated condition and include Rush Creek, Summit Creek, Providence Creek and a three mile section of Big Creek, below the Blue Canyon Campground. Most of Dinkey Creek is in good watershed condition, except Bear Meadow Creek and Oak Flat Creek, where accelerated erosion and excessive sedimentation has resulted in sediment laden channel pools.

### 2.1.3. Sensitive Wildlife Species

The DLRP area contains a diverse array of terrestrial and aquatic wildlife species and associated habitat or vegetation types. Species with the greatest management concern are federally listed threatened and endangered species, or candidates, as well as Forest Service Sensitive species (Table 2). Many of these sensitive terrestrial species depend on late-seral and old-growth forest conditions (e.g., large diameter trees, snags, and logs, closed canopies with high structural complexity and heterogeneity) for denning or nesting, including the Pacific fisher (*Martes pennanti pacifica),* American marten (*Martes americana),* California spotted owl (*Strix occidentalis occidentalis),* Northern goshawk (*Accipter gentiles*), and Great gray owl (*Strix nebulosa)*. In addition, a suite of aquatic and terrestrial sensitive species depend on healthy and functioning montane meadows or riparian areas for suitable breeding and foraging habitat, including willow flycatcher (*Empidonax trailii*), Great gray owl, Yosemite toad (*Bufo canorus*), mountain yellow-legged frog (*Rana muscosa*), foothill yellow-legged frog (*Rana boylii*), California red-legged frog (*Rana aurora draytonii*),

*California Spotted Owl*

Lahontan cutthroat trout (*Oncorhynchus clarki henshawi*), relictual slender salamander (*Batrachoseps relictus*), western pond turtle (*Clemmys marmota*), and several bat species (Table 2).

**Table 2. Federally listed, federal candidate, or Forest Service Sensitive Species that have been observed or potentially occur within the Dinkey Landscape Restoration Project area.**

| Species | USFS Sensitive Species | Federal Status [a] | General Habitat Requirements |
|---|---|---|---|
| **Terrestrial Species** | | | |
| Pacific fisher *Martes pennanti pacifica* | Yes | C | Coniferous forests, late-seral |
| American marten *Martes americana* | Yes | -- | Coniferous forests, late-seral |
| Great gray owl[b] *Strix nebulosa* | Yes | -- | Montane meadows and adjacent coniferous forest |
| California spotted owl *Strix occidentalis occidentalis* | Yes | -- | Coniferous forests, late-seral |
| Northern goshawk *Accipter gentiles* | Yes | -- | Coniferous forest, late-seral |
| Willow flycatcher *Empidonax traillii* | Yes | -- | Montane meadows |
| Pallid bat *Antrozous pallidus* | Yes | -- | Foothill woodland, riparian, and coniferous forests |
| Western red bat *Lasiurus blossevillii* | Yes | -- | Riparian and coniferous forest |
| Townsend's big-eared bat *Corynorhinus townsendii* | Yes | -- | Foothill woodland, riparian, coniferous forest, cave roosting |
| **Aquatic Species** | | | |
| Yosemite toad *Bufo canorus* | Yes | C | Montane meadows |
| Mountain yellow-legged frog *Rana muscosa* | Yes | C | Subalpine and alpine lakes and streams |
| Foothill yellow-legged frog *Rana boylii* | Yes | -- | Foothill and montane riparian |
| California red-legged frog *Rana aurora draytonii* | No | T | Foothill riparian |
| Lahontan cutthroat trout *Oncorhynchus clarki henshawi* | No | T | Montane streams |
| Relictual slender salamander *Batrachoseps relictus* | Yes | -- | Riparian and montane meadows |
| Western pond turtle *Clemmys marmota* (both subspecies) | Yes | -- | Foothill riparian, lakes, and ponds |

[a] Federal Status - E=Endangered; T=Threatened; C=Candidate for threatened or endangered

[b] State Endangered Species in California

# 3. Science and Management Basis for Ecological Restoration Strategy

## 3.1. Essential Scientific and technical documents

The DLRP strategy seeks to enhance fire resiliency, landscape heterogeneity, and habitat quality for sensitive wildlife species across the three major vegetation zones: coniferous forest, foothill hardwood, and riparian/meadows. The foundation of this restoration strategy rests upon the following essential scientific and technical documents:

- Coniferous Forest
  - *An Ecosystem Management Strategy for Sierran Mixed-Conifer Forests,* PSW-GTR-220 (North et al. 2009)
- Foothill Hardwood and Chaparral
  - *Guidelines for Managing California's Hardwood Rangelands by the California Integrated Hardwood Range Management Program* (1996)
  - *Proceedings of Symposia on Oak Woodland Ecology, Management, and Restoration in California* (PSW-GTR-160, 1997; GTR-184, 2001; and GTR-217, 2008)
  - *Regenerating Rangeland Oaks Sustainability of Sierra Nevada Hardwood Rangelands (Standiford et al. 1996)*
  - *Ecological Foundations for Fire Management in North American Forest and Shrubland Ecosystems* (Keeley et al. 2009)
- Montane Meadows and Riparian Forests
  - *California Riparian Habitat Restoration Handbook* (Griggs 2009)
  - *Ecology, Biodiversity, Management, and Restoration of Aspen in the Sierra Nevada* (Sheppard et al. 2006)
  - *Applied River Morphology* (Rosgen 1996), and *Watershed Assessment of River Stability and Sediment Supply* (Rosgen 2006)

The Ecosystem Management Strategy for Sierran Mixed-Conifer Forests (PSW-GTR-220) is the foundational document for this restoration project since coniferous forests dominate the project landscape. However, the technical reports and framework documents above provide a comprehensive, current, and adaptive approach for restoring all prioritized ecosystems within Dinkey Landscape Restoration Project area.

### 3.1.1. Ecological Research in the Project Area

Science research in the DLRP area is one of the richest in the Sierra Nevada. Since 1990, the longest demography study of the California spotted owl has been underway, which includes more than a dozen nesting pairs in the area. Pacific fisher, another sensitive species, has been located, tracked, and monitored in the area for the last four years. Other research centered on the DLRP has examined: Pacific fisher populations in the DLRP; the effects of both potential fuels and restoration treatments on fisher habitat and populations; and the effects of

*Jeffrey pine with fuel accumulation, Teakettle Experimental Forest*

uncharacteristic severe wildfire on Pacific fisher (Spencer et al. 2008). Adjacent to the Dinkey area is another long-term study, the Kings River Experimental Watershed (KREW), on watershed response to fuels treatment, the only study of its kind in the Sierra Nevada. A KREW study plan and study components can be found at http://www.fs.fed.us/psw/programs/snrc/water/kingsriver/.

Of all the research in the area, however, work at the Teakettle Experimental Forest including PSW-GTR-220 has formed the foundation of the management strategy (North et al. 2009) applied in the DLRP. The Teakettle Experiment, a 10-year study of ecosystem response to fuels treatments, has provided key insights into the ecological processes of Sierra Nevada mixed-conifer forests. This experiment has emphasized the importance of stand and landscape heterogeneity for wildlife habitat, ecosystem health, and forest resilience to fire and drought. More than 50 publications and a DVD movie have resulted from work at Teakettle. Past and ongoing research at Teakettle is done in collaboration with Sierra National Forest managers and often in response to management issues that require better scientific information. For instance, forests are considered as a potential carbon sink that might help offset anthropogenic $CO_2$ emissions. However, it is unclear how these carbon assets might be best managed in ecosystems that are prone to frequent fire. Current research at the Teakettle Experimental Forest has examined the relative carbon cost and benefits of reducing fuels (an immediate carbon loss) against potential large losses in the advent of wildfire. In many respects, the DLRP is the landscape-level application of scientific research based on dozens of collaborative experiments at Teakettle. A complete list of research and publications is found at http://teakettle.ucdavis.edu/index.htm.

### *3.2. Landscape strategy-heterogeneity*

A primary goal of this restoration strategy is to restore heterogeneity (i.e., diversity in vegetation structure and composition) at the landscape scale to create a vegetation mosaic that is resilient to wildfire and varies by aspect, slope steepness, slope position, soil productivity, contemporary vegetation composition, and unusual micro-site conditions. The abstract from the PSW-GTR-220 clearly describes this goal:

> *Current Sierra Nevada forest management is often focused on strategically reducing fuels without an explicit strategy for ecological restoration across the landscape matrix. Summarizing recent scientific literature, we suggest managers produce different stand structures and densities across the landscape using topographic variables (i.e., slope shape, aspect, and slope position) as a guide for varying treatments. Local cool or moist areas, where historically fire would have burned less frequently or at lower severity, would have higher density and canopy cover, providing habitat for sensitive species. In contrast upper, southern-aspect slopes would have low densities of large fire-resistant trees. For thinning, marking rules would be based on crown strata or age cohorts and species, rather than uniform diameter limits. Collectively, our management recommendations emphasize the ecological role of fire, changing climate conditions, sensitive wildlife habitat, and the importance of forest structure heterogeneity.*

The use of topographic variables is described further on page 20 of the paper:

> *In general, stem density and canopy cover would be highest in drainages and riparian areas, and then decrease over the midslope and become lowest near and on ridgetops. Stem density and canopy cover in all three areas would be higher on northeast aspects compared to southwest. Stand density would also vary with slope becoming more open as slopes steepen.*

Figure 3 depicts the landscape heterogeneity described in PSW-GTR-220 (North et al 2009). The landscape strategy would emphasize open stand conditions on southerly slopes and ridge tops. Dense to moderately dense stand conditions would be emphasized by employing relatively high growing space retention on northerly slopes, in canyons, and in areas with Pacific fisher restrings sites of high to moderate quality. Tree removal would occur throughout all diameters, up to 30 inches at breast height, consistent with the desired restoration condition. Reductions in hazardous fuels and the resulting fire behavior and severity would be consistent with the goals and objectives of the Sierra Nevada Forest Plan Amendment (USDA Forest Service 2004a).

The DLRP landscape will be treated to create a complex mosaic of habitats that are consistent with the topographic features and historic fire regimes.

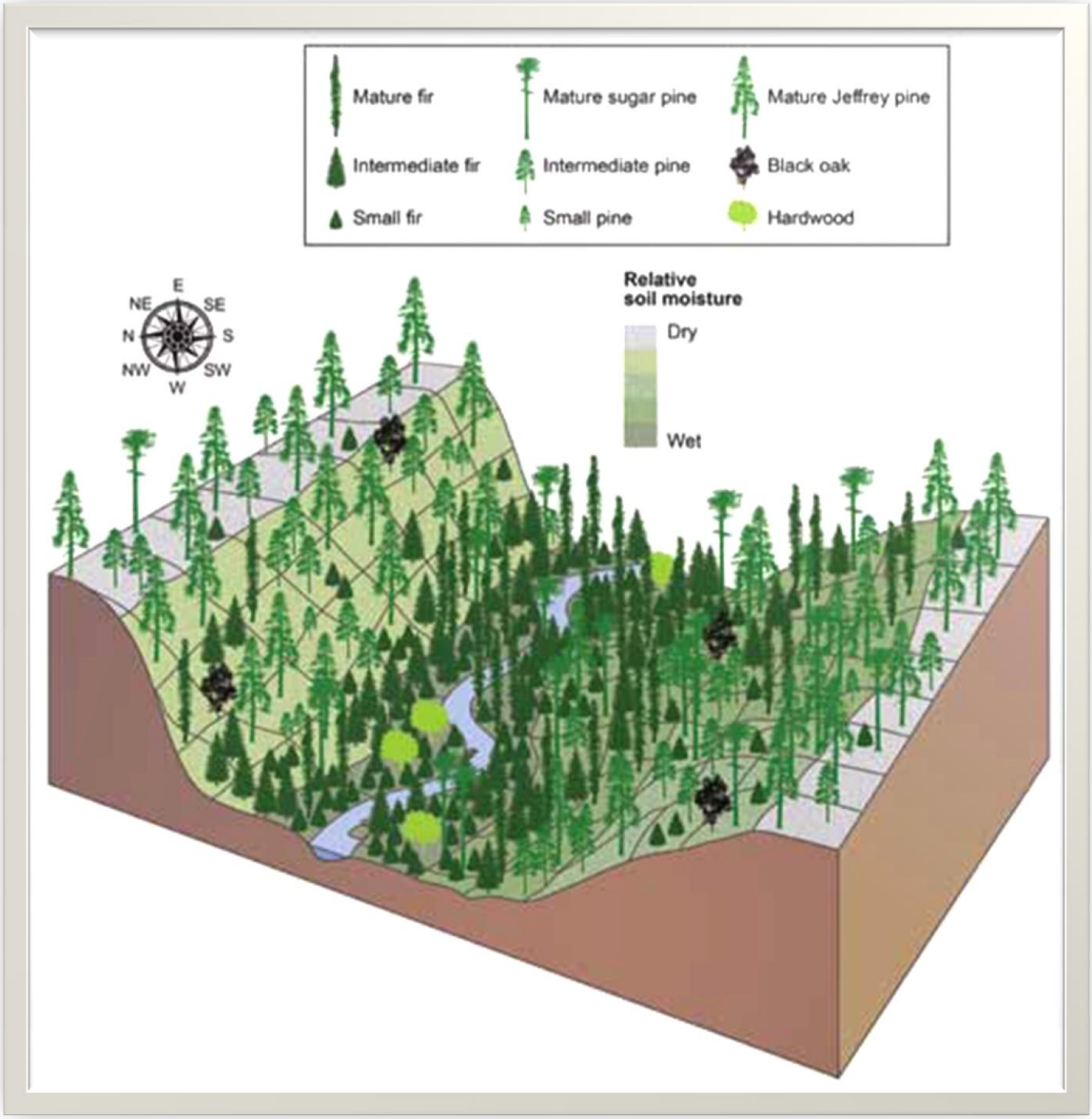



*Figure 3: Topographic zone and desired tree densities*

### 3.3. Coniferous Forest Stand-level strategy

The DLRP strategy emphasizes the following science-based priorities at the stand level:

#### *3.3.1. Fire resilience and reintroduction of fire*

Restoration treatments will target forest stands that are at greatest risk of high-severity wildfire and have the most potential to benefit from increased stand-level heterogeneity, including Sierra mixed conifer, ponderosa pine, and montane hardwood stands. Within these stands, treatments would accentuate horizontal and vertical variation in tree density. Creation of tree gaps and retention of tree cohorts with similar canopy strata would promote horizontal and vertical discontinuity in fuels, reducing wildfire risk in restored stands. Public and firefighter safety would also be promoted through reduced tree densities, surface fuels, and ladder and crown fuels within the WUI. Prescribed fire would reintroduce a key ecological process to conifer forests at a frequency of 5 to 15 years with target flame lengths less than 4 feet. The reintroduction of fire in coniferous forest will reduce surface fuels and facilitate important ecosystem processes such as nutrient cycling. Reductions in tree density and surface fuels through thinning and fuel reduction will reduce risks to local communities and minimize fire severity impacts to a wide range of forest habitats (Safford et al. 2009).


*1900 photo taken in the Dinkey Creek Area of Sierra Mixed Conifer Forest*

#### *3.3.2. Forest structure and composition*

Tree removal and retention in coniferous forests will allocate growing space based on micro-topography features, such as seeps, concave pockets, shallow soils, and cold air drainages. Restoration treatments will be consistent with historic fire-adapted stands, such as those at the Teakettle Experimental Forest and the Lake Tahoe Basin, with equal densities of small, medium, and large-diameter trees within a stand (North et al. 2004, Taylor 2004).

Additionally, trees will be separated by groups based on their canopy strata to approximate historic fire-adapted stands. The more open and variable forest conditions reflective of historic forests would instill a greater resistance to insects, disease, and drought, resulting in a more resilient forest.

*Dinkey landscape Big Creek drainage Ponderosa Pine forest type, photo taken in 1900*

Treatments will also focus on the restoration of tree species that are fire-adapted, currently underrepresented in fire-excluded stands, and favored by sensitive wildlife species. Restoration treatments will focus on the removal of shade-tolerant white fir and incense cedar that are overly dense in fire-excluded stands. Shade-intolerant pines (ponderosa pine, Jeffrey pine, sugar pine) and oaks (black oak, canyon oak) will be selected for regeneration and retained in coniferous forest stands.

#### *3.3.3. Wildlife habitat and key structure*

Pacific fisher and California spotted owl habitat emphasis is promoted across the landscape. The stand structure strategy identifies and retains key resting and nesting structures identified by scientific research within or near the DLRP area. Retention is facilitated through field identification and relative ranking of micro-site conditions found within a stand. California spotted owl PACs within the WUI are treated consistent with public and firefighter safety. Habitat emphasis treatments for fisher and spotted owl recognize the importance of late-seral forest structures with sufficient canopy cover, large home ranges, suitable and accessible foraging habitat, and stand heterogeneity. The restoration strategy described in PSW-GTR-220 incorporates the creation, retention, or enhancement of key habitat structures (large trees and snags, dense forest patches, defect trees >20”), oaks, and within-stand forest gaps for pine regeneration and understory plant diversity (North et al. 2009).

### 3.4. Hardwood Forests and Mixed Chaparral Strategy

#### *3.4.1. Fire resilience and behavior*

Desired conditions for hardwood forests and mixed chaparral in the DLRP include:

- Reintroduction of fire consistent with historic fire regimes
    - Low-intensity fire in foothill hardwood to facilitate regeneration
    - Low-frequency fire in mixed chaparral vegetation; avoid frequent fire
- In hardwood-pine forests, reduce shrub density and continuity and increase oak and pine resistance to high-severity wildfire

- Within mixed chaparral vegetation, target fuel reduction treatments immediately adjacent to the WUI and away from wildland areas
- Employ comprehensive noxious weed and invasive plant management strategy
    - Avoid use of prescribed fire or fuel reduction treatments within foothill chaparral vegetation adjacent to invasive plant infestations
    - Aggressively treat noxious weed infestations near burned stands of foothill hardwood or mixed chaparral

#### *3.4.2. Blue oak and valley oak regeneration*

Blue oak and valley oak woodlands in the DLRP area have limited regeneration and are predicted to undergo significant range contractions based on future climate change scenarios for the Southern Sierra Nevada foothills. Hardwood management recommendations for blue oak and valley oak woodlands (Swiecki and Bernhardt 1991, Swiecki et al. 1993) include:

- shrubs are treated to enhance oak regeneration in blue and valley oak stands;
- Grazing regimes should minimize the duration and intensity of browsing pressure on woody vegetation to reduce negative impact of browsing on oak regeneration;
- Prescribed fire may promote blue or valley oak regeneration but only at lower frequencies;
- Overstory canopy cover should generally not be reduced below 20% cover within any 0.1 ha unit if regeneration is desired;
- Following cutting or other gap-creating events such as wildfire, livestock use should be minimized until any recruiting oak saplings have grown taller than the browse line or grazing regimes reduce effects on oaks;
- Consider planting seedlings in mesic locations near the edge of current blue oak or valley oak stands to buffer stands from future climate change impacts (Millar et al. 2007).

Chaparral density would decrease and understories would become more open. Consequently hardwood trees would become larger and more space and light would become available for oak regeneration, understory plant diversity, sensitive plant species, and grass production.

#### *3.4.3. Foothill hardwood and chaparral Wildlife habitat*

Habitat emphasis areas for California spotted owl, mule deer (*Odocoileus hemionus*) winter range, and foothill bird species would be identified for each treatment area. Fire, grazing, and planting would be managed to enhance oak regeneration and Native American basket weaving materials. Fire and fuels treatments would be applied strategically to increase the effectiveness of fire suppression activities and assist in reintroducing fire into the hardwood and chaparral vegetation types.

### 3.5. Watershed, Montane Meadow, and Riparian Forest Strategy

*The historic Dinkey Creek Bridge*

Meadow and riparian habitats would be treated to benefit both vegetation composition and hydrologic function. Figure 4 displays the watersheds over threshold, meadows, and CARs found in the DLRP. Vegetation treatments would benefit aspen and willow retention and regeneration. Hydrologic function and natural stability would be restored in meadows and riparian areas with incised stream channels, accelerated stream bank erosion, altered flow regimes, and amplified downstream sediment transport. Desired conditions for montane meadows and riparian forests include:

- Wildlife Habitat
    - Retain large wood debris in riparian areas to provide wildlife cover and to regulate stream temperatures
    - Increase soil moisture regimes in meadows
    - Remove encroaching conifers from montane meadows using tree removal or prescribed burning
- Watershed function
    - Reconnect historic meanders and create new reaches to increase channel sinuosity
    - Reduce fine sediment production through the repair of headcuts, road decommissioning, and installation of bioengineered bank treatments or in-stream control structures
    - Construct or reshape channel cross-sectional dimensions to allow floodplain inundation at flows greater than bank full and to increase water depths at low flow
    - Reconnect off-channel ponds and side channels in meadows to enhance and reestablish hydrological linkages between the active channel and biotic refugia
    - Reduce water flow rates and peaks consistent with a functioning system
- Riparian/meadow Vegetation
    - Noxious weed eradication and prevention
    - Increase density and growth of aspen, alder, cottonwood, and willow
    - Prescribed fire and removal of competing conifers to enhance growth of aspen
    - Increase abundance and diversity of herbaceous vegetation within meadows

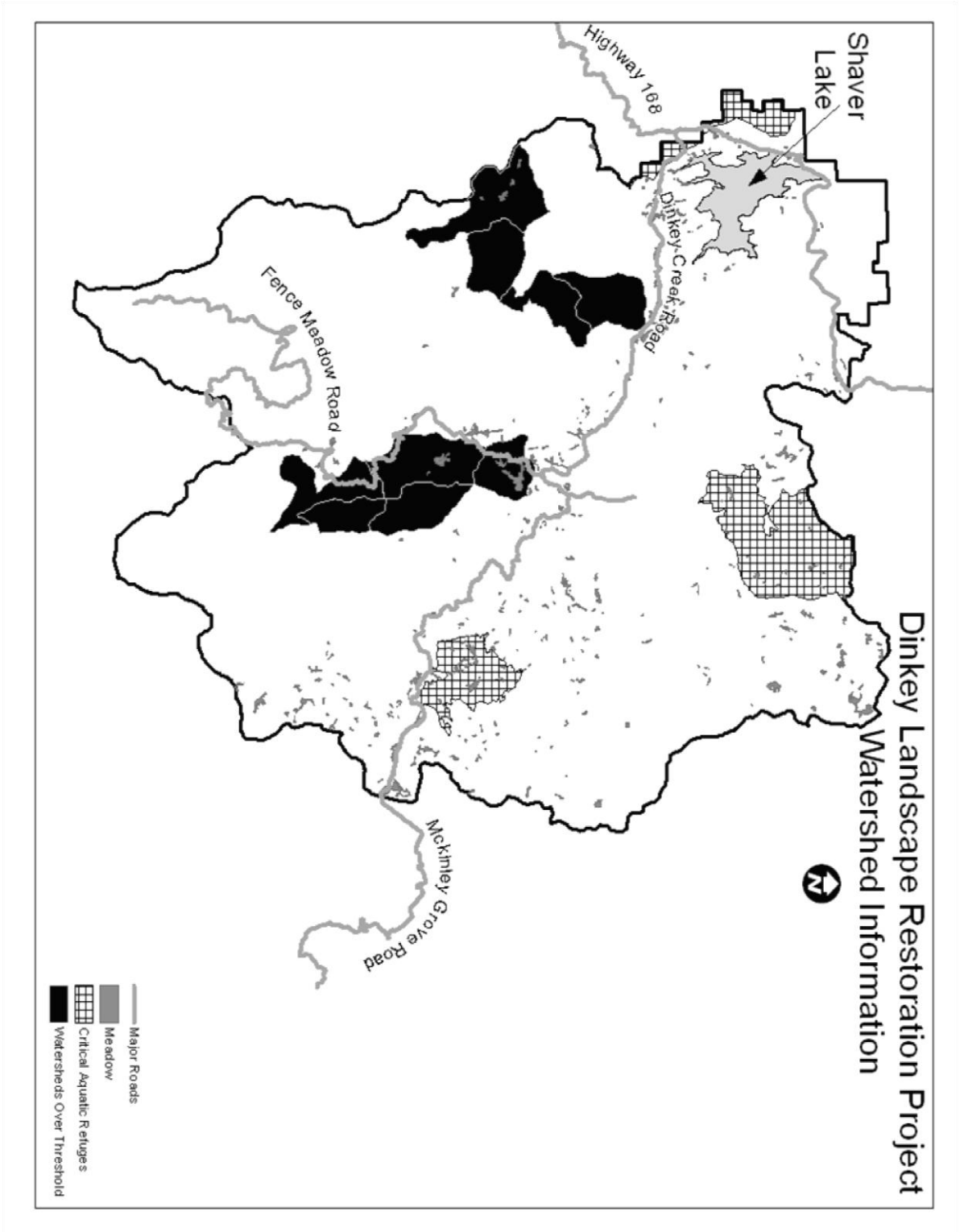



*Figure 4: Location of watersheds over threshold, Critical Aquatic Refugees, and meadows across the Dinkey Landscape*

# 4. Refinement and Adaptation of Restoration Strategy

## 4.1. Dinkey Collaborative Forum

The DLRP was developed using a collaborative approach to management. The collaborative forum developed a process for planning, monitoring and project needs (appendix A and B). Refinements to the landscape approach by the collaborative group include:

- Developed definitions of desired conditions
- Refinement of landscape aspect and topographic zones
- Stand growing space retention guideline for landscape and topographic zones
- Tree retention and removal guidelines and priorities
- Pacific Fisher rest sites field guideline priorities

## 4.2. Dinkey Landscape Heterogeneity

The collaborative process used the Ecosystem Strategy of PSW-GTR-220 (North et al. 2009) to divide the project landscape into landscape zones: Northerly, and Southerly, Canyon, Slope, and Ridge. Neutral aspects fall between north and south and are aspects that receive only partial sunlight early or late in the day. Figure 5 displays the heterogeneity of landscape zones across the DLRP area. Ridges occur on the upper portions of slopes, and Canyons include the lower third of slopes based upon the location of streams and slope conditions. Within each combination of aspect and landscape zones, variables for stand structural conditions and processes (fire) were assigned on a relative scale of “lowest-to-highest”. Using this scale, the highest canopy cover and basal area (stem area) was found in canyons and the “lower” and relatively “lowest” canopy cover and basal area were found on ridges.

The Distribution of Landscape zones within the DLRP is:

- Northerly 19 percent and 29,000 acres
- Southerly 35 percent and 55,000 acres
- Canyons 19 percent and 30,000 acres
- Ridges 15 percent and 23,000 acres
- Neutral 12 percent and 19,000 acres

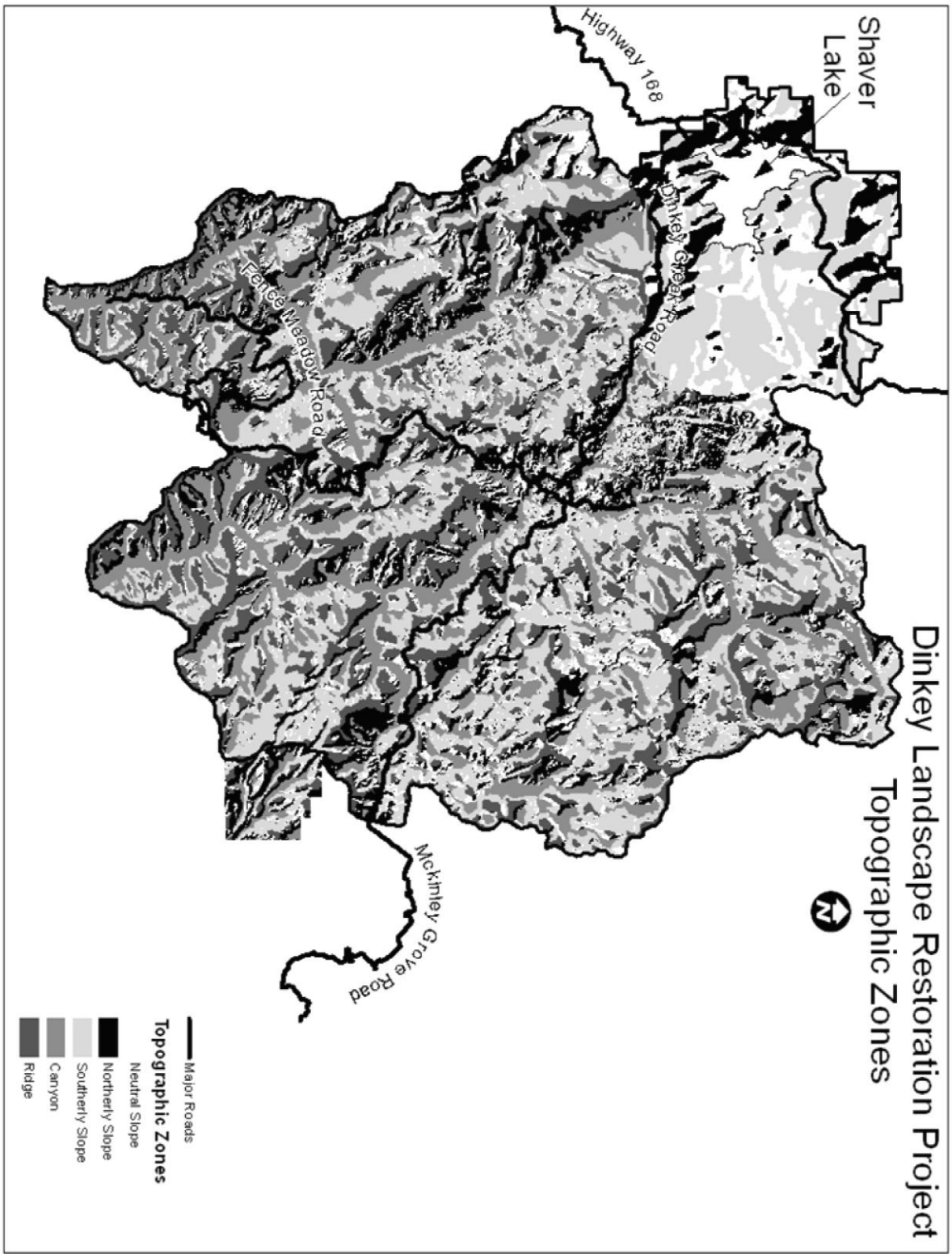



*Figure 5: Topographic Zones Across the Dinkey Landscape*

### 4.3. Wildlife Refinements: Pacific Fisher

#### *4.3.1. Research*

In 2006, the Kings River fisher study was initiated jointly by Forest Service Region 5 and the Pacific Southwest Research Station to: 1) fill gaps in our current understanding of fisher ecology and habitat requirements and 2) address the uncertainty surrounding the effects of fuel and forest restoration treatments on fishers and their habitat. Additional information on the fisher study can be found at the following web page: http://www.fs.fed.us/psw/programs/snrc/bio_diversity

The Kings River fisher project uses multiple sampling techniques and a before-after/control-impact (BACI) framework. This means that population, behavior, and physiological data are collected in both control and treatment areas, and the effects of management activities can be identified using a combination of genetic mark/recapture, radio telemetry, and remote camera data. Changes in fisher density, survival, reproduction, and habitat use will be quantified before and after treatments to evaluate the effects of the DLRP and other management activities on fisher populations.

*Pacific fisher with radio collar, Sierra National Forest*

#### *4.3.2. Fisher Habitat*

Kings River fishers use a variety of prey species and forest structures. Dens have been found in black oak and a variety of conifer species. The majority (71%) of dens was in live trees, but all had some degree of decadence and DBH ranged from 69 to 165 cm (27 to 65 inches). Rest sites are more variable and have included live and dead trees of many tree species, cavities, platforms, stick nests, stumps, and logs. There are currently 27 known denning sites in the DLRP area.

Since February 2007, 59 fishers have been captured, with 57 of these radio-collared. Preliminary estimates of density are 13.4 fishers per 100 $km^2$. Fisher home range areas have been identified (Figure 6). More than 80% of females showed signs of having reproduced and 52 dens have been located. Overall annual survival was 72%, with males having significantly lower survival rates than females. Predation accounted for 79% of all mortality.

Recent research in the DLRP strongly indicates a relationship between aspect and topographic landscape zones and fisher use (Underwood et al. 2010). Both Pacific fisher activity points

(from radio telemetry) and California spotted owl nests, roosts and sightings were significantly different from uniform, with a disproportionate number of observations in canyons, and fewer observations than expected near ridgelines.

Other recent studies in the DLRP have modeled the probability for fisher use across the southern sierra Nevada bioregion (Spencer et al. 2008) (Figures 6 and 7). This same study indicates that while mechanical treatments pose a risk to Pacific fisher populations, wildfire entering the untreated Dinkey landscape would result in the greatest loss of habitat and reduction in fisher population (Spencer et al. 2008). This study along with others strongly suggests that some restoration treatment is needed to maintain fisher populations in a region with increasing fire severity and wildfire risk (Miller et al. 2009).

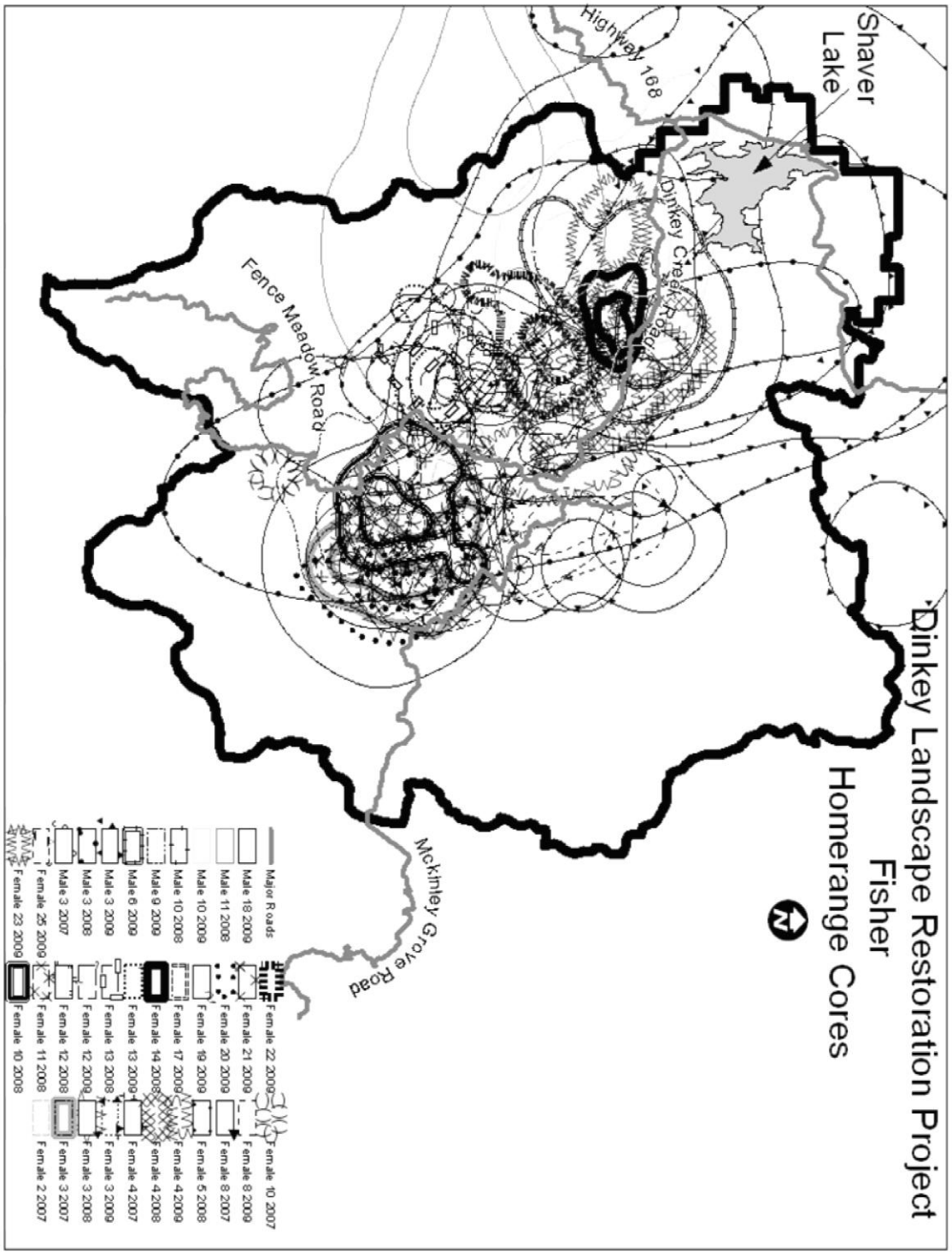



*Figure 6: Fisher home range cores across the Dinkey Landscape for each of the individual fishers monitored*

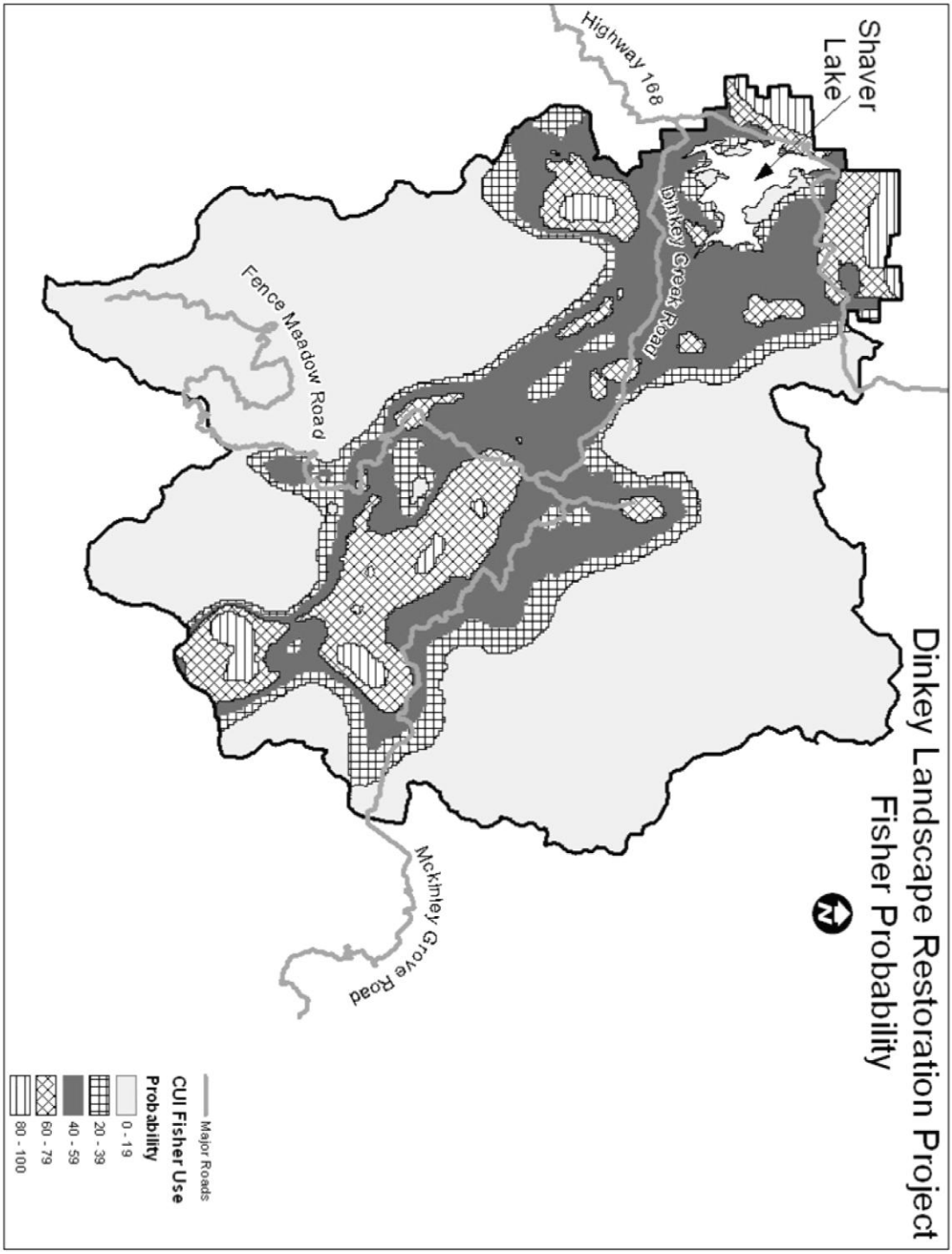



*Figure 7: Probability of fisher detection across the Dinkey Landscape*

### 4.4. Wildlife Refinements: California Spotted Owl

Over the last 100 years or so, selective logging and fire suppression have reduced the number of large trees, increased the density of smaller diameter classes, and shifted composition toward shade tolerant white fir and incense cedar. These changes are at the heart of the concerns about California spotted owl habitats as outlined by Verner et al. (1992). These authors recommended an interim management approach that has been adopted most recently in the 2004 Sierra Nevada Forest Plan Amendment (USDA Forest Service 2004). Along with an emphasis on reducing the risk of wildfire, the amendment identifies two land allocations that maintain important habitats.

#### *4.4.1. Research*

The California spotted owl demographic study was initiated in 1990 to evaluate the effects of habitat and habitat alteration (timber harvest and fuels treatments) on spotted owl reproduction, survival, and population rate of change. Reproduction has varied greatly from year to year, but adult survival shows little estimated annual variation. The estimated population rate of change for spotted owls within the study area is not statistically different from a non-declining population. In 2009, 34 spotted owl pairs were found, 25 of which fledged young. Surveys are ongoing in the DRLP and will provide monitoring of spotted owls in the proposed 2010 DLRP treatment areas.

#### 4.4.2. PACs

Protection Activity Center (PAC): A PAC is a delineated land allocation comprising the best available 300 acres of spotted owl habitat, which is managed specifically for sustaining nesting habitat for the purpose of maintaining viable populations of spotted owls (Figure 8). Within the DLRP, there are 182 PACs that have specific regulatory requirements that will be accommodated in application of the suggestions in PSW-GTR-220 and the refinements described above based on local research and experience.

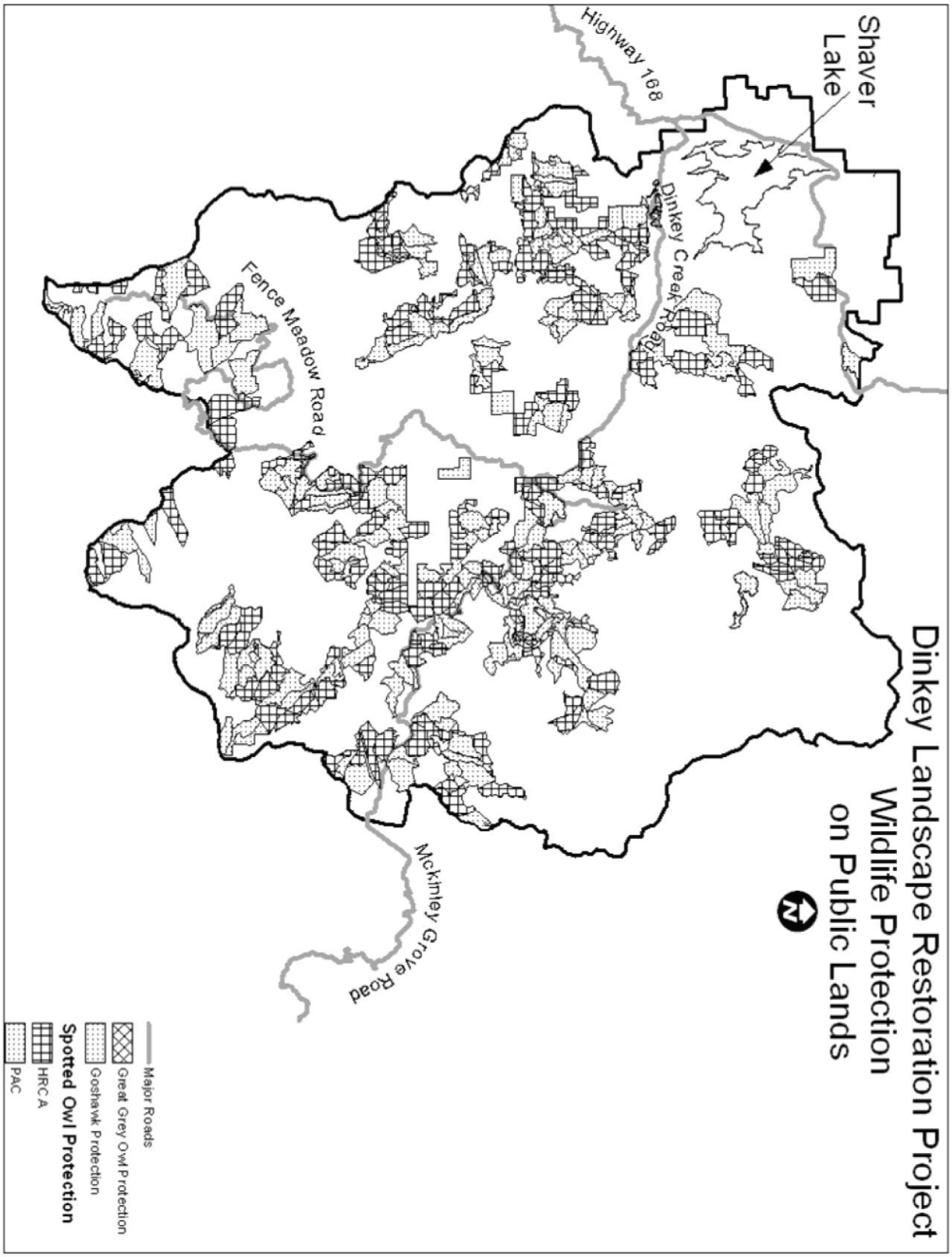



*Figure 8: Location of HRCA's and PAC's for Spotted Owl, Goshawk, and Great Grey Owl across the Dinkey Landscape*

#### 4.4.3. Home ranges

Home Range Core Area (HRCA): An HRCA comprises approximately 700 acres (including the PAC) of the best available spotted owl habitat for the purpose of providing foraging habitat (Figure 8). For each PAC, there is a HRCA but the regulatory requirements for their management accommodate the suggestions in PSW-GTR-220 and the refinements described above based on local research and experience.

Approximately 20,000 acres of the DLRP currently designated as a PAC and an additional 20,000 designated as a HRCA. Overall, more than a quarter of the landscape receives some type of spotted owl protection. PACs and HRCAs account for approximately 26% of the DRLP area.

### 4.5. Wildfire and Prescribed Fire –Disrupting Large fires

Across the Sierra Nevada, several lessons have been learned about placement of fuels treatments to disrupt large uncharacteristic fire. A recent paper by Collins et al. (2010) summarizes this information:

> *Finney et al. (2007) show that treatment locations based on optimization algorithms (Finney 2004, 2007) more effectively reduce simulated fire growth across several landscapes compared with random location of fuel treatments. Schmidt et al. (2008) also report that regular arrangement of treatments outperformed random arrangement with respect to reducing fire spread and area burned. Planning fewer, larger individual treatments across the landscape appears to be a better strategy when human community protection is a primary concern (Schmidt et al. 2008). These larger treated stands can also be used as suppression or other fire management activity anchor points (Omi 1996, Agee et al. 2000, Moghaddas and Craggs 2007).*

Suggested treatment proportions for landscape level fire treatments range from 20 to 30% of the landscape at a treatment rate of 1 to 2% of the landscape acres per year (Finney et al. 2007). Excluding treatments from 55% to 65% of the landscape had detrimental effects on the ability of treatments to reduce the effects of large fires.

*High-severity burned stand (upper-montane coniferous forest) taken in Yosemite NP, Sierra Nevada*

*Severe fire in drainage, Sierra National Forest*

### *4.5.1. Landscape fire history*

Forests have shifted in composition from fire-adapted to fire-intolerant species. Fire intolerant species tend to form unhealthy stands prone to large-scale wildfires, as well as increased outbreak of disease and insects (Graham et al. 1999). Dry, low-elevation ponderosa pine forests in the Sierra Nevada are classified as fire regime I, mid-elevation mixed conifer forests are typically fire regime III, and high elevation true fir forests are characterized as fire regime IV. Seventy-two percent of the Dinkey Landscape is classified as condition class 2 and 3, have uncharacteristic conditions that are a moderate or high departure from the natural fire regime (see Table 3).

The historical low-severity fire regime which dominated the project area was one of high frequency – low intensity fire in the ponderosa pine forest, transitioning to mixed severity in the mixed conifer forest, and one of low frequency – mixed intensity in the true fir forest (Brown and Smith 2000). Fire suppression efforts in the last century have substantially departed from historical fire regimes. Fire history and tree ring studies in the Dinkey Landscape area suggest a historical fire return interval of every 3-17 years (median of 11 years; Drumm 1996, Phillips 1998, North et al. 2004). The Dinkey Landscape has missed several fire entries, possible as many as 20 low intensity fires. This absence of fire has resulted in stands that are overstocked with fire intolerant trees and shrubs, converting it to a fire susceptible forest type prone to high severity fire.

*Table 3 current fire regime condition class*

| Fire Regime | Condition Class | Percent land area |
|---|---|---|
| I | 1 | 2% |
| I | 2 | 22% |
| I | 3 | 44% |
| III | 1 | 9% |
| III | 2 | 12% |
| III | 3 | < 1% |
| IV | 1 | 10% |
| IV | 2 | <1% |
| IV | 3 | 0 |

From the 1910 to present, several large fires have occurred within or directly adjacent to the DLRP area. The majority of large fires have burned from the foothill hardwood or mixed chaparral into the coniferous zone (see Figure 9). Exceptions to this trend are the Rock Creek fire 1981 and the Bretz mill fire 1947. Large areas of the landscape north and south of McKinley

Grove road have not had a recorded large fire in 100 years (Figure 9). Historic large fire movement patterns would affect communities at risk and wildlife habitat (Figure 10). Landscape strategies to disrupt large fire movement need to create forest conditions that are consistent with the frequent fire regimes of Sierra mixed conifer, ponderosa pine, and montane hardwood. These same landscape strategies should reduce fire intensity/severity along the transition from chaparral/hardwood into higher elevation forests.

*Rock Creek fire (1981) after 20 years of recovery, Dinkey landscape*

The recorded fire history of the project area dating back to 1910 shows a total of 23 fires occurring. The largest fires were between 520 and 5,000 acres. Fire history data and frequency (all fires by size class) for the entire High Sierra Ranger District (1965–2005) was entered into ProbAcre, which is a model used for computing aggregate burned acreage probabilities for wildfire risk analysis. There is a 75 percent probability that all the fires occurring on the District will total 1,000 acres every year. There is a 50 percent probability that total acreage burned over the District will be roughly 2,200 to 5,000 acres every year.

The Sierra National Forest has not experienced the devastating severe large fires of the neighboring Sequoia (south border) and Stanislaus (north border) National Forests. The wildfire probabilities above are based on the lower rate of large fires found on the Sierra. Whereas the rate of ignition, fuel hazard, vegetation components, and topography is similar across each forest, the probability of fire reflects the success of suppression forces and unknown factors. Continued fire exclusion and suppression makes the future fire ever more destructive. Wildfires in the DLRP area are frequent enough and large enough to have detrimental effects on the human population and forest environment.

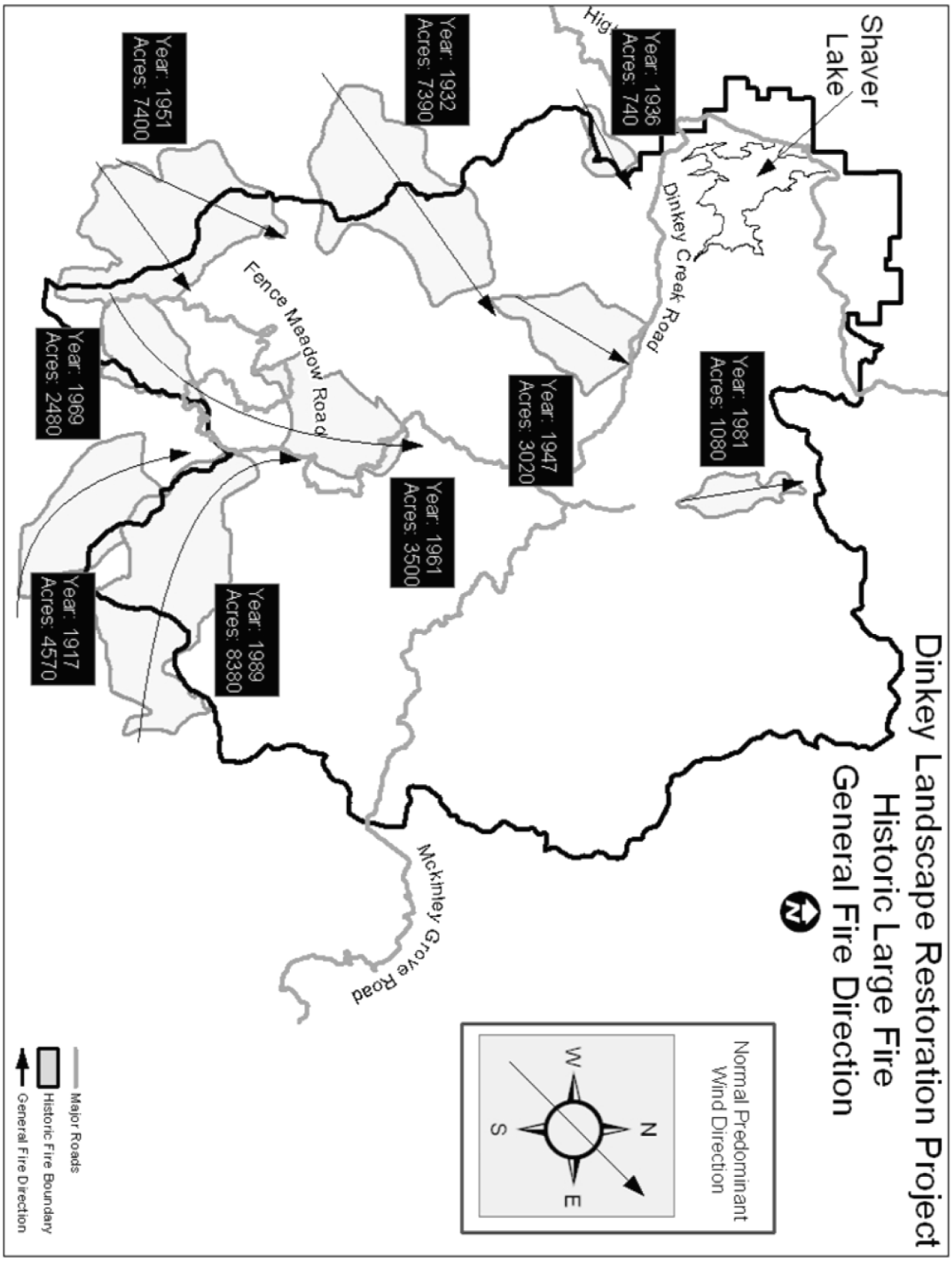



*Figure 9: Historic Large Fires and their general spread direction since 1900 across the Dinkey Landscape*

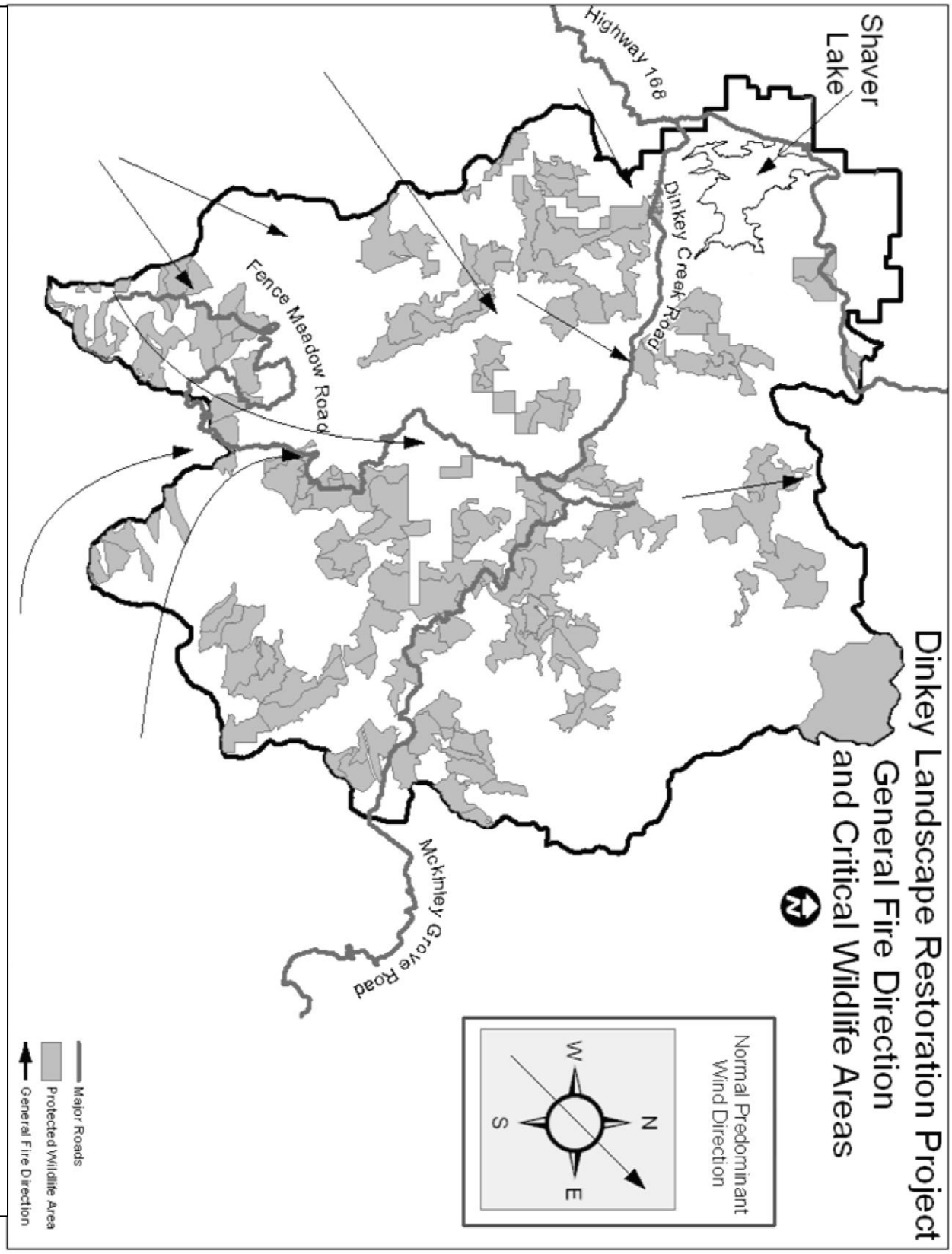



*Figure 10: Historic Large Fires and their general spread direction since 1900 and critical wildlife habitat across the Dinkey Landscape*

### 4.5.2. Wildland Urban Interface

The DLRP contains substantial areas of wildland urban interface (WUI), which describes an area where human habitation is mixed with areas of flammable wildland vegetation. Several communities located in or adjacent to the DLRP are identified as communities at high risk from wildfire (Federal Register, August 17, 2001 [Volume 66, Number 160], p. 43388). The 2004 Sierra Nevada Forest Plan Amendment (USDA Forest Service 2004a) identifies the following three land allocation zones for the WUI:

- Defense Core and Defense Zone: The WUI Defense Core Zone includes all treatment stands that contain an urban core (i.e., a community or inhabited structures and immediate environs). The WUI Defense Zone is a buffer in closest proximity to communities and human infrastructure. WUI Defense Zones generally extend from the structures in a community out roughly 0.25 miles. Fire control is the primary objective in this zone. Within the DLRP there are approximately a combined 9,600 acres.
- Threat Zone: The WUI Threat Zone extends from the outer edge of the Defense Zone approximately an additional 1.25 miles. The objective for this area is to reduce wildfire spread and intensity and to maintain habitat functionality. Within the DLRP there are approximately 31,000 acres of Threat Zone.

*A third entry prescribed burn within the Ponderosa pine, Dinkey Landscape*

All the zones have specific regulatory requirements that must be accommodated in application of the suggestions in PSW-GTR-220 and the refinements described above based on local research and experience. Figure 11 displays field adjusted WUI zones across the DLRP.

### *4.5.3. Prescribed fire experience*

Fire was once common in the project area (Drumm 1996; Phillips 1998) and the neighboring Teakettle Experimental Forest (North et al. 2005). Ecosystem strategies suggested by PSW-GTR-220 (2010) emphasize the use of prescribed fire as a restoration tool.

The High Sierra Ranger District has extensive experience with prescribed fire dating from the beginning of an underburning program in 1994. Over the ensuing years approximately 17,300

acres have been underburned for maintenance of defensible fuel profile zones (wide fuelbreaks), reducing surface fuel loads and reintroducing fire into the landscape (see Figure 13). Burns are typically low intensity underburns conducted in the late winter or spring. Scorch heights are typically less than 15 feet. Surface flame lengths are typically less than four feet. Three prescribed fire treatments are required to achieve desired results. One prescribed fire treatment is required to achieve results when combined with mechanical treatments. Prescribed fire alone takes approximately 15 years to achieve desired conditions; prescribed fire and mechanical treatments take approximately 5 years to achieve desired conditions.

This experience creates a fertile opportunity for accelerating the reintroduction of fire into the landscape as suggested in PSW-GTR-220.

Currently there are over 25,000 acres which have been identified by the forest as potential areas for prescribed burning treatments. Many of these areas have completed the planning process and are now awaiting implementation.

Currently the project area averages 2,000 to 3,000 acres of prescription fire treatment a year. Limiting factors of treatment include predictable factors, such as funding and lack of personal; as well as less predictable constraints such as weather conditions, air quality, and wildlife. With additional funding it is estimated that up to 5,000 acres a year could be treated, on average.

#### *4.5.4. Desired fire resilience*

Successful past treatments have resulted in the density of surface fuels less than 15 tons per acre and vegetation and ladder fuels have been removed over 20–40% of the landscape. In these conditions, rates of fire spread and severity at the head of a fire have been reduced but stand qualities necessary for sensitive habitats have been retained. Flame lengths for wildfires average less than four feet and rates of spread average less than 50% of pre-treatment rates of spread. The dominant fire type is surface fires with limited passive crown fires (torching in individual or small groups of trees). Active crown fires are a threat to the wildlife habitat, communities, and fire fighter safety only in extreme weather conditions.

After treatment flame lengths and rates of spread vary by coniferous forest type when fine fuel moistures are 3 percent, and mid flame (eye level) wind speeds range between 8 to 15 miles per hour (with gusts to 22 mph),:

- Sierra mixed Conifer, Ponderosa pine, Montane Hardwood, Foothill hardwood
    - Flame lengths range up to 8 feet in height, average flame lengths are below 4 feet
    - Rates of spread range up to 4 chains per hour.
    - Some torching and passive crown fire is still possible

- Red fir and subalpine
    - Flame lengths range from 0-20 feet in height
    - Rates of spread ranged from 0-4 chains per hour.
    - Modeling showed only surface fires possible

#### *4.5.5. Change in fire suppression costs*

Using the Wildfire Decision Support System (WFDSS) various fire size scenarios were modeled under 90$^{th}$ percentile weather conditions. The fire behavior characteristic, Fire Line Intensity (FIL), is used describe the fire behavior that may be expected pretreatment and post treatment. A Stratified Cost Index (SCI) Table (cost per acre) was developed for each fire size scenario and range of FILs. Based on the SCI table for timbered areas, for a fire of 4,000 acres (considered a large fire on the forest) an average fire cost with no treatment is expected to fall within an FIL of 5 with an average cost of $344 per acre. With treatments, FIL would be decreased from 5 to 1 in most treated areas, with a 65% decrease in average cost per acre from $344 to $122 per acre. This modeling does not account for the spatial benefits that would occur in the strategic placement of the treatment areas. Additive benefits in the strategic placement of treatment areas would result in a damping of fire behavior outside of treated areas as well as within treatment areas. This has the potential of helping to reduce fire size potential which could reduce per acre fire costs.

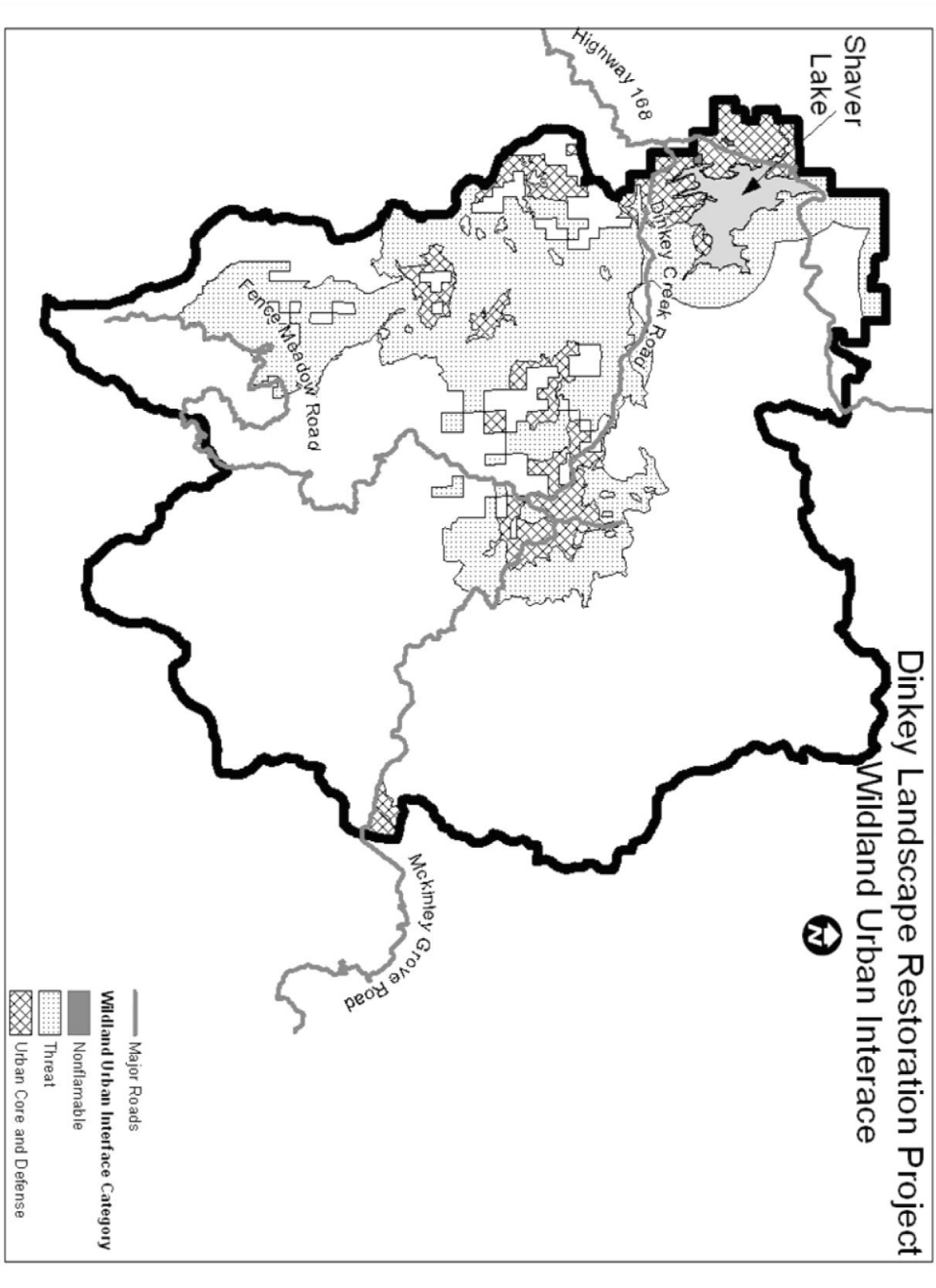



*Figure 11: Wildland Urban Interface across the Dinkey*

### 4.6. Watershed restoration

In order to meet the desired condition of healthy functioning watersheds, clean water and improved aquatic habitat, watershed restoration opportunities were identified during the Kings River Project landscape analysis. Four watershed restoration plans were identified in the **Providence Creek (1976 acres), Bear Meadow Creek (3858 acres) and Rush Creek (10,387 acres)**, HUC 7 watersheds. Totaling benefitting acres in these watersheds are 16,221 acres. Thirty eight sites totaling 35 actual acres are proposed for treatment. Some of these treatment sites are located in meadows and have the potential to prevent additional meadow habitat degradation if these areas are treated. Treatment of these sites will reduce sediment by 20-30 tons/year and will restore 35 acres of lower montane aquatic and wildlife habitat, and prevent degradation of an additional 50 acres of meadow and riparian habitat. Treatments include clearing and cleaning culverts, reshaping unstable slopes, stabilizing gullies in meadows, subsoiling and installing water bars on skid roads and abandoned roadbeds and skid trails.

### 4.7. Noxious weeds

Noxious weed surveys are routinely conducted for projects at the same time as the sensitive plant surveys by a seasonal crew under the direction of the District Botanist. Since vehicles often carry weed seeds into an area, extensive roadside surveys have also been conducted in the DLRP area. There are approximately 90 acres which are known to contain invasive species. Of these, foxglove (*Digitalis purpurea*) and bull thistle (*Cirsium vulgare)* occupy a vast majority of these acres at 51 and 32 acres, respectively. Other inventoried and located invasives include yellow starthistle *(Centaurea solstitialis),* cheatgrass *(Bromus tectorum),* soft brome (*Bromus hordeaceus)*, and spotted knapweed (*Centaurea maculosa).*

Principle risks of spreading or introducing noxious weeds are:

- Disturbance is expected to be high in areas of the project where implementation involves mechanical restoration treatments and prescribed fire. These activities carry a high potential for ground disturbance in localized areas that can result in bare soil suitable for seed rain from nearby plants including noxious weeds, if nearby.
- Equipment often comes from infested areas, and proper decontamination protocols are required to minimize the spread of weed seeds or propagules into the DLRP area.

### 4.8. Other key wildlife considerations

There are currently 11 goshawk PACs encompassing 2,000 acres across the DRLP area. There are also 4 Great Grey Owl PACs encompassing 200 acres.

Lewisia disipala, on sensitive soil, Dinkey landscape

The Cow Creek CAR which is about 4,500 acres, compromising a vast majority of the CAR within the DLRP area has the primary purpose of protecting the Lahontan cutthroat trout (*Oncorhynchus clarki ssp. henshawi*). The second largest CAR, snow corral, has the primary purpose of protecting the mountain yellow-legged frog (*Rana muscosa)*. In addition, there have been numerous sightings of the Yosemite toad (*Bufo canorus*) and the Western pond turtle (*Artinemys marmorata)* within portions of the DLRP area. Finally, there has been a single sighting of the reticulated slender salamander (*Batrachoseps attenuates)*.

## 5. Landscape Treatment – Strategy Implementation

The approach combines the science foundations, collaborative planning, and local knowledge into a set of treatment schedules for strategically placed mechanical restoration treatments; prescribe fire, watershed restoration (Table 4):

- Landscape restoration treatments occur across 20 to 30% of federal lands. Total landscape treatments (private and federal) result in 25% to 35% within landscape. Treatments are strategically placed to disrupt large fire movement, support fire suppression, and support prescribed fire (Figure 12).
- Landscape level fire resilience treatments occur in between and take advantage of strategically placed landscape restoration treatments. Fire resilience treatments include prescribed fire treats on 3,000 to 5,000 acres per year and low intensity fuel ladder removal thinning to reduce smoke production and limit prescribed fire intensity.
- Prescribed fire is dependent on weather and air quality conditions. Underburns receive a priority for treatment. Level one priority occurs before level five priorities (Figure 13).
- Restoration treatments and fire resilience treatments provide a dynamic landscape treatment that creates conditions for lower cost maintenance and returns the process of fire to the landscape. Together they create both forest structure changes and process changes to the fire excluded landscape.
- Watershed restoration occurs in watersheds over threshold. Watershed restoration occurs as a predicate to other treatments
- Invasive species are eradicated or controlled across the landscape. The Timing of invasive species eradication occurs in concert with restoration and fire resilience treatments
- Plantations are thinned to increase resistance to fire (prescribed and wildfire) and accelerate characteristics consistent with the frequent fire regime. Treatments increase tree size and create heterogeneity within older plantations.

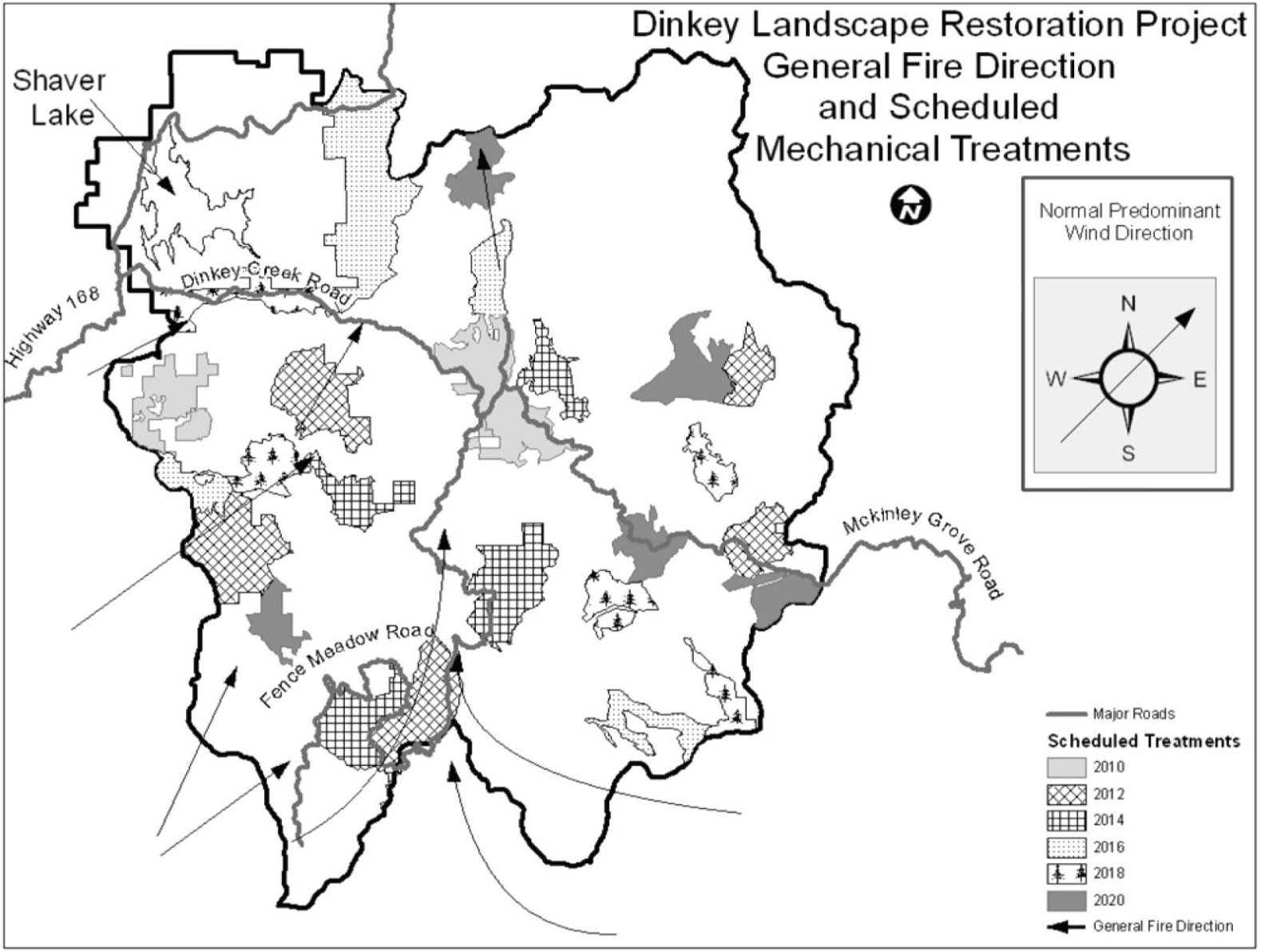



*Figure 12: Historic Large Fires and their general spread direction since 1900 and mechanical restoration treatment schedule across the Dinkey Landscape*

*Table 4 below describes the acres of treatments by fiscal year.*

| Year | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | Totals |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Mechanical Restoration-acre** | 3100 | 0 | 8314 | 0 | 5964 | 0 | 7083 | 0 | 4754 | 0 | 5277 | 34,492 |
| **fire resilience pre-treatment acre** | 0 | 0 | 0 | 402 | 651 | 600 | 600 | 600 | 0 | 0 | 0 | 2853 |
| **Rx fire-acres** | 3052 | 4541 | 7881 | 2679 | 4342 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 46,495 |
| **Watershed Restoration-acre** | 0 | 5150 | 5150 | 3858 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14,158 |
| **Road Decommission Miles** | | 2 | | | | 2 | | 2 | 2 | | | 8 |
| **Meadow Riparian Habitat acres** | 0 | 0 | 0 | 0 | 50 | 100 | 225 | 50 | 0 | 0 | 0 | 425 |
| **Plantation Maintenance acre** | 230 | 600 | 800 | 1200 | 900 | 1200 | 1200 | 1200 | 1200 | 1200 | 1200 | 10930 |
| **pine/oak Regeneration acres** | | | 93 | 0 | 249 | 0 | 179 | 0 | 212 | 0 | 143 | 876 |
| **Invasive species eradication or control acres** | 4 | 4 | 5 | 45 | 45 | 45 | 45 | 5 | 5 | 5 | | 208 |

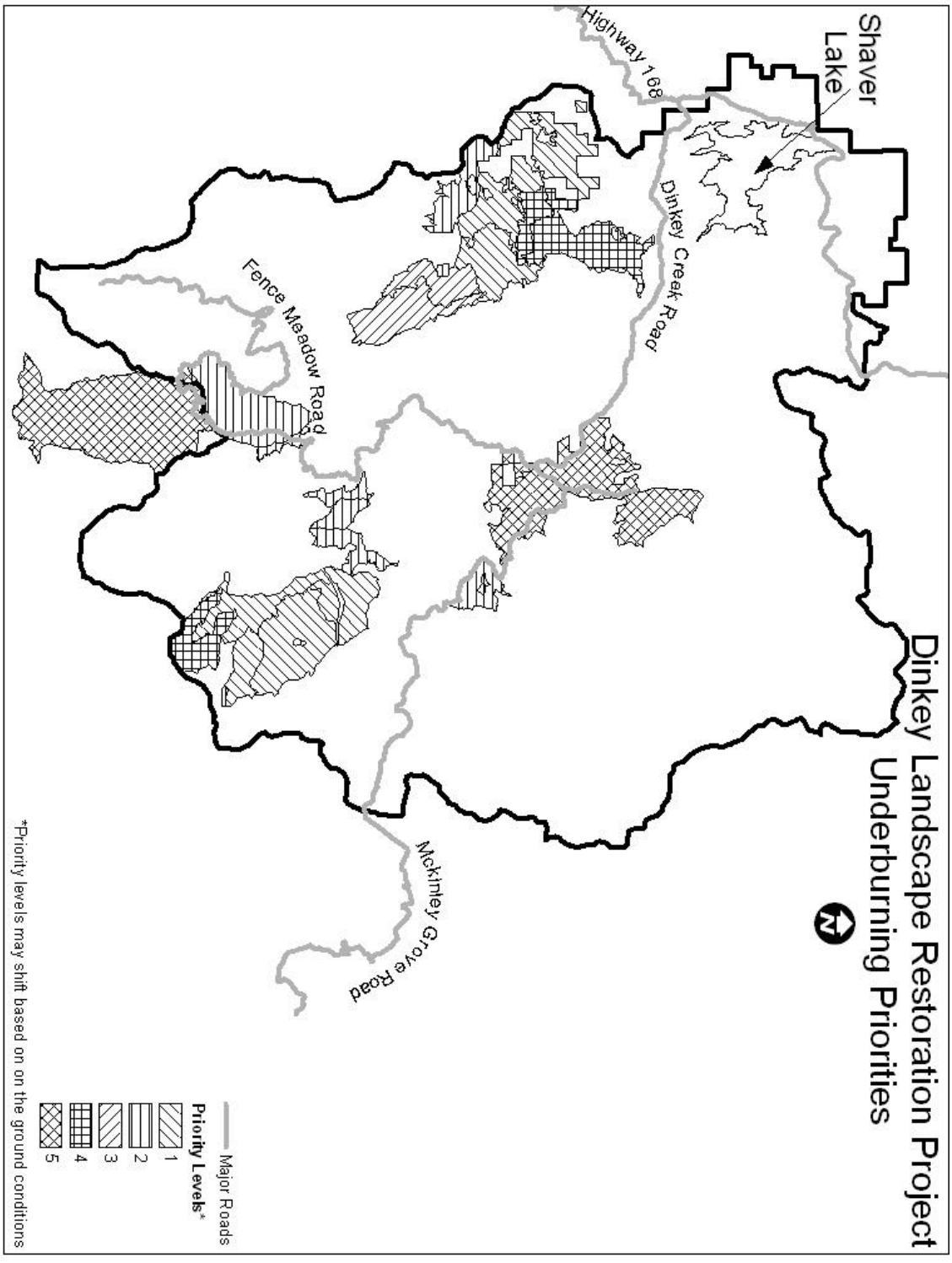



*Figure 13: Prescribed fire treatments with priority for treatment. Treatment priority one are proposed to occur before level five priorities.*

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# APPENDIX A

## Connection to Other Plans for the Landscape

Regulatory Setting

The DLRP is a priority area for treatment as identified by the objectives in the Healthy Forest Initiative (HFI) and the Healthy Forest Restoration Act of 2003 (HFRA).

- The Healthy Forest Initiative for Wildfire Prevention and Stronger Communities signed into law by President Bush on August 22, 2002, implements core components of the National Fire Plan and the 10-year Comprehensive Strategy, which were developed after the devastating 2000 fire season and agreed to by states, tribes, and stakeholders. Both provide direction for prioritizing treatment in areas that are at risk of severe wildland fires, especially communities in the WUI, in order to protect communities, firefighters, wildlife, and forest health.
- The Healthy Forest Restoration Act of 2003 (HFRA) authorizes projects on federal lands to reduce fuel loads and increase or maintain healthy forest conditions. It provides a foundation to work collaboratively with at-risk communities to reduce wildfire hazards caused by fuel loads within the wildland urban intermix (WUI) that exceed desired conditions as defined by the Forest Plan (16 USC 6612 Sec.102 (b)).
- Ecological restoration USDA Forest Service Interim directive (FSM 2000) – Ecological Restoration and Resilience
- The Sierra National Forest Land and Resource Management Plan as amended by the Sierra Nevada Forest Plan Amendment (2004) provides the standards and guidelines for the DLRP. It is expected to recognize the following land allocations which are listed in hierarchical order and meet the associated Forest-wide standards and guidelines or direction.

*Investments and Benefits*

The business plan utilizes broad concepts of “investments” and “benefits”. The Sierra NF has purposely defined “investments” broadly so that it can capture the value added by being inclusive of the effort, resources, and money contributed by the Collaborative Group and their constituents. It attempts to capture funds spent on Federal land for purposes of matching funding requirements, while also recognizing investments of industry and non-profit groups actively assisting DLRP efforts.

Likewise the definition of “benefits” is broadened to include and capture many valuable non-monetary benefits. This allows the Forest to discuss with the public, the direct cost savings of fighting fires and reduced property damage, and assists to define the benefits of clean air,

water, and healthy lands enjoyed by San Joaquin Valley residents and the millions of visitors that visit this landscape.

ALIGNMENT WITH OTHER GOALS AND OBJECTIVES

Program work has been carefully considered to ensure alignment with the Forest Service's National Strategic Goals, the "Business Plan for the Sierra National Forest" (2006), the Collaborative Forest Restoration Act, and the goals/objectives of the Collaborative Group (Dinkey Project Planning Forum, DPPF) and other law, regulation and policy.

Key factors considered include:

1. Reduce the risk from catastrophic wildland fire. Restore the health of the Nation's forests and grasslands to increase resilience to the effects of wildland fire.
2. Conduct broad landscape restoration for sensitive resources.
3. Reduce impacts from invasive species. Restore the health of the forest to be resilient to the effects of invasive insects, pathogens, plants, and pests.
4. Improve watershed condition. Increase the number of forest and grassland watersheds that are in fully functional hydrologic condition.
5. Create value added investments of Federal and private funding.

ACCOUNTABILITY AND REPORTING

In a long term project with complex funding (many sources) it is imperative to have accurate and consistent accounting and reporting. The Sierra NF has chosen a three prong approach that uses existing accounting/reporting systems and is responsive to established requirements. This includes existing Federal reporting systems including such as Work Plan, Transaction Registers, Timber Information Manager (TIM), the reporting requirements in the CLFRA itself; established reporting that is integral to the private industry accounting practices; and lastly, we have added a yearly accounting review to the Collaborative Group.

1. Reporting through federal systems such as Work Plan will be continued. This will include preliminary Work Plans, mid-year review, and end of year fiscal reports. The CFLRA requires annual reporting of performance measures from the "10 Year Comprehensive Strategy Implementation Plan" (2006) which will also discuss changes to wildfire management and ecological restoration treatments over time.
2. Corporate Spending will continue utilizing their internal accounting systems, to reduce the burden of cooperating organizations with extra reporting. Additional Reports, as required, will be forwarded as a measure of the "investment" by other institutions which affect the landscape and program.

3. Finally, to ensure that Collaborative Group stay involved yearly reporting to the group and will bring into account the larger concepts of "investments" and "benefits" that we presented earlier. This is to ensure that the monitoring can make real time adjustments over the ten year time period of the project.

INVESTMENTS (Synergy and Multipliers)

Federal Funding (Monitoring of owls and fisher, prescription burning program for restoration, Stevens act, ARRA, Subsequent projects, Stewardship contracts (Dinkey N&S), and recreation.

Private Funding (bio-gen plant, lumber mill, monitoring on private lands, timber sales on private lands, vegetation management on private lands).

BENEFITS

The definition of "benefits" to include and capture many valuable non-monetary benefits the program might implement. This allows discussion with the public concerning direct cost savings of fire suppression and reduced property damage, to equally important benefits of clean air, water, and healthy lands enjoyed by residents of the San Joaquin Valley, and millions of visitors. There are obvious benefits of keeping the industry supplied with a reliable volume of wood products vitally important to the economic and social setting of California communities. However, as we manipulate vegetation in a manner consistent with the latest and best science we can improve crucial habitat for the pacific fisher, California spotted owls, Yosemite toad, western pond turtle, and many other wildlife.

This program will provide jobs. Endemic unemployment in Fresno, Tulare, and Kern Counties is 11+% (California 9.9%); 22% of the population and 18% of families live below the poverty level; per capita income is 17% less than the national rate; and the ratio of poor to rich is 3 times the California rate.

Efficient processing facilities are crucial to society. Ready markets for forest production needs to be maintained as significant volumes of hazardous trees on private and federal lands need treatment.

LETTERS OF SUPPORT

The Collaborative Group continues to develop relationships with industry to coordinate needs, and community representatives and the Fire Safe Council are integrated to ensure management is based on good science, restoration of the landscape, and responsiveness to the local communities. Letters of support are attached from key industries such as Sierra Forest Products (Terra Bella sawmill) based upon their participation in the Collaborative Group, "Employment at the sawmill is 130 people… this project will provide many jobs for those working in the woods. I would estimate this project will provide jobs for 25 loggers and 16

truck drivers. With the multiplier effect, the project will certainly have a positive economic impact on both Fresno and Tulare Counties."

# APPENDIX B

## Strategy Application

Collaboration based on the Dinkey Planning Forum approach. The collaboration involves interested parties on and off the Ranger District, local agencies and large private landowners in two critical functions of implementing the DLRP.

Planning Forum Members & Interests Represented

| | Forestry | Environmental | Air | Wildlife | Tribal | Fire | Industry | Governmental | Land-owner | Youth |
|---|---|---|---|---|---|---|---|---|---|---|
| **Rich Bagley** | X | | | | | X | | | X | |
| **Sue Britting** | | X | | X | | | | | | |
| **Kent Duysen** | X | | | | | | X | | | |
| **Larry Duysen** | X | | | | | | X | | | |
| **Patrick Emmert** | X | | | | | | | | X | |
| **Lisa Gymer** | | | | X | | | | X | | |
| **Ray Laclergue** | | X | | | | | | | X | |
| **Daniel Martinez** | | | X | | | | | | | |
| **Scott Nester** | | | X | | | | | | | |
| **Ray Porter** | X | | | | | | | X | X | |
| **Ramiro Rojas** | X | | | | | | | X | | |
| **Craig Thomas** | | X | | X | | | | | | |
| **Gary Torres** | X | X | X | X | | X | | X | | |
| **Resource Conservation District** | | | | | | | | | X | |
| **Tracy Rowland (BLM)** | | | | | | | | | | **X** |

1. Planning

   The collaboration approach would build on the successful effort known as the Dinkey Project Planning Forum. In 2009 over six months, the Planning Forum developed two projects within the DLRP (Dinkey North and Dinkey South to be implemented in 2010). The Planning Forum developed the proposed action to implement the strategy identified in PSW-GTR-220. Project implementation focuses on public and fire fighter safety; management for Pacific fisher habitat and restoration of forest structures; and maintenance of California spotted owl habitat.

   The Planning Forum is a group representative of all the diverse interests in the forest: forestry, industry, ecology, wildlife, fire safety and landowners. Planning Forum members provide milestone briefings to constituents to ensure support for planning outcomes beyond Forum membership. The Planning Forum relies on technical resource specialists that include fisher experts, the PSW-GTR-220 researchers, and the Sierra's public affairs officer. The Planning Forum also has a technical subcommittee with an in-depth knowledge of fire, forest ecology, wildlife habitat and silviculture. This subcommittee develops detailed proposals for the full Forum's refinement and approval.

   With the decision to consider a landscape-scale project, the collaborative is expanding its membership to engage more fully the nearby tribal government, representatives of the biomass industry, communities in the project area, county government, economic development organizations, and the Bureau of Land Management. The forum is a consensus-seeking body. The definition of consensus spans the range from strong support to abstention or "standing aside." If unable to reach agreement (although this has not occurred to date), the group forwards the outcomes of its discussion for the Sierra National Forest to consider in the final outcome.

   Another result of the collaborative planning would be ten-year comprehensive goals.

2. Monitoring

   The Planning Forum would participate in monitoring efforts, calling upon its technical resource experts to interpret and present data throughout implementation. Monitoring would be used to access Dinkey North and Dinkey South and adapt the strategy as appropriate over the course of the life of the DLRP, including the collaborative Planning Forum's efforts. Monitoring would be essential to sustain the broad range of stakeholder support and engagement.

   The Dinkey Project Planning Forum has identified a process for developing restoration actions and NEPA implementation for scheduled treatment areas (2011 to 2020). The planning forum will use an assessment process to evaluate site-specific restoration needs for sensitive species, fuel conditions, and ecological processes, and recommend specific

actions to address the identified needs. The treatment schedule includes mechanical and prescribed fire restoration treatment years interspersed with monitoring. Monitoring results and ongoing scientific studies in the project area are incorporated through the collaborative process into future management. This schedule allows the collaborative group to engage fully in multi-party monitoring and adaptive management.

The Kings River Fisher Project (KRFP) monitoring effort, California spotted owl demographic study, the Teakettle Experimental forest, and Kings River Experimental Watersheds are found within or adjacent to the DLRP area. These research and monitoring efforts provide a unique setting for science lead research and monitoring to inform restoration treatments.

The KRFP was initiated in 2007 to fill gaps in our current understanding of fisher ecology and habitat requirements and address uncertainty surrounding the effects of timber harvest and fuels treatments on fishers and their habitat. KRFP is found within the DLRP area on both private and NFS lands using several monitoring techniques in a spatially nested design. Since February 2007, 59 fishers have been captured, with 57 of these radio-collared. KRFP provide monitoring of fisher and DLR treatments.

The California spotted owl demographic study was initiated in 1990 to estimate spotted owl reproduction, survival, and population rate of change and to examine the effects of habitat and habitat alteration (timber harvest and fuels treatment) on these parameters. The estimated population rate of change for spotted owls within the study area is not statistically different from a non-declining population. In 2009, 34 spotted owl pairs were found, 25 of which fledged young. Surveys are ongoing in the DRL Project area and will provide monitoring of spotted owls in the proposed 2010 DLRP treatment areas.

The Teakettle Experimental Forest is adjacent to the DLRP boundary. Foundational Research within Teakettle provides information on how fundamental ecosystem processes respond to fire and thinning disturbance. Studies are focused on primary alterations in forest conditions. PSW/NAU Teakettle Carbon Stocks research that will be taking place in the next three years is immediately adjacent to the DLRP area. This carbon stocks study will provide current science information as to carbon sequestration following thinning and burning treatments similar to those proposed in restoration areas.

The Kings River Experimental Watershed (KREW) is a watershed-level, integrated ecosystem project for headwater streams in the Sierra Nevada. Eight sub-watersheds have been chosen and fully instrumented to monitor ecosystem changes to streams adjacent to the DLRP boundary. Watersheds are located in two groups; mixed-conifer forest, and red fir/mixed-conifer. Treatments with these experimental watersheds will provide guidance to treatments within the DLRP boundary.

Two Yosemite toad studies are also being conducted within the KREW area. Several years of movement data has been collected to establish patterns subsequent to breeding and

habitats utilized for foraging. The second study is using piezometers to establish water level within meadows utilized by Yosemite toad for breeding. The study will continue after the various treatments to identify whether the water table is affecting breeding habitat as a result of the restoration treatments.

The Dinkey Planning Forum, which includes scientific technical advisors, will assess successful implementation through improvements in fuels reduction, evaluation of burning program (acres burn vs burning results), evaluations of habitat improvements planned versus actual, and evaluation of restoration treatment effects to California spotted owl and Pacific fisher habitat use, landscape-scale movements, and demographics. The Dinkey Planning Forum will issue a monitoring report annually and host a 5-year symposium.

NEPA documents currently take advantage of the HFRA. Project planning and monitoring would follow the collaborative planning process:

- Collaborative group develops stand level desired conditions and proposed actions through consensus process
- Technical advisors review key species structures and habitat information conduct surveys when necessary
- Forest service develops appropriate NEPA document for implementation
- Monitoring occurs
- Technical advisors summarize monitoring and/or survey information
- Continue to involve the fisher scientists, authors from the Ecosystem Management Strategy General Technical Report and other scientists, as appropriate, to advise on the collaborative forum's recommendations
- Collaborative meets annually with the monitoring program to learn about the newest science and understanding gained through their efforts in the project area.
- Collaborative reviews stand level desired conditions and develop proposed action based on previous years monitoring.
- Hold a science panel in years 2015 and 2020 to interpret data and appropriate adaptive management.

A. Conducting the Strategy- Schedule

1. Mechanical Restoration Treatments

Restoration treatments are scheduled to occur every other year during the 10 year planning period. NEPA documentation and decisions for restoration treatments that occur in 2010

will be complete in June of 2010. Implementation will occur in 2010 using stewardship authority and service contracts.

Table 4 displays the year of treatment, gross treatment acres for management units (project areas) treated in each year. Treatments within these management units include mechanical harvests, hand cutting, biomass removal, prescribed fire, and tree planting.

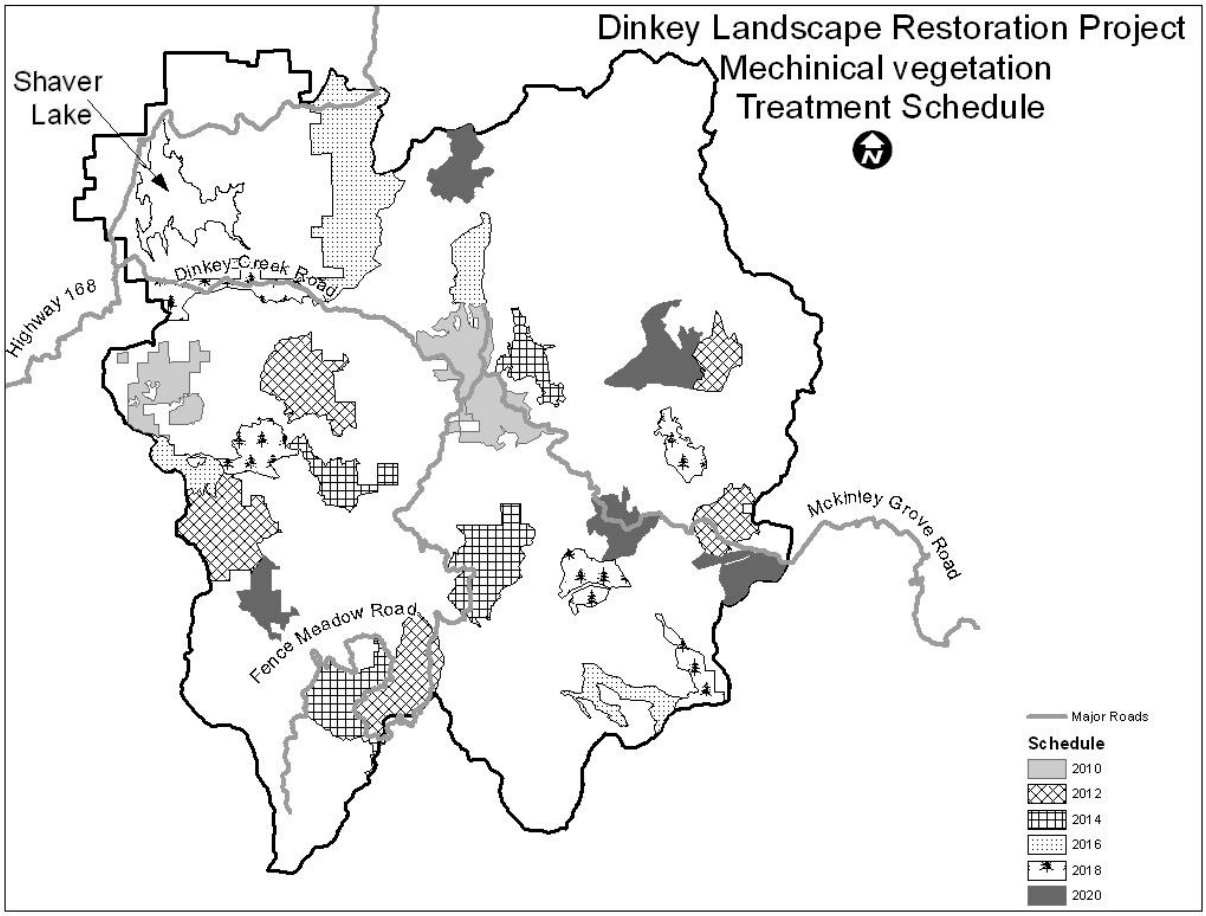


Figure 1: Mechanical Treatment Schedule Across the Dinkey Landscape

2. Fire resilience treatments -Prescribed Fire Treatments/ladder fuel removal

Fire resilience treatments are proposed to occur each year of the decade. Reintroduction of fire and fire resilience treatments have occurred on 3052 acres in fiscal year 2010. Prescribed fire is proposed to occur in fiscal years 2011 to 2013 without pretreatment of small diameter ladder and understory fuels. Beginning in 2014 pretreatment of prescribed fire areas will occur. This treatment will pre-treat strategic prescribed fire control areas.

This will be in portions of conifer stands amenable to mechanical removal. Removed material will be transported to biomass plants.

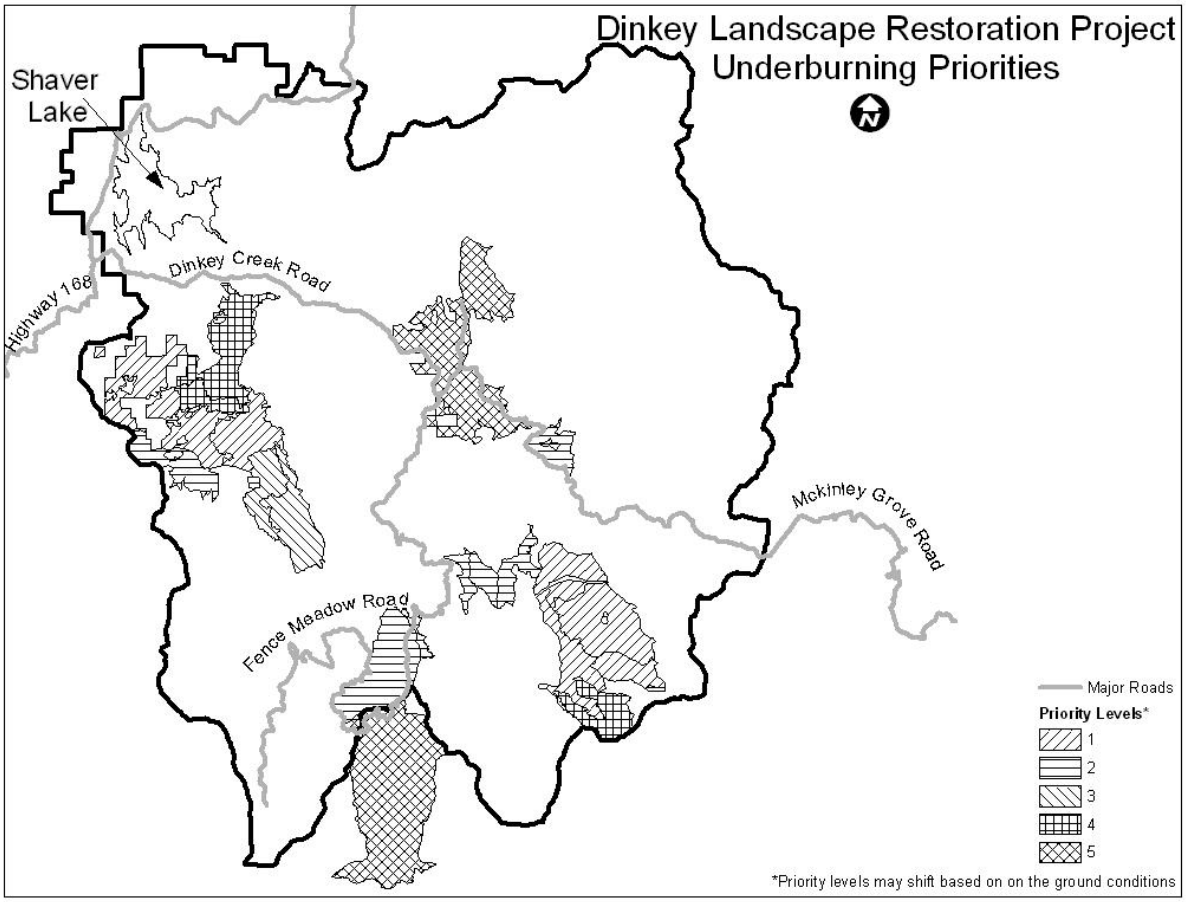


Figure 2: Underbuning priorities Across the Dinkey Landscape

3. Watershed and riparian habitat Treatments

Watershed restoration treatments targeted to hydrologic function and riparian habitat occur early in the 10 year planning period. Hydrologic function treatments are targeted in watersheds over threshold of concern for cumulative watershed effects. Four watershed restoration plans were identified in the Providence Creek (1976 acres), Bear Meadow Creek (3858 acres) and Rush Creek (10,387 acres), HUC 7 watersheds. Totaling benefitting acres in these watersheds are 16,221 acres. Treatments with in watersheds over threshold begin in fiscal year 2011 and continue through year 2013. These treatments will also mitigate the impacts from restoration treatments within these same watersheds.

In order to meet the desired condition of healthy functioning watersheds, clean water and improved aquatic habitat, watershed restoration treatments include removal of encroaching conifers, reshaping unstable slopes, stabilizing gullies in meadows, subsoiling

and installing water bars on skid roads, clearing and cleaning culverts, and abandoned roadbeds and skid trails.

Meadow and riparian area restoration treatments are schedule to begin in year fiscal year 2014 and continue until 2018. These treatments are designed to reduce conifer encroachment, increase willow and aspen along meadow edges. In stream riparian treatments will repair head cuts and restore hydrologic function in individual meadows indentified through project level evaluations.

4. Plantation Maintenance

Plantation treatments are designed to accelerate the creation of old forest characteristics in plantations. Treatments will reduce tree density, reduce brush cover, create additional age classes and increase within stand heterogeneity.

5. Noxious Weed/invasive species Treatments

Noxious weed and invasive species control and eradication treatments will use a variety of tools to accomplish the objectives. Hand, mechanical and chemical tools are available for use to control or eradicate noxious weeds. It is expected that retreatment will need to occur on the currently identified 57 acres.

Treatments begin in fiscal year 2010 with eradication of Bull Thistle (*Cirsium vulgare*), Hoary mullen (*Verbascum thapsus*), and cheat grass (*Bromus tectorum*) found in mechanical restoration treatments proposed for latter in fiscal year 2010.

Subsequent years will remove populations of fox glove (*Digitalis purpurea*), Spanish broom, and yellow star thistle (*Centaurea solstitialis*).

Table 1 below describes the acres of treatments by fiscal year.

| Year | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | Totals |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Mechanical Restoration-acre** | 3100 | 0 | 8314 | 0 | 5964 | 0 | 7083 | 0 | 4754 | 0 | 5277 | 34,492 |
| **fire resilience pre-treatment acre** | 0 | 0 | 0 | 402 | 651 | 600 | 600 | 600 | 0 | 0 | 0 | 2853 |
| **Rx fire-acres** | 3052 | 4541 | 7881 | 2679 | 4342 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 46,495 |
| **Watershed Restoration-acre** | 0 | 5150 | 5150 | 3858 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14,158 |
| **Road Decommission Miles** | | 2 | | | | 2 | | 2 | 2 | | | 8 |
| **Meadow Riparian Habitat acres** | 0 | 0 | 0 | 0 | 50 | 100 | 225 | 50 | 0 | 0 | 0 | 425 |
| **Plantation Maintenance acre** | 230 | 600 | 800 | 1200 | 900 | 1200 | 1200 | 1200 | 1200 | 1200 | 1200 | 10930 |
| **pine/oak Regeneration acres** | | | 93 | 0 | 249 | 0 | 179 | 0 | 212 | 0 | 143 | 876 |
| **Invasive species eradication or control acres** | 4 | 4 | 5 | 45 | 45 | 45 | 45 | 5 | 5 | 5 | | 208 |