Yosemite Stanislaus Solutions Collaborative Landscape Strategy

March 2013

Picture Descriptions, clockwise from top right

Top right – California spotted owls
Next right –Mi-Wok Ranger District
Smaller right – Faust Cabin Meadow, Mi-Wok Ranger District
Bottom right – Clavey River
Center bottom – Clavey River
Lower left – Small logs, Granite Stewardship, Groveland Ranger District
Smaller left – California mule deer
Upper left – Overly dense ponderosa pine plantation, 1987 Stanislaus Complex, Mi-Wok Ranger District
Backdrop – Recently thinned forest with pine regeneration and varied habitat

Executive Summary

Of all the natural areas in America, the Yosemite region is known worldwide for the scenic beauty of its mountain landscape and for its snowmelt-driven waterfalls. Over four million people visit Yosemite National Park each year, and millions more benefit from recreation in the nearby lands of the Stanislaus National Forest and Bureau of Land Management. Countless people in the San Francisco Bay Area and the Central Valley depend upon the Yosemite region as a prolific source of pure, fresh water. The area is truly iconic in many ways.

And yet, this broad region west and northwest of Yosemite National Park is also unique for having suffered intensely through massive wildfires that have significantly degraded the ecosystem and damaged important watershed values. This region is the Yosemite Stanislaus Solutions Collaborative Landscape Area (YSS Landscape). Naturally, the region features dry foothill grasslands and chaparral that rise up into oak woodlands and then into moist conifer forests. Over recent decades, however, epic wildfire conflagrations have consumed vast areas of the forest habitat and have set back natural processes outside of the range of natural variability. Wildlife, water quality, recreation, and the economic vitality of the region's business industries have all suffered.

The challenges presently facing this landscape go beyond the devastating effects from having more than a quarter million acres suffer high severity fire over the past three decades. Historic runs of salmon and steelhead are extirpated in the region, and many other native fish and amphibian species are at high risk. The extremely large and popular great gray owl (*Strix nebulosa*) is just one example of rare wildlife that is also in need of assisted recovery. Sedimentation into streams and rivers from eroded route segments needs to be reduced. Many ecosystem challenges combine to exacerbate individual impacts to the area's resources.

Yet the potential for significant recovery and speedy restoration is extremely high. Despite decades of inadequate funding for rehabilitation and maintenance work, the public land agencies of the region are engaged, collaborating, and aligned.

The skill sets and technical capacity of the private work force in the region are also extremely positive. An extremely diverse coalition of organizations, citizens, and government bodies is working together in a collaborative process to accomplish effective strategic planning.

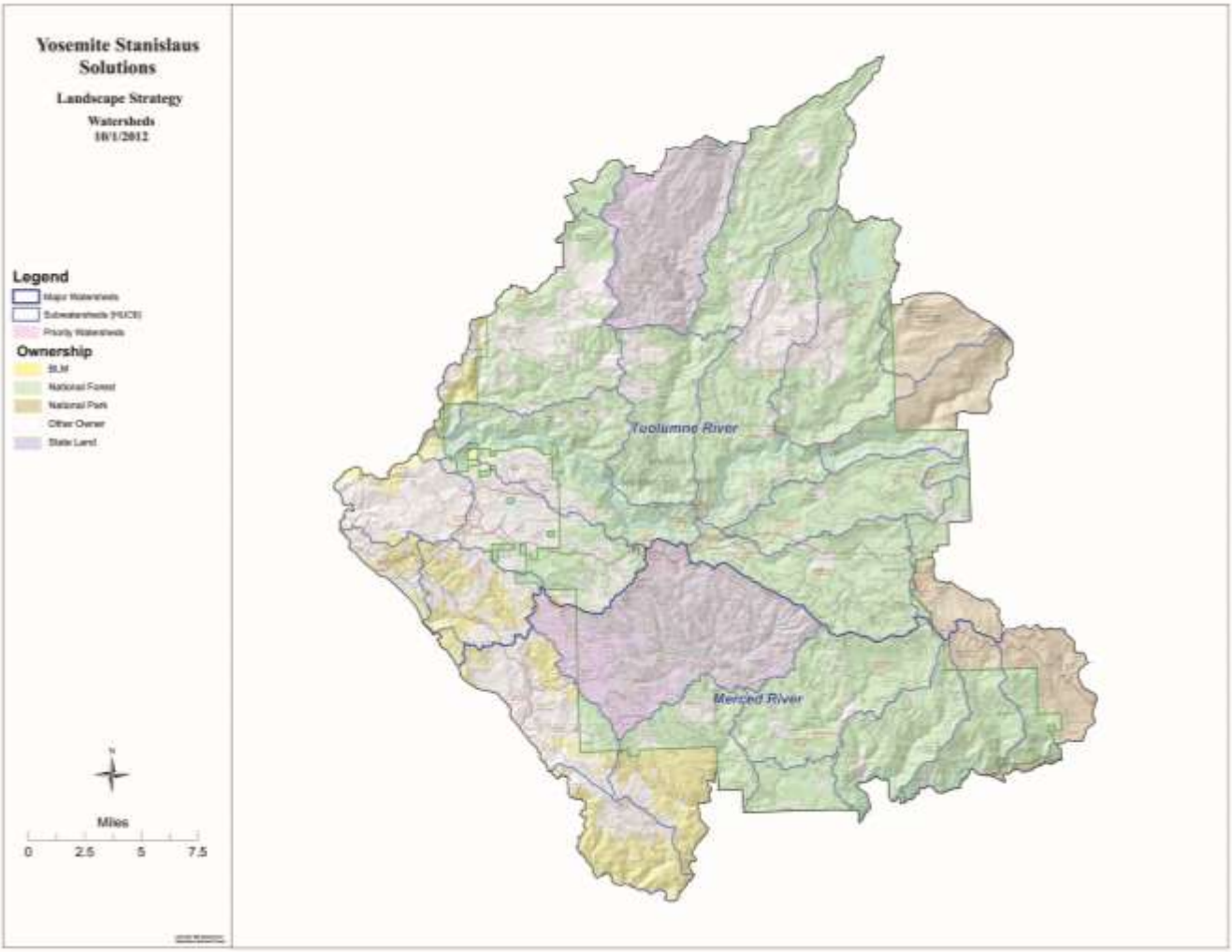
What is now needed to make huge strides for this iconic region is pivotal funding and focused support from agencies and the private sector that can assist the YSS collaborative to rehabilitate the health of this important, highly popular area. Work done to restore this intensely visited landscape would not only directly benefit the region. It could also serve as a visible example for millions of annual visitors – showing what can be done to transform a region. This Landscape Strategy outlines the need, the vision, and the YSS community's commitment to make that happen.

Table of Contents

1. Introduction and Designation of the Landscape Area

The Yosemite Stanislaus Solutions (YSS) Landscape is a highly complex landscape strategically located on the western edge of Yosemite National Park and the southern edge of the Stanislaus National Forest. The Landscape is comprised of public lands managed by the Bureau of Land Management (BLM), National Park Service, Forest Service and land owned by Tribal and private partners. Elevations range from approximately 800' on BLM chaparral to 7,990' in the Bourland Creek Headwaters of the Stanislaus National Forest (Figure 1). The northern boundary of the Landscape includes the headwaters of the Clavey River that flows into the renowned Tuolumne River which traverses the heart of the Landscape. The southern portion of the Landscape is bounded by the Wild and Scenic Merced River. Within the Stanislaus National Forest portion of the Landscape, two Priority Watersheds – Middle Clavey River and Bean Creek/North Fork Merced River – have been designated (Figure 1).

Figure 1. YSS Landscape area with Stanislaus National Forest Priority Watersheds.



The Tuolumne River watershed is a significant aspect of the Landscape, in that it supplies extremely clean, high-quality drinking water to the citizens of one of California's largest cities, San Francisco. Twenty-nine miles of the Tuolumne River which are designated Wild and Scenic are within the Landscape. Overall, the Landscape encompasses 427,915 acres, of which 268,481 acres are National Forest. Over 30,000 acres can be attributed to Yosemite National Park, often referred to as the "crown jewel of the National Park System".

In recent decades, large, damaging fires have posed a threat to communities as well as challenges for our land managers who desire to protect water quality, wildlife, recreation and other resources, while at the same time providing economic opportunities. The Landscape has a long history of large fires which now require substantial restoration to bring them to a state of fire resilience, ecological health, and economic viability.

2. Ecological Significance of the Landscape

The YSS Landscape is uniquely positioned to provide substantial benefits from ecological restoration efforts. The vast areas that have been impacted by large wildfires are in need of restoration including improving the health and resilience of plantations so these areas can become our forests in the future. Many of these plantations are near communities, thus creating defensible spaces for protection of human life and property during future wildfires is needed.

Another goal of this strategy is restoring mature forest ecosystems to provide habitat connectivity across the Landscape and with consideration of adjacent habitat. Improving connectivity of mature forest wildlife habitat from Yosemite National Park across eastern and northern portions of the YSS Landscape would be beneficial to species such as the California spotted owl (*Strix occidentalis occidentalis*) and northern goshawk (*Accipiter gentilis*), as well as facilitating a potential northward progression of the Pacific fisher (*Martes pennanti*).

These mature ecosystems have the potential to become more resilient to future wildfire, thus ensuring a diverse forest structure within the Landscape. As a result, the economic vitality of the region would be increased by the goods and services a resilient forest ecosystem would provide into the future. Locally, the industrial infrastructure exists to produce a myriad of products. Sustaining a resilient forest, while supporting local communities and enhancing local economies, is a desired outcome of implementing the Landscape Strategy.

The great gray owl (*Strix nebulosa*), a species which occurs here in this landscape and in very few other California locations, would benefit from a restored landscape. These great gray owls are part of a very small population (200-300 individuals) that has been identified as a new sub-species, genetically distinct from great gray owls to the north, which occurs almost exclusively on the Stanislaus National Forest and Yosemite National Park

The Tuolumne (Jawbone) and Yosemite Deer Herds would be other beneficiaries of our restoration efforts. California mule deer are an important game species occupying this landscape and have been experiencing local population declines for the past several decades. The two herds occupy various habitat types throughout the year, depending heavily on the critical winter habitat located in the lower elevations. In many areas large mast producing oaks were burned in recent fires and have not produced a substantial acorn mast in recent years. Personal observations (Maddox) following the 1987 Stanislaus Complex of fires indicate that although black oaks generally re-sprouted vigorously, it took about 13 years for the oaks to start producing acorns and 21 to 22 years to really get back to good acorn mast production.

Restoring forest ecosystems and improving watershed conditions would sustain high-quality water availability for domestic and agricultural uses. The Tuolumne River and Merced River provide water to millions for domestic and agricultural uses, as well as providing world-class recreational opportunities and aquatic habitat.

The challenges facing the YSS Landscape are of a magnitude which requires a concerted landscape approach and our efforts will generate benefits in a multitude of areas.

3. Current and Historic Condition Descriptions

3.1 Ecological types

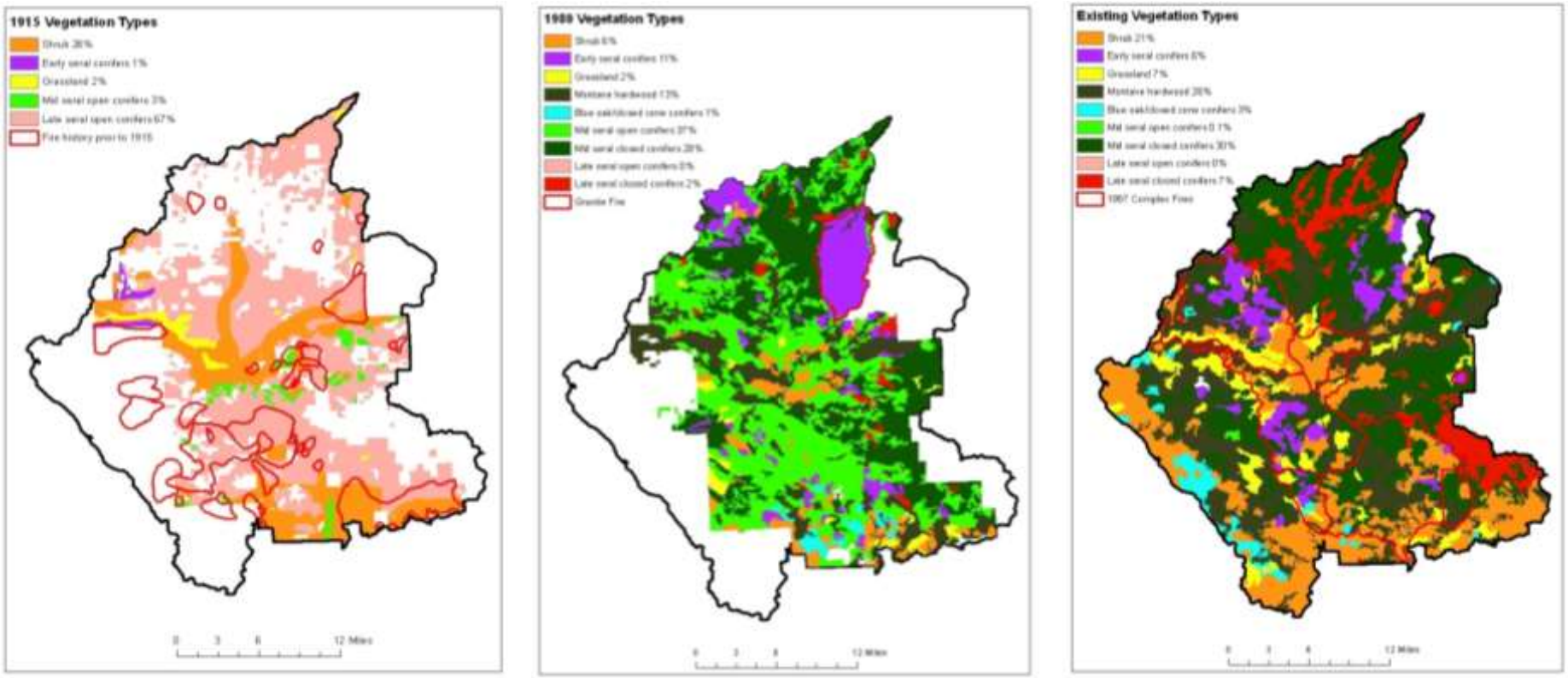
Historical Context

Early history in the Landscape saw the prevalence of the Native American Me-Wuk. These early land managers played a considerable role in shaping the ecological landscape. Proactive burning to maintain travel corridors and food resources resulted in a forest resilient to fire and pests, prolific wildlife and native plant communities, and extremely large trees, the likes of which early European settlers had never seen.

As westward expansion began, the setting of the Landscape changed from Native American management, with predominant activities evolving into mining, logging, and water infrastructure development. Over time, low intensity fire did not occur, and the current condition of forests in the Landscape can be attributed in large part to the absence of this type of fire over the last century.

The dominant pre-European forest structure across the YSS Landscape would have been mostly late seral open canopy forests with a heterogeneous landscape structure consisting of groups of similar aged trees and openings dominated by young conifer regeneration, shrubs, and other herbaceous plants. This structure was a relic of recurring fire on the landscape which created patches and openings (Figure 2).

Figure 2. Landscape disturbance characterized by changes in vegetation cover from 1915, 1980 (pre-1987 fires) and existing vegetation.



All fires prior to 1915 were overlaid on the 1915 vegetation cover map. The Granite Fire which burned in 1973 is overlaid on the 1980 vegetation cover map. The footprint of the 1987 Stanislaus Complex is overlaid in red on the existing vegetation map to illustrate changes in the landscape due to occurrences of wildfires. On the existing vegetation map, early seral conditions exist in the early seral conifer, shrub, and grassland cover types and make up about 34% of the landscape. The reader should note that there are differences in the techniques of the three vegetation maps allowing only broad conclusion to be drawn within the YSS boundary. In addition, each map is a snapshot in time and is reflective of the disturbance that existed prior to the mapping endeavors.

Current Conditions

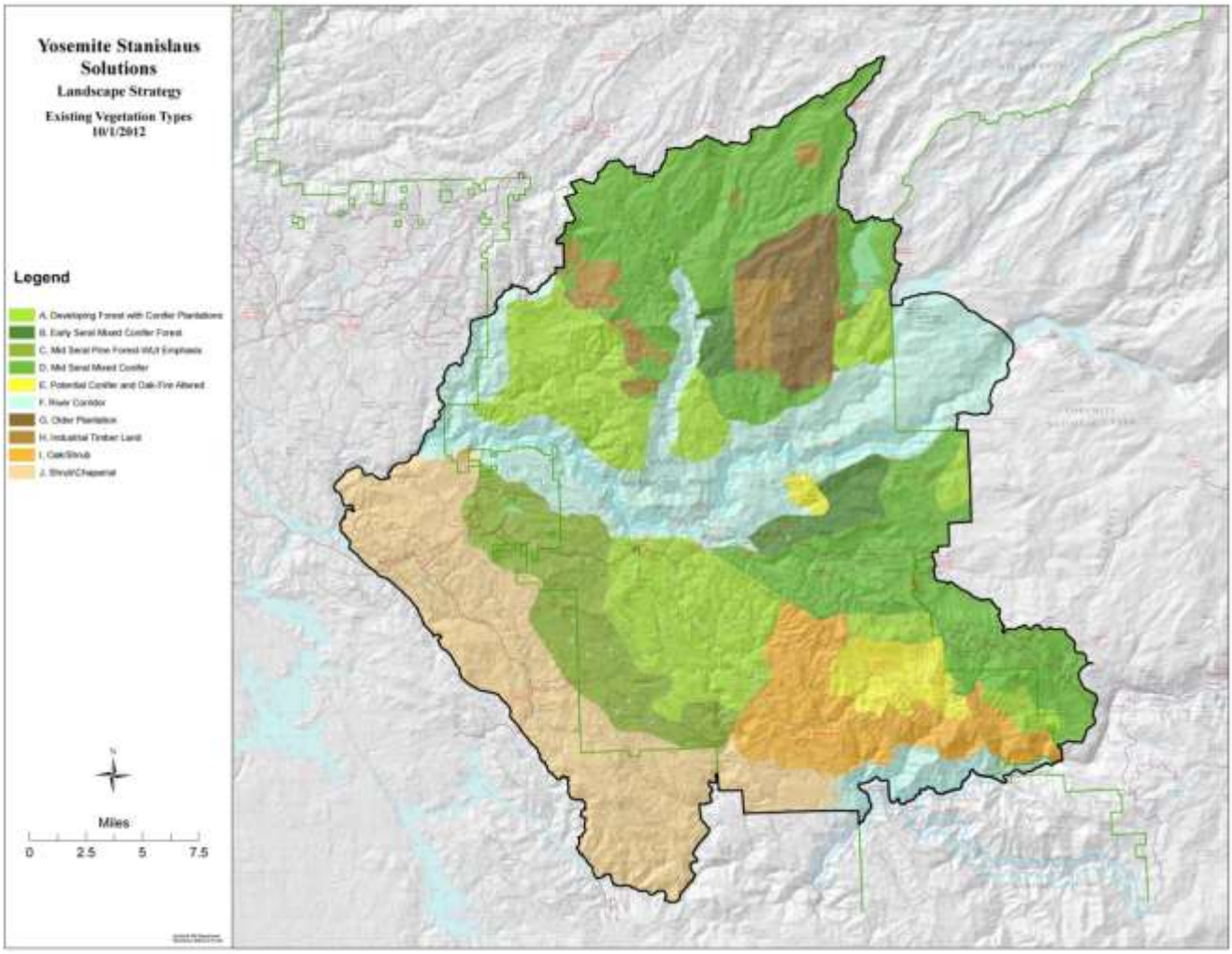
The YSS Landscape today includes a mosaic of ecological vegetation types from shrub and chaparral, ponderosa pine and black oak in the lower elevations, mixed conifer forests in the mid elevation, and red fir at the highest elevations, consistent with natural ecological transition from valley floor to higher elevations in the Sierra Nevada (Table 1 and Figure 3). For the purpose of this strategy, classification of ecological types follows this elevational gradient, classifying areas based on general conditions and species compositions (i.e. vegetation structure). The ecological type classifications also reflect relatively recent effects of ecosystem processes (e.g. wildfire) and land management (e.g. conifer plantations vs. natural stands). These classifications provide a broad description of the landscape and are not intended to provide a fine-scale account of the landscape.

Table 1. Current vegetation types within YSS Landscape.

Vegetation/Ecological Types	Acres	% of Landscape Area
Developing Forest with Conifer Plantations	66,952	15.6%
Early Seral Mixed Conifer Forest	10,186	2.4%
Mid Seral Pine Forest-WUI Emphasis	30,870	7.2%
Mid Seral Mixed Conifer Forest	99,202	23.2%
Potential Conifer and Oak – Fire Altered Landscape	11,704	2.7%
River Corridors	83,579	19.5%
Older Plantation	13,734	3.2%
Industrial Forest Land	11,302	2.6%
Oak/Shrub – Altered by Fire	28,742	6.7%
Shrub	71,644	16.7%

Devastating wildfires have altered vegetation species composition, structure, and density throughout this landscape. Most notably, the 1987 Stanislaus Complex of fires affected much of the landscape, killing large areas of the vegetation and leaving few green trees in its path. In subsequent years, the Forest Service reforested large portions of this burned area as well as reforesting other fires that occurred in the 1990s. Site preparation followed by planting of ponderosa pine interspersed with a variety of other conifer species, occurred on approximately 32,000 acres of the most accessible and productive acres. Despite this reforestation effort, the sheer size of this uncharacteristically large burned footprint on the landscape made it impossible to reforest all areas that had previously been dominated by conifer forest.

Figure 3. Current vegetation types within the YSS Landscape.



The developing forest of reforested areas burned since 1987 includes an array of vegetation assemblages of mixed oak, brush and conifer plantations. Tree sizes range from 4-16 inches in diameter with few isolated pockets of larger, remnant conifers and oaks that survived past wildfires. Conifer plantations are typically located on ridges or areas with gentle slopes that were conducive to mechanical site preparation and planting operations. Most draws and steep slopes are dense with black oak, canyon live oak, and/or brush species. Conifer plantations intermixed with well-established oak and brush species are also common along transitions between steep to gentle slopes or draws and ridges. Approximately 25,000 acres of the YSS Landscape that had been conifer forest or conifer/oak forest prior to 1987 have not been reforested. Brush and oak quickly re-sprouted and have since regained most of their pre-fire canopy cover.

Mid seral mixed conifer areas currently have the largest trees in the YSS Landscape meeting several California Wildlife Habitat Classifications (CWHR) based on tree size and canopy closure. Natural mixed conifer forest that has not experienced the effects of recent fire is mostly found in the eastern and northern regions of the Landscape. In general, these areas have relatively high tree densities with canopy closure ranging from moderate (40 to 59%, CWHR M) to dense (60 to 100%, CWHR D). Mid seral mixed conifer forest stands in this Landscape support small trees ranging from 11 to 24 inches in diameter (CWHR 4) to medium and large trees with diameters greater than 24 inches (CWHR 5). Forest vegetation is primarily even-aged and structurally homogenous with species composition changing with elevation. Fir species are more prevalent than pine species with increasing elevation, partly due to historical logging that targeted pine. The eastern half of the Landscape, from Crane Flat in the south to Bourland Creek in the north, forms a band of mid seral mixed conifer forest that connects large areas of this habitat in Yosemite Park with large areas denser forest to the north. Many areas currently support habitat suitable for late-seral dependent species, as evidenced by northern goshawk (*Accipiter gentilis*) and California spotted owl (*Strix occidentalis occidentalis*) protected activity centers (PACs) that include breeding locations and occur throughout the Landscape**.**

Early seral mixed conifer areas are dominated by dense small trees generally less than 16" in diameter (CWHR 1, 2, 3 and 4). These stands have reached a stage of maturity to successfully occupied most of the available growing space, resulting in tree densities that are relatively high with little understory vegetation. These early seral mixed conifer stands in the Landscape are capable of developing large trees, a diverse species mix and with relatively high canopy closure.

Older plantations within the landscape occur in the 1973 Granite Fire burned area. These plantations are comprised of pine species that currently range from 16" to 22" in diameter (CWHR 4), although these stands contain less diversity of habitat than that found within naturally occurring forested areas.

Potential Conifer and Oak – Fire Altered – Portions of the YSS Landscape, primarily in the southern region, which have a history of frequent fire have had very limited reforestation following fire. Shrub and chaparral vegetation types largely dominate this land although it is capable of sustaining a forested landscape. Large remnant conifer and oak species are scattered within this shrub dominated vegetation and often confined to drainages. Historic descriptions of this portion of the landscape indicate that in 1915 the area was characterized by open canopy forested conditions with large trees. The first aerial photos from 1944 support this description. Restoring these brush dominated, fire-altered areas within the Landscape to the type of structure and species assemblages that existed prior to the 1987 fires would entail reforestation, as well as implementing treatments to increase growth and vigor of the existing, scattered trees.

Meadows, oaks, aspen, and riparian areas in the YSS Landscape are important habitat for a variety of species, especially great gray owls. Small meadows are scattered across the Landscape and are threatened by conifer encroachment in the absence of low intensity fire, altered stream channels affecting hydrologic function and the effects of grazing. On the southern portion of the YSS Landscape, invasive plants are

prevalent and have displaced native vegetation capable of supporting rich wildlife communities. Dominant invasive plant species in these meadow systems include yellow-star thistle (*Centaurea solstitalis*), tocalote (*C. melitensis*) and medusahead (*Taeniatherum caput-medusae*), all of which are challenging to eradicate.

Aspen clones occur in meadow and riparian ecosystems of the YSS Landscape. Naturally rich in vegetative and wildlife diversity, the health of these stands is in decline due to the same factors that affect meadows, as well as the lack of low intensity fire that naturally stimulates stand regeneration and helps prevent weakened vigor of the aspen caused by pathogens that are common in mature aspen stands. Surveys of aspen in the Clavey River watershed were completed in the 1990s as part of the collaborative Clavey River Ecosystem Project (CREP). Results of this inventory indicate aspen has great potential for expansion and improved stand health to promote perpetuation of this important vegetation type in the YSS Landscape. The opportunity also exists to reduce invasive plant presence within aspen stands, promote native grasses and forbs and facilitate recruitment of blue oak

Restoration of hydrologic function is needed in meadows and riparian areas. Restoring stream channel geomorphology and riparian and meadow vegetation will increase groundwater storage capacity, improve water quality by reducing sediment loading and improve plant diversity and wildlife habitat. Where roads cross streams, restoration is needed to improve drainage from road surfaces and non-functioning culverts which will reduce flow velocity and associated sediment delivery to surface water and improve water quality.

3.2 Fireshed History, Fire Regime, Fire Behavior and Disturbance Regimes

Fire has always been a naturally occurring ecological process in California forests and within the YSS Landscape (Van Wagtendonk and Fites-Kaufman 2006). In early 1900, C.S. Fitch described effects of fires in Yosemite National Park as continuing for weeks with no notable damage to the large diameter trees with the exception of small portions of cedar and fir trees dying (Fitch 1900). Prior to the mid-1800s, fires burned at low to moderate severity and frequency (Skinner and Chang 2006), maintaining open stands of large trees with a diverse understory (Figure 4). At this time, forests within the Landscape were dominated primarily by fire-resistant coniferous species that exhibited high levels of vertical and horizontal heterogeneity (Show and Kotok 1924) due in part to frequently occurring low to moderate severity fires. Modern fire regimes have been altered by over a century of fire exclusion, extensive logging and a continually changing climate. These factors have contributed to a distinct alteration in forest composition and structure within the Landscape. More than half of the Landscape (250,000 acres out of 428,000 acres) has experienced the effects of wildfire since 1984. As a result, the YSS Landscape may be amongst the most intensely burned area of any in the country.

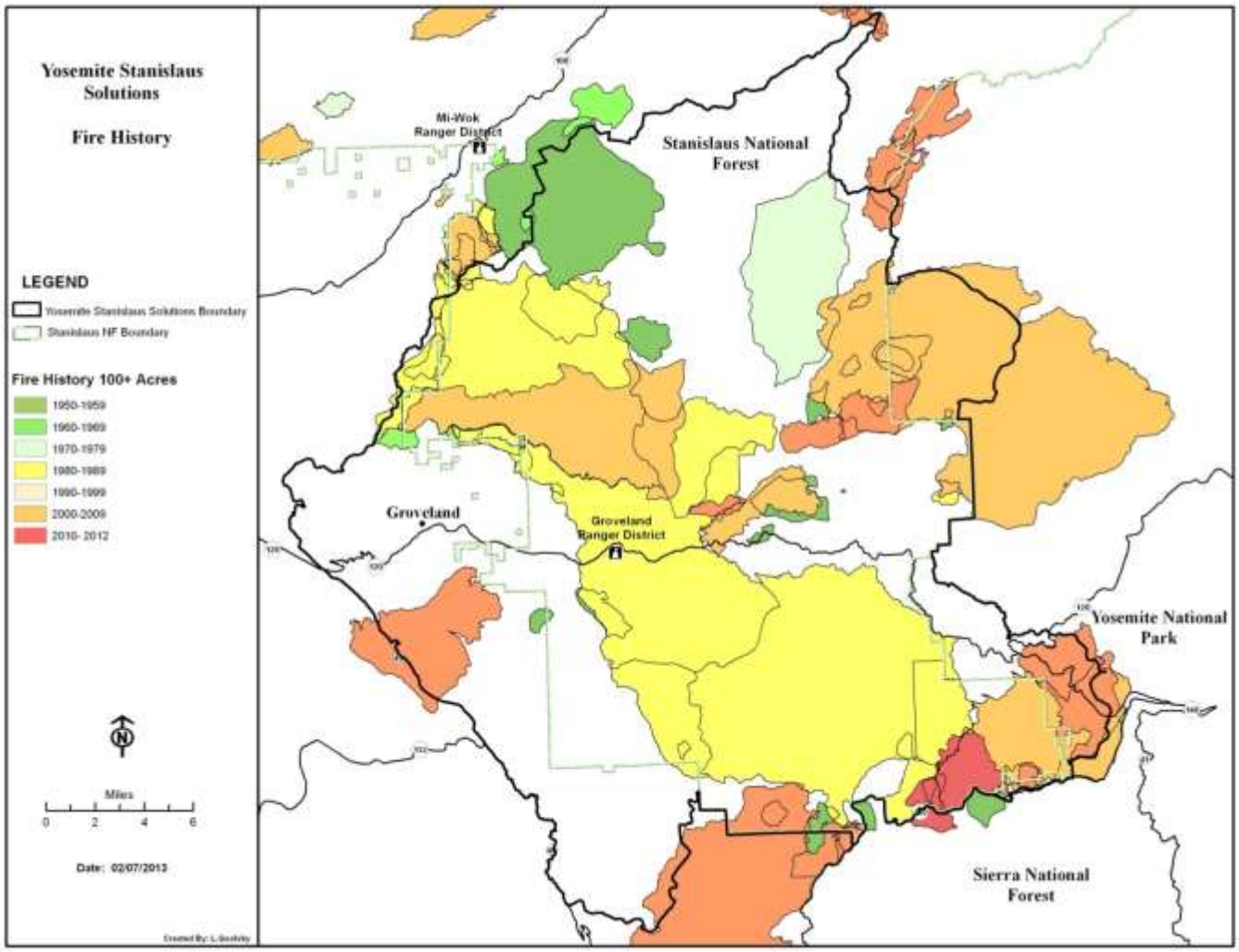
Figure 4. Ponderosa-sugar pine forest type with a groundcover of bear clover, located in Tuolumne County 3 miles south of Luke Camp in the footprint of the 1987 Stanislaus Complex fires. Note the heterogeneity in the stand and the man in the lower right corner for scale. Photo taken by Wieslander in 1941.

3.2a Fire History across the YSS landscape

Fires have been quite prominent across the YSS Landscape with human and lightning ignitions occurring throughout most of the area since 1908 when records were kept (FRAP database).

Fire is recognized as a keystone process in mixed conifer vegetation types that have been altered by decades of fire suppression. The majority of the human caused and naturally occurring lightning fires were easily suppressed in the early - mid 1900s, generally with burned areas less than 10 acres. Fires that escaped suppression efforts during this time burned under the most extreme weather conditions, resulting in large stand replacement fires. As a result of fire suppression small sized, low severity fires over the last 50 years has declined and the frequency of large stand replacement fires has increased in the YSS Landscape (Figure 5).

Figure 5. History of fires greater than 100 acres in size on the YSS Landscape over the past 50 years.



3.2b Fire Regime

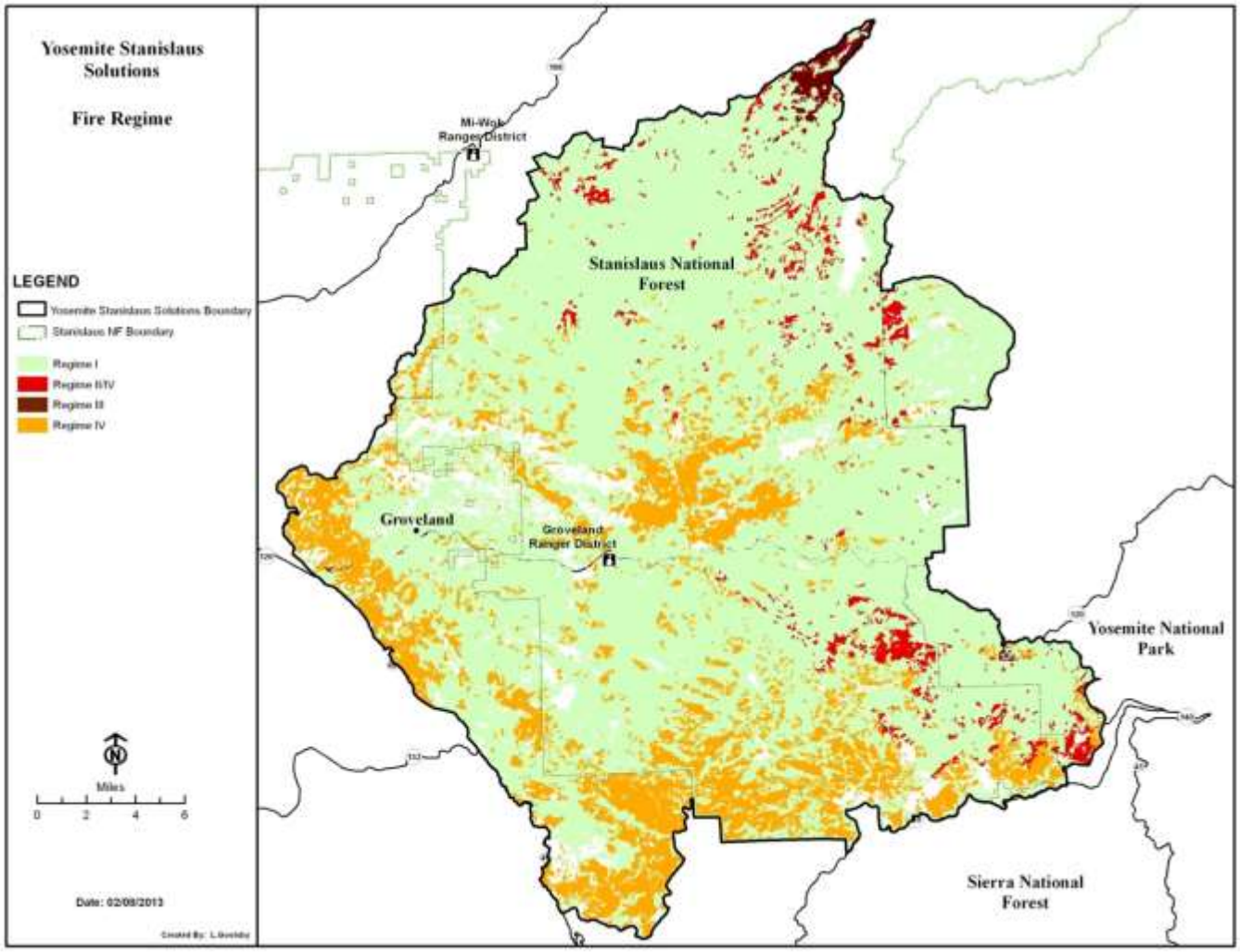
Natural fire regimes are characterized by the size, frequency, magnitude and severity of fires in the absence of modern human intervention for a given area. Natural fire regimes are often described as historical fire regimes because the influence of aboriginal burning included and are generally described as the role fire naturally plays across a landscape. The five natural fire regimes are classified based on average number of years between fires (fire frequency) combined with the severity of the fire on the dominant overstory vegetation (e.g., fire killed trees). These five regimes include:

- Fire Regime I – 0-35 year frequency and low (surface fires most common) to mixed severity (less than 75% of the dominant overstory vegetation replaced);
- Fire Regime II – 0-35 year frequency and high (stand replacement) severity (greater than 75% of the dominant overstory vegetation replaced);

- Fire Regime III – 35-100+ year frequency and mixed severity (less than 75% of the dominant overstory vegetation replaced);
- Fire Regime IV – 35-100+ year frequency and high (stand replacement) severity (greater than 75% of the dominant overstory vegetation replaced);
- Fire Regime V – 200+ year frequency and high (stand replacement) severity.

The fire regimes within the YSS Landscape have been altered from those that were prominent prior to Euro-American settlement (Stephens et al. 2007). Within the Landscape there are four distinct fire regimes that were dominant in the pre-European forests and are still evident in the existing vegetation (Figure 6).

Figure 6. Natural fire regime distribution across the YSS Landscape.



Fire Regime I was composed of forest types that burned quite frequently at low to mixed severity. Within this fire regime, the lower elevation ponderosa pine and black oak forest type would have had fairly

frequent fire occurring every 5-55 years (Table 3). At mid elevations, where dry mixed conifer was the dominant vegetation type the fire return interval would have been exposed to fire every 5-50 years while the more moist mixed conifer stands would have a fire frequency ranging from 5-80 years. At the highest elevations, red fir and sub alpine forests would be best represented by Fire Regime III and IV having typically mixed severity fires occurring every 15-130 years and 100-420, respectively.

Interspersed within the ponderosa pine, black oak forest type, chaparral vegetation types composed of various shrub species had a much longer fire return interval ranging from 30 – 90 years. Montane chaparral would have had a slightly shorter fire return interval. These shrub dominated systems typically burn at high severity as the above ground portions of the plant structures are completely consumed (Fire Regime II).

More oak dominated vegetation types such as the low elevation oak woodland and the mixed evergreen types would have burned at low to mixed severity. Oak woodlands had a relatively short fire return interval of 5-45 years while the mixed evergreen vegetation type would have occurred in lower slope positions and along river corridors that burned every 15-80 years.

Table 3. Reference fire return intervals of pre-Euro-American settlement fire regimes relevant to the YSS Landscape (adapted from Van de Water and Safford 2011).

Pre-Euro-American settlement fire regimes	Dominant species	Mean minimum and maximum reference fire return intervals
Oak woodland	blue oak, valley oak, interior live oak, gray pine	5-45
Chaparral	chamise, manzanita, ceanothus, scrub oak, grey pine	30-90
Ponderosa	ponderosa pine, Jeffrey pine, sugar pine, black oak	5-40
Mixed evergreen	Douglas fir, tan oak, madrone	15-80
Dry mixed conifer	ponderosa pine, sugar pine, incense cedar, white fir, black oak	5-50
Moist mixed conifer	white fir, Douglas fir, incense cedar, ponderosa pine, sugar pine, lodgepole pine	5-80
Montane chaparral	manzanita, ceanothus, huckleberry oak, cherry, chinquapin	15-50
Red fir	red fir, white fir, western white pine	15-130
Lodgepole	lodgepole pine	15-290
Subalpine	hemlock, whitebark pine, western white pine, lodgepole pine, red fir	100-420

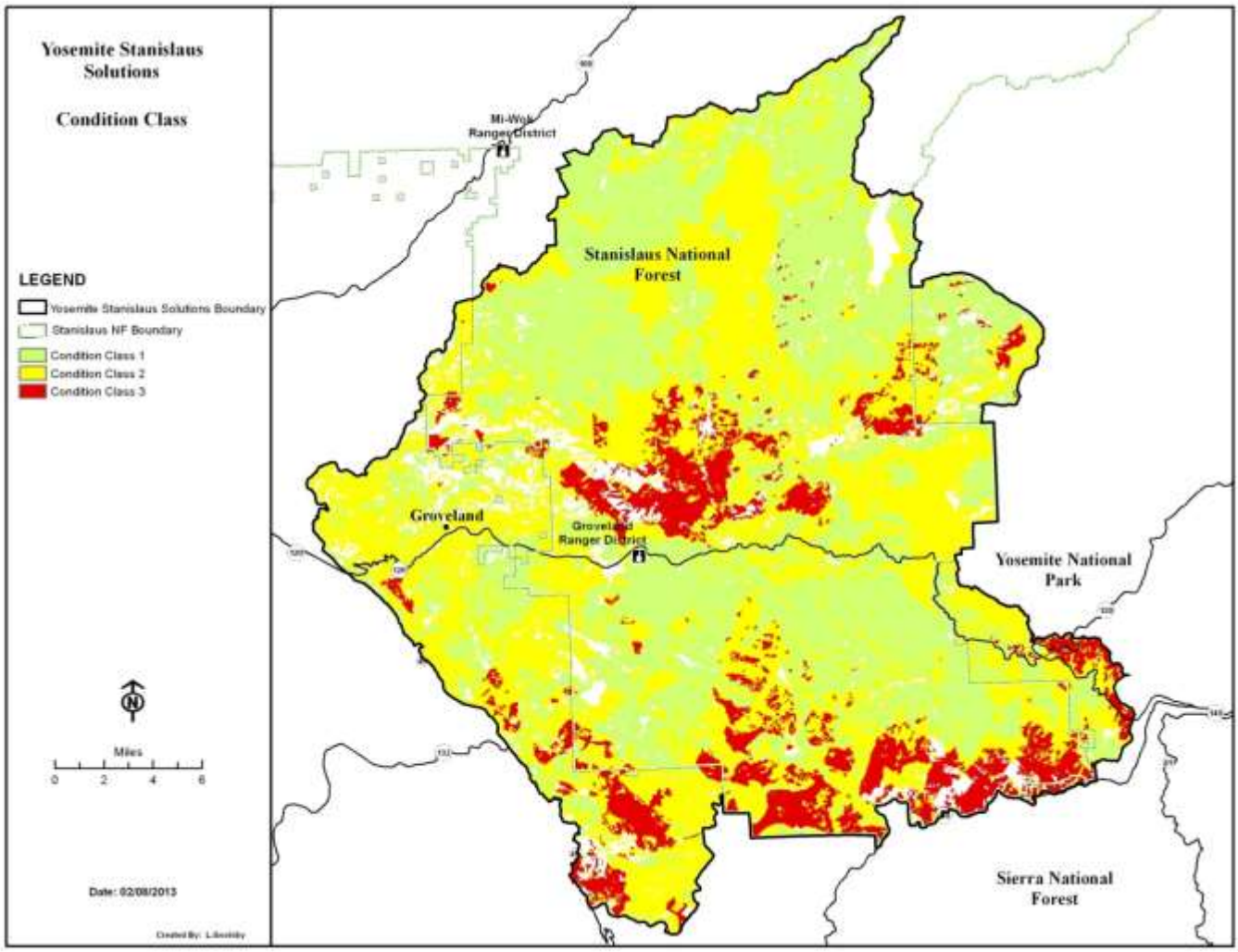
3.2c Fire Regime Condition Class

A Fire Regime Condition Class is a measurement of the amount of departure from natural fire regimes. The degree of departure is measured by changes to one or more of the following ecological components: vegetation characteristics (species composition, structural stages, stand age, canopy closure, and mosaic pattern); fuel composition; fire frequency, severity, and distribution; and other associated disturbances (e.g., insect and disease mortality, grazing, and drought). The three classes are based on low, moderate, and high departure from the central tendency of the natural (historical) regime.

- Condition Class 1 - Within the natural (historical) range of variability of vegetation characteristics; fuel composition; fire frequency, severity and pattern; and other associated disturbances.
- Condition Class 2 - Moderate departure from the natural (historical) regime of vegetation characteristics; fuel composition; fire frequency, severity and pattern; and other associated disturbances.
- Condition Class 3 - High departure from the natural (historical) regime of vegetation characteristics; fuel composition; fire frequency, severity and pattern; and other associated disturbances.

For the YSS Landscape, 42% of the area is Condition Class 1, 41% is Condition Class 2 and 10% of the area falls into Condition Class 3 (Figure 7).

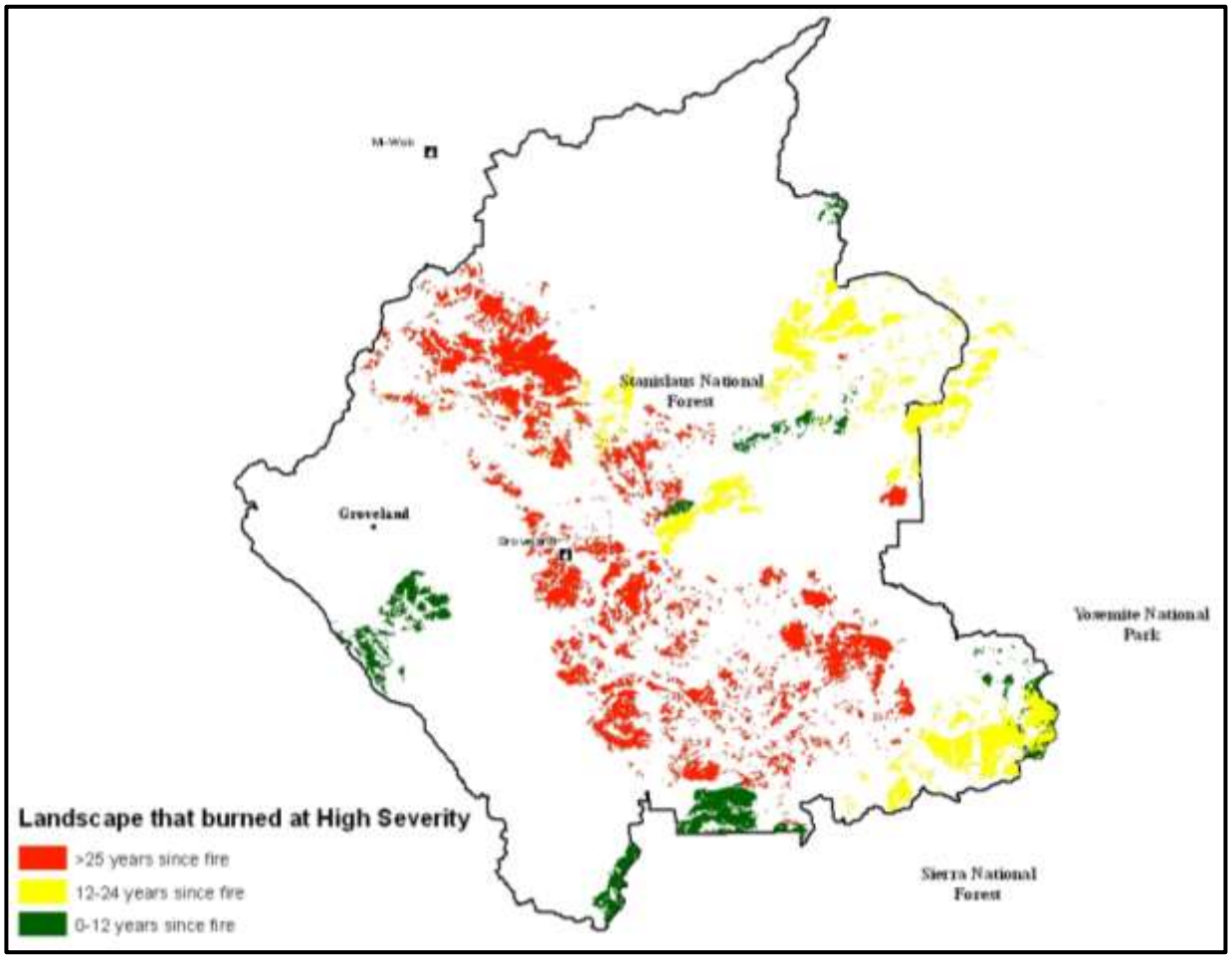
Figure 7. Distribution of Fire Regime Condition Class across the YSS Landscape.



3.2d High Severity Fires across the YSS Landscape

More than 60% of the Landscape has been affected by wildfire in the past 28 years with fires being large in size and of moderate to high severity (Figure 8). Recent research has shown that these trends are consistent throughout the Sierra Nevada (Miller et al. 2009) with stand replacing fires being quite common. In the thirty fires that occurred within the Landscape, about 36% of the fires have been consuming more than 50% of the overstory canopy. This drastically changes the structure and composition of the post-fire environment.

Figure 8. High Severity Fire within the YSS Landscape.



To more clearly define the fires typical within the YSS Landscape in recent years, consider the stand replacing fire in the Hamm Complex (1987) which covered approximately 33,000 acres. Over 63% of this fire area burned at moderate to high severity with the largest stand replacing patch exceeding 1,000 acres. Examining a fire which occurred under a more natural fire regime, a study showed that only 15% of the landscape experienced stand replacing fire and the largest patch size was 148 acres while the mean was only 10 acres (Collins et al. 2010). This is drastically different from the extent of stand replacing fire that has occurred in the YSS Landscape.

These stand replacing events are driven by a number of contributing factors that have led to an extreme departure from the historic fire regime (Figure 7). The majority of the Landscape is burning much less frequently with less severe fire than would occur in a natural fire regime, leaving more dense and continuous vegetation on the landscape to burn larger areas at higher severity.

Conversely, large areas which have experienced fire in the last 28 years are burning more often than would have been true in a historic fire regime. Fires are occurring more frequently and with higher severity throughout the foothill zone in the YSS Landscape. Of those areas that have burned in the recent history, four key areas have experienced more than 5 fires which according to the expected fire return interval would be more than would have occurred in a reference fire return interval. The current fire return interval in both tree and shrub dominated vegetation types throughout the foothill zone present considerable challenges because of their close proximity to rural and urban communities. In addition, approximately 20% of the foothill zone is classified as having more than 67% departure from the historic fire return interval.

3.3 Wildlife Connectivity

The YSS Landscape presents an excellent opportunity to better consider a number of wildlife species of concern. Taking a Landscape approach to land management is important for sustaining wildlife populations because this scale provides a more complete consideration of important life history requirements including seasonal habitat use, dispersal, colonization and genetic connectivity. Landscape review of potential wildlife habitat is useful for development of a focused strategy to restore and maintain a more resilient Landscape with greater capacity to provide year-round habitat to a diverse suite of wildlife species. While stand level management is often applied to these species as part of larger vegetation management projects, landscape scale considerations are important to address the population extent and connectivity of these species. In considering landscape barriers and values for these species, there are a number of clear considerations, challenges, and opportunities in the YSS Landscape.

The Pacific fisher (*Martes pennanti*) is a mature forest-dependent species that, although not known to occur in the Landscape, occurs outside the boundary, south of the Merced River. Pacific fisher occupy mature forest vegetation types for denning and resting while foraging occurs in a wide variety of habitats. The Pacific fisher is a Region 5 Forest Service Sensitive species and a candidate for listing under the Endangered Species Act.

Two other species that do occur in the mature forest vegetation types of this Landscape include the California spotted owl (*Strix occidentalis occidentalis*) and northern goshawk (*Accipiter gentilis*). These species which are Region 5 Forest Service Sensitive Species occupy mature forests for breeding and forage in a variety of habitats.

The Landscape also encompasses important year-round and wintering habitat for several herds of mule deer (*Odocoileus hemionus californicus*), and breeding territories for several pairs of great gray owls (*Strix nebulosa*).

California mule deer are an important game species occupying this Landscape and have been experiencing local population declines for the past several decades. Two herds in particular, the Tuolumne (Jawbone) Herd and the Yosemite Herd, frequent various habitat types, depending heavily on the critical winter habitat at lower elevations within the Landscape. In many areas large mast producing

oaks have burned in recent fires and although they generally re-sprout vigorously, they have not produced substantial acorn mast in the post-fire environment. Other habitat limitations for mule deer include overly dense stands of small trees and shrubs, and in some areas limited canopy closure that provides protection during extreme weather.

Great gray owls occupy mature forests in close proximity to meadows for breeding, foraging heavily within meadows and in other habitats such as oak woodlands. These great gray owls are part of a very small population (200-300 individuals) occurring almost exclusively on the Stanislaus National Forest and Yosemite National Park and have been identified as a new sub-species, genetically distinct from great gray owls to the north. There is a great deal of interest in these species; great gray owls being fairly rare, or in the case of deer, as a game species with apparent localized population declines.

As described in the Forest Service PSW General Technical Report #220 (and associated GTR #237), stand and landscape heterogeneity, including managing for oaks and hardwoods and generally reducing stand densities will improve long-term stand and landscape resilience to maintain and improve habitat for populations of these mature forest species on the Landscape.

3.4 Aquatic Habitats

Little information is available to inform us about historical conditions of aquatic fauna and habitats within the YSS Landscape. Early data (1911-1920) collected by Joseph Grinnell and others can provide some insight into the expected composition and elevational distribution of amphibians for the Landscape; however, information specific to fish communities is scant. For amphibians, many of the same species collected by Grinnell and others continue to persist in the Landscape, but it is reasonable to assume many of these populations are small in size and may have lost interconnectedness at larger spatial scales. Foothill yellow-legged frog (*Rana boylii*), western pearlshell (*Margaritifera falcata*), and limestone salamander (*Hydromantes brunus*) are still extant within the YSS planning area; however, California red-legged frog (*Rana draytonii*) and Sierra Nevada yellow-legged frog (*Rana sierrae*) are not likely to be present. Four of these amphibians are Region 5 Forest Service Sensitive species that were very likely components of the historical assemblage of amphibians. Additionally, the California red-legged frog is a federally threatened species and several historic accounts are documented within the Landscape. Amphibian inventories from the early 1900s were resurveyed in the last 20 years; results indicate changes in the relative abundance of the five key amphibian species in the survey area. One additional aquatic species that can be considered with the amphibians is the western pond turtle. This species, like the foothill yellow-legged frog, exists in multiple locations within the Landscape, but populations are generally small and skewed toward older individuals with limited apparent recruitment of young individuals into those populations.

For the fish community, there were historic runs of steelhead (*Oncorhynchus mykiss*) and Chinook salmon (*Oncorhynchus tshawytscha*) in all the main rivers of the Landscape, including the main tributaries of the Tuolumne and Merced Rivers. At lower elevations (<4,000 feet), the native fish community was

comprised of few species and included hardhead (*Mylopharodon conocephalus*), Sacramento pikeminnow (*Ptychocheilus grandis*), California roach (*Hesperoleucas symmetricus*), Sacramento sucker (*Catostomus occidentalis*), resident rainbow trout (*Oncorhynchus mykiss*), and riffle sculpin (*Cottus gulosus*).This native community was likely limited in distribution by large geologic features (waterfalls, very steep gradients) and much of the YSS Landscape was likely fishless. Beginning in the early 1900s, trout were extensively stocked to provide recreational opportunities. Currently there are few streams without fish, typically headwater, intermittent and seasonal streams.

Several spatial scales are described – from broad issues affecting much of the YSS Landscape down to very specific issues affecting much smaller sub-watersheds. For all aquatic habitats in the YSS Landscape (the broadest scale), the greatest influence on aquatic habitats is the road system which affects aquatic habitats by contributing sediment, interrupting surface flow patterns, and impairing aquatic organism passage. Segments of the road system that are hydrologically connected to streams are sources of fine sediment that can impair aquatic habitats by reducing oxygen availability. Road density analyses and hydrologically connected road surveys have been conducted within the YSS Landscape and are used to evaluate impacts to aquatic habitats and confirm which streams are receiving excess amounts of fine sediment from road surface erosion. Other broad scale impacts occurring at road – stream crossings include culvert failure and stream diversion risks. Culverts that are undersized commonly fail to pass sediment and large woody debris during storm flows and are vulnerable to becoming plugged. Once plugged, the streamflow typically crosses the road prism and erodes sediment from the road surface. Another risk associated with plugged culverts is that the roadway can fail when water pools upstream of the road. During this type of event, large volumes of sediment are delivered to aquatic habitats that can have long lasting, detrimental impacts to biological and physical stream functions.

Recent Stanislaus National Forest surveys of culverts for aquatic organism passage have indicated that greater than 80% of culverts pose a passage barrier to some life stage of an aquatic organism (typically young of the year trout). Some of these culverts prevent the effective up- and downstream passage of aquatic organisms because the velocity of the water flowing through the culvert is too swift or the drop at the downstream end of the culvert is high enough to prevent upstream passage. Criteria for assessing culvert passage of aquatic organisms include few factors applicable to most amphibian and macroinvertebrates, but using trout as a surrogate provides a minimum criteria that may be stringent enough to permit all species adequate passage. These invertebrate organisms are important linkages between terrestrial and aquatic environments because they are responsive to inputs of needed resources, such as nutrients, and provide a food resource to a wide variety of aquatic and terrestrial species that forage in riparian environments.

Opportunities at the YSS Landscape scale include reducing point sources for sedimentation and improving aquatic organism passage at road-stream crossings.

At the next smaller scale of the Tuolumne River and Cherry Creek watersheds, the primary issue in the context of aquatic habitats is hydrologic changes resulting from the construction of dams for water

impoundment and hydroelectric power production. These formerly free-flowing rivers and streams have been altered by multiple upstream and downstream dams. For the Tuolumne River, there are dams downstream (Don Pedro Reservoir, LaGrange Dam) and upstream (Hetch Hetchy Reservoir, Cherry Creek Reservoir, Lake Eleanor) of the YSS Landscape. The downstream dams have precluded the historic migration of salmon and steelhead into the Landscape and have isolated the upstream reaches for other species by interrupting the connectivity of the native fish and herpetofaunal communities in the upstream and downstream reaches. The upstream dams have altered aquatic habitat in numerous ways including changing temperature and flow regimes (water, nutrient, and sediment), blocking migrations of some fish species, and through isolation of stream reaches. For the reach of the Tuolumne River between Early Intake and Hetch Hetchy (San Francisco Public Utilities Commission infrastructures) there has been recent effort to modify the flow regime to better resemble historic conditions and to maintain important biological and physical processes. The reach of the Tuolumne River between Early Intake/Cherry Creek (Holm Powerhouse) and Don Pedro Reservoir is still widely divergent from the historic condition due to pulsed flow releases during the summer for hydroelectric production and to support the recreational boating activity on the river. This divergence likely has impacts to the habitats required by the foothill yellow-legged frog and western pond turtle. The foothill yellow-legged frog evolved to match its breeding strategy to the recession of streamflow following the spring snowmelt, or peak flow, period. This frog species breeds in shallow edge waters typically near depositional sandbars where water recedes slowly during the attenuation of peak seasonal flow. This allows the developing tadpoles to reside in relatively slow moving, warm waters where algal and diatom food resources are abundant enough to support growth and development. The dam controlled pulsed flows that occur on a daily basis affect this habitat type by eliminating low velocity refugia environments, dewatering habitats that support the production of food resources, and sustaining colder waters that may not allow for development from the tadpole to terrestrial stage by the onset of winter. Western pond turtle hatchlings utilize habitats similar to those used by the foothill yellow-legged frog and current conditions are unsuitable for supporting turtle reproduction. Secondarily, the current flow regime observed in this reach affects habitats required by aquatic macroinvertebrates, an important food resource for numerous aquatic and terrestrial wildlife species.

In Cherry Creek, the flow regime downstream of the reservoir has been altered from the historic condition because a large proportion of the available streamflow during summer is diverted via tunnel to a downstream hydroelectric- powerhouse. Very high annual and historic flows are attenuated by the dam which has interrupted several important physical processes which affect aquatic habitats. At present, conifers have encroached onto depositional bar areas making them more stable during peak flows. The habitat formation processes of many river systems in the Sierra Nevada are dependent upon the downstream transport of streambed materials during peak flows. A comparative study of the Cherry Creek and Clavey River channels illustrates this departure.

The upper North Fork Merced River watershed, including the subwatersheds of Smith, Bean, Bull, Moore, and Jordan Creeks, is a third and smaller spatial scale describing aquatic habitat. This area has potential as a conservation area for foothill yellow-legged frog and western pond turtle. Most of these

streams support small, possibly interconnected populations of these two sensitive species and is the largest area within the YSS Landscape in which they occur. Across the remainder of the Landscape, small population of foothill yellow-legged frog and western pond turtle are highly isolated, lacking other populations in close proximity for breeding and genetic exchange. There are multiple issues affecting aquatic habitat within this smaller landscape including stream flow, invasive species, degraded terrestrial conditions, and suction dredge mining.

Terrestrial conditions also affect aquatic species. Much of the YSS Landscape was affected by the 1987 Stanislaus Complex fire. Most of this burned area is dominated by shrub vegetation types with pine plantations representing a smaller proportion of the area. The existing overstocked plantations and dense shrub vegetation are affecting subsurface runoff patterns to streams in the burn, thereby reducing streamflow in this broad geographic area. As a result, many of the stream reaches that historically maintained persistent (perennial) water and maintained a diversity of aquatic habitats now only retain water in limited quantities in the deeper pool habitats. The limited availability of suitable year-round aquatic habitat may be influencing populations by increasing competition for resources between individuals and affecting territorial behavior. For the foothill yellow-legged frog, limited available and suitable habitat could be increasing vulnerability to predation. Another consequence of the current terrestrial vegetation condition on the landscape is that the turtle nesting habitat may no longer be represented extensively enough and adjacent to suitable pool habitat to support successful reproduction. The western pond turtle requires sunny, open, low angle slopes dominated by herbaceous vegetation in close proximity to deep pool habitat for nesting. Lack of nesting habitat has led to populations that are skewed to older individuals with an obvious lack of successful recruitment of young into the population. Anecdotally, when the Tuolumne Fire (2005) burned across the western pond turtle-occupied Drew Creek watershed, there was a pulse of successful recruitment for several years following the fire.

Aquatic and terrestrial invasive species are also affecting habitat quality within these subwatersheds. Bullfrogs, a non-native competitor, have the potential to severely impact foothill yellow-legged frog and pond turtle populations because adult bullfrogs can prey on all terrestrial life stages of the foothill frog and early life stages of the turtle. Perennial ponds within this area support breeding populations of the bullfrog. Noxious terrestrial weed species have contributed to the degradation of terrestrial habitat used by the western pond turtle and, to a lesser extent, the foothill yellow-legged frog. Dense stands of yellow-star thistle (*Centaurea solstitalis*) along Jordan Creek and North Fork Merced River may inhibit very small hatchling turtles from reaching stream habitat as they emerge from nests.

Suction dredge mining has occurred extensively in the upper North Fork Merced River watershed and has the potential to alter habitats used by the western pond turtle and foothill yellow-legged frog if this activity resumes. Noise from the machine and the presence of the dredge operator creates a disturbance if it occurs during a time when either species is basking. Basking is used to increase body temperature to facilitate metabolic functions such as egg development. If sufficient disturbance is present, the two species may not be able to bask adequately to produce maximum clutches of eggs. Further, female western pond turtles are extremely sensitive to disturbance when nesting and may not lay eggs if

extensively disturbed. Dredging noise may affect foothill yellow-legged frog underwater calls during breeding. This communication is important for the frog in attracting mates, especially in small populations where mating opportunities are limited.

Opportunities within the Upper North Fork Merced River include restoration of vegetation density to a more historic pattern, reintroducing fire to maintain important terrestrial habitat elements, reducing densities of aquatic and terrestrial invasive species, and limiting disturbance such as suction dredging from waters supporting populations of the foothill frog and pond turtle.

3.5 Water

The weather within the YSS is dominated by a Mediterranean climate, with warm dry summers and cool, wet winters. This is subsequently reflected in the hydrology. The elevation range of the YSS Landscape transects the rain-snow transition zone and extends into the winter snow zone in the high elevations. Fall and winter flows are driven by the rain-snow line with high flows occurring during heavy rainfall events coinciding with high snowlines. Peak flow events throughout the river system coincide with early winter rain-on-snow events. Spring streamflow is driven by snowmelt runoff and reservoir management of upstream dams. Summer streamflow recedes from July through October when fall rain returns. Most of the flow regime in YSS is dominated by reservoir management within the YSS Landscape. Three reservoirs (two upstream of the YSS) within the Tuolumne Basin are operated by the City and County of San Francisco's Public Utility Commission as part of the Hetch Hetchy Regional Water System. The largest reservoir within the YSS, Cherry Reservoir offers aesthetic value as well as diverse recreational opportunities including: boating, camping, and fishing. Water stored in Cherry Reservoir is used at Holm Powerhouse located approximately 11 miles downstream on Cherry Creek. The powerhouse is operated to meet power generation demands and is also operated to provide recreational boating flows on the mainstem of the Tuolumne River. These stretches of rivers offer world class boating experiences.

Also within the YSS are significant unimpaired waterways: the Clavey and Merced Rivers. The Clavey River (a tributary to the Tuolumne) is one of three unimpaired rivers in California. The Clavey offers exceptional aesthetic and biodiversity value, as well as recreational opportunities. Over the years the Clavey has also become a well-known kayaking river, with people traveling from around the world to experience it. The Clavey's watershed position and elevation range, combined with its free-flowing state provides valuable scientific value as water managers evaluate the impacts of a changing climate. The Merced River originates in the high elevations of Yosemite National Park. This free-flowing section of the river offers exceptional aesthetic, biodiversity and recreational value.

3.6 Noxious Weeds

Noxious weeds and other invasive species within the YSS Landscape vary from absent to almost total displacement of native vegetation. Roughly 60% or more of the Landscape is believed to support some type of noxious weed infestation. Some of the more threatening noxious weed species known to occur in

the Landscape include yellow-star thistle (*Centaurea solstitialis*), Italian thistle (*Carduus pycnocephalus*), tocalote (*Centaurea melitensis*), spotted knapweed (*Centaurea stroebe*), medusahead (*Taeniatherum caput-medusae*), Klamath weed (*Hypericum perforatum*), barbed goatgrass (*Aegilops triuncialis*), Dyer's woad (*Isatic tinctoria*), and bull thistle (*Cirsium vulgare*). Wildlife habitat, native plant species, rangeland health, ecosystem integrity and fire regimes are all adversely affected by annual expansion of noxious and invasive weed species in the Landscape.

The most widespread weed in the Landscape is yellow-star thistle. Where forest canopy closure is high, the density of yellow-star thistle can be very low. This condition persists in many of the pine plantation areas of the Landscape. In the vicinity of Jordan Meadow and Bull Creek, open grasslands are completely dominated by yellow-star thistle, displacing native species, altering the fire and fuels dynamic, and making habitat unsuitable for some native wildlife species. Some private land owners in the area have aggressively used herbicides to control yellow-star thistle on their land.

Many of the noxious weed populations can be found in close proximity to roads, a vector for introduction and dispersal from vehicle traffic, equipment, people, livestock and native wildlife. Isolated small populations of medusahead and barbed goatgrass are well established and increasing in acreage. Most of these noxious weed species produce abundant seed at least once each year and many have wind dispersed seeds that are adapted to spread fast and far.

Several projects have attempted to control some of the larger noxious weed infestations and eradicate some of the smallest populations. Jordan Meadow has been treated with prescribed burning for more than 10 years and yellow-star thistle in this location has been controlled in portions of the meadow and density has been reduced overall. However, yellow-star thistle remains a dominant plant in this meadow as a whole. Yellow-star thistle and some additional noxious weed species are being treated within the Monotti Project. In the Granite Stewardship Project yellow-star thistle, puncture vine (*Tribulus terrestris*) and other noxious weed species were treated with some success. However, noxious weeds persist in some areas.

The Stanislaus National Forest contributes to a multi-agency project in the Merced River Canyon with the Sierra National Forest and Yosemite National Park to control and eradicate yellow-star thistle. Treatments have been ongoing for several years, including hand pulling and applying herbicides with boom trucks on steep slopes. Burning, hand pulling, herbicide spraying and even targeted grazing can be used alone or in combination to control or eradicate noxious weeds from wildlands. Some of the smaller populations of certain species can be hand pulled for multiple years, but the best success will be achieved through the use of multiple techniques.

4. Desired Ecological Conditions and Rationale

The overarching theme of the Landscape Strategy for the Yosemite Stanislaus Solutions Landscape is one of resiliency and diversity. Promoting resiliency is a key goal when recognizing that the recurrence of fire and the existing conditions preclude assurance that any forest or habitat will persist into the future on this

Landscape without restoration. Recent fire history has altered large portions of this Landscape, disrupting the natural structure and function of various ecosystems. Promoting diversity and heterogeneity is important, both in the context of various habitats and the dynamic nature of the ecosystems.

It is unlikely that pre-European ecosystem structure and processes can be perfectly replicated across the Landscape given current socio-economic trends, needs, and demands. Managing for resilient ecosystems that provide the same functions and ecosystem services, however, is a more tangible possibility. In GTR 237, North and Stine (2012) point out that the definition of ecological resilience has evolved from early ideas that focused on the ability of ecosystems to readily recover to an equilibrium steady state following a disturbance. This definition implies a climax state that does not fully address the adaptive capacity of ecosystems and their ability to persist through evolutionary time under varying environmental conditions and changing climate. More recent definitions of ecological resilience, however, incorporate ecosystem processes as they relate to a historic range of variability. In other words, ecological resilience is the ability of an ecological system to absorb a certain level of disturbance before the system changes its structure by switching into a new regime of behavior. The changes in fire frequency and resulting severity observed throughout the YSS Landscape are indicators of such changes in regime behavior and highlight the need to better integrate the interrelations between humans, natural resources, and ecosystems.

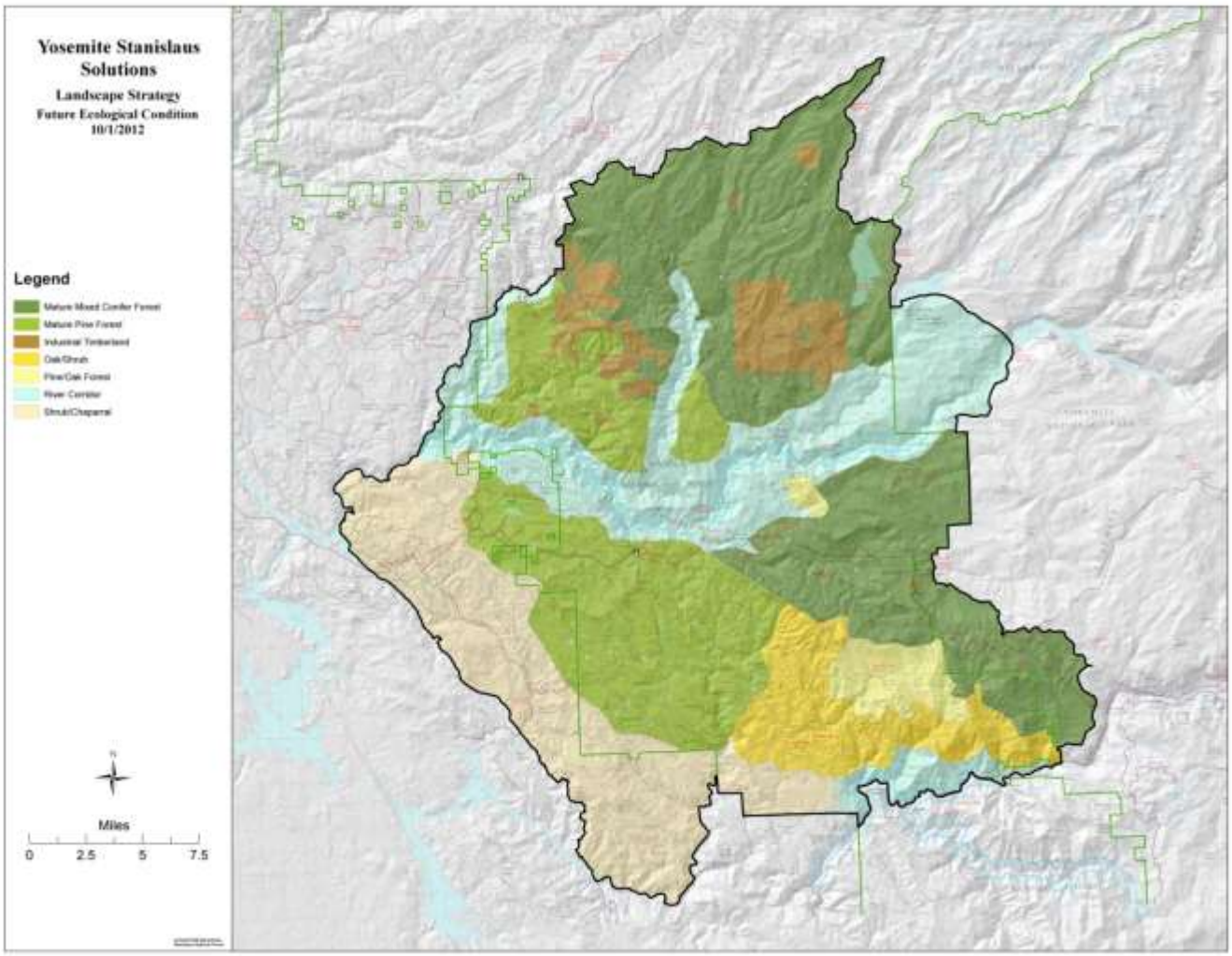
Figure 9 displays the potential forests which could occur on the Landscape over time. While the map shows broad areas of mature forest, for example, within the larger area there would be a mosaic of conditions. No one state of forest condition is envisioned over the Landscape or even within one area shown on the map. Rather, a resilient forest consisting of some areas of open stands, large trees, inclusions of hardwood and brush, as well as clumps of more vigorous small trees which will become the forest and habitat of the future is possible. In the process, goods and services will ensue from this Landscape.

Developing the resiliency which is desperately needed on this landscape will be achieved through consideration of multiple scales. There is a variety of existing forest conditions which could become a more resilient mature forest in the future. Compare Figure 3 to Figure 9 to see that the Early Seral Mixed Conifer Forest could become Mature Mixed Conifer Forest in the future. The Current Mid Seral Mixed Conifer and the Older Plantation areas would be maintained to continue to develop into CWHR 5 stands over the same time, while creating diversity through the formation of gaps and patches.

The existing condition identified on the map as “Developing Forest with Conifer Plantation” could become the mid seral to mature forest of the future. For example, the eastern half of the YSS area, from Crane Flat in the south, to Bourland Creek in the north, forms a band of mixed conifer forest that connects habitat in Yosemite Park with the denser forest to the north. The goals for this band are to move the forest stands which are currently “Developing Forest” and “Early Seral Mixed Conifer Forest” from CWHR size classes 2 and 3 into sizes 4 and 5 over the next 3-4 decades. Opportunities exist to thin plantations to ensure a conifer presence on these sites and to promote the development of mid- and late-seral forest structure. The larger trees in the post 1987 plantations are currently 6-10 inches in diameter.

Modeling indicates that an additional 15-20 years of growth are needed to reach tree sizes that are resilient to some level of surface fire. Promoting biodiversity by favoring species with low local abundance will be important in both the uniform conifer plantations and plantations containing high levels of oak and brush. It will be important to conduct necessary fuels treatments around the plantations (which have conditions ranging from dense brush to large remnant conifers and oaks) to ensure that future wildfires do not consume the plantations or set back the development of larger oak.

Figure 9. Desired potential vegetation types and seral stages of the YSS Landscape.



Taking a closer look at an example on the YSS Landscape of the *Developing Forest* and potential restoration:

> The Mi-Wok Complex project is located within the Landscape's range for future mature pine forest. As a currently developing forest, the Complex consists primarily of young 10-20 year old pine plantations dispersed throughout similarly aged oak and brush stands that naturally regenerated following the Stanislaus Complex Fire of 1987. Many plantations have a Stand Density Index of greater than 230, which is the threshold for imminent bark beetle- and competition-related mortality (Oliver 1995). Conditions throughout the majority of the area do not lend themselves to safe use of prescribed fire. Low, inter-locking branches would readily act as ladder fuels, carrying fire from the ground and through the canopy. Treatments prescriptions will emphasize increasing resiliency by reducing stand densities to avoid epidemic levels of insect-, fire-, and drought-related mortality. Relatively uniform distribution and small tree sizes makes it difficult to shift plantations towards higher levels of spatial heterogeneity; however, treatment prescriptions would accelerate the development of large trees and promote conditions better suited for reintroducing fire in the future.

Potential Conifer and Oak – Fire Altered

There exists the opportunity to reforest some of these brush-dominated Potential Conifer and Oak areas (E). Stands could also be managed to increase the growth and vigor of existing scattered trees so that they reach a size that can withstand fire, and to protect those individual trees from fire until they reach a fire-resistant size. This approach would maintain and promote a fairly open forest condition where it is currently present, moving conditions towards those described in 1915. Large areas of brush can be regenerated by prescribed burning or mechanical methods to increase forage palatability and to increase structural heterogeneity.

The Landscape Strategy focuses on developing stand resilience while recognizing current and anticipated future conditions, especially in regards to the effect of wildfire. Adapting the strategy to new information and looking for opportunities to maintain and enhance sensitive and uncommon habitats is also a part of the strategy.

Striving for ecological resiliency and diversity is already underway across the Landscape. The Reynolds Creek project in the mature mixed conifer forest at the northern end of the Landscape has incorporated treatment prescriptions that emphasis the creation of a heterogeneous forest structure that mimics the effects of mixed-severity fire and benefits native wildlife. Treated stands in the Reynolds Creek project will have interspersed pockets of dense tree clumps, areas of widely-spaced trees, and small gaps that encourage the recruitment of a new generation of trees. Following these thinning treatments with prescribed fire and introducing prescribed fire to sparser, unthinned stands result in vegetation structure and allow for natural processes that would occur in the context of historic disturbance regimes.

4.1 Structure and Species Composition

The changes in forest structures reflect the changes observed in regime behavior and past management. Large, high-severity fires and railroad logging have reduced forest heterogeneity, creating large areas of relatively young, dense, even-aged forest. Increasing heterogeneity across the landscape will increase forest resiliency and help forests persist through both expected and unexpected environmental stresses, while also delivering many ecological and socio-economic benefits. Areas with lower tree densities would have a greater capacity to withstand short-term impacts (e.g. wildfire, drought, insect attacks) without causing long-term impacts in overall ecosystem function (GTR 237, North and Rojas 2012). As a result, wildfire and other disturbances would act to increase heterogeneity rather than causing devastating effects that decrease it. Managing for forest resiliency would require treatments that would reduce stand densities, which would increase individual tree growth, vigor, and wood volume production. Treatments would also create variation in canopy cover, promoting fine-scale variations in rain through fall, temperature, and light conditions. These fine-scale variations would provide different microsite environments that would broadly benefit both wildlife and understory plant communities.

Opportunities exist across both the mixed conifer forest and the pine forest to increase heterogeneity (both species and structural) on multiple spatial scales. On a fine scale, leaving trees with interlocking crowns and large trees with high wildlife value would increase variability compared to even-spaced thinning. On a slightly larger scale, following concepts from General Technical Report 220, (North, Stine, O'Hara, Zielinski and Stevens, 2009), would promote pine maintenance and regeneration by preferentially removing fir and cedar and would increase structural heterogeneity of stands by creating a clumpy structure with densities ranging from open gaps to dense groups of trees. On a project-scale, hotter and drier ridges and south slopes would have lower tree densities and more open conditions compared to drainages and north slopes which generally are cooler and support more biomass.

4.2 Ecosystem Functions and Strategy for Restoring Fire across the Landscape

Increasing heterogeneity on multiple spatial scales contributes to our capability to provide a sustainable arrangement of diverse ecosystems and seral stages important for healthy, thriving wildlife populations. While some areas within the YSS Landscape are currently suitable for certain wildlife species, it is unlikely that these areas will remain so indefinitely. As evidenced by the history of YSS Landscape, natural disturbance events often interrupt the dynamic process of vegetation development. This Landscape has the potential to provide a diverse suite of vegetative communities in various seral stages that will contribute to the long-term sustainability of key vegetative structure and various species of wildlife. Promoting ecosystem processes such as nutrient cycling, hydrologic patterns, and fire across the landscape, will result in a resilient landscape in the long-term.

4.3 Wildlife and Aquatic Habitats

Over the next several decades as we treat the *developing forests and younger plantations*, they will increase in vertical and horizontal heterogeneity and can then provide critical dispersal and potential

habitat for the eventual northern progression of the Pacific fisher. These healthy forested areas will also provide critical thermal cover for mule deer. As currently mature forests are treated to become more resilient, California spotted owls and northern goshawks will continue to thrive and colonize these areas. Furthermore, treating dense shrub and oak woodland habitats will protect and provide forage for mule deer, and habitat for many prey species sought by fisher, great gray owls, spotted owls, and northern goshawks. Restoring the hydrologic function within meadows and riparian areas will restore and maintain native vegetation, which in turn provides for increased wildlife diversity. Within this improved and resilient Landscape, stochastic events are more likely to add to the diversity of the system over time allowing wildlife species to flourish.

The development and maintenance of relatively dense, connected habitat with *mature forest* characteristics is the desired condition for the eastern and northern portions of the YSS Landscape. Focus would be on the middle elevations, which can generally be described as the area from 4,000 to 7,000 feet in elevation with consideration given for slope, aspect, and other site-specific factors. This area typically defines the snowline, higher moisture in general, the historic and currently denser stands and the transition from more open stands of oak, pine, and shrubs to true Sierra mixed conifer, which includes more fir (*Abies* sp.). This band is generally below the red fir (*Abies magnifica*), lodgepole (*Pinus contorta*) and areas of open granite at the higher elevations and is more likely to continue to provide suitable dense conifer habitat for Pacific fisher, California spotted owl, and northern goshawk. Within this mid-elevation band, there is a good opportunity for developing and maintaining connectivity between existing PACs to connect highly suitable habitat to facilitate the eventual dispersion of the Pacific fisher further north in the Sierra Nevada.

PACs below the mid-elevation band would provide suitable mature forest habitat and diversity across the landscape in these unique pockets, but would remain somewhat isolated by more open habitat that is more suitably accessed by mobile bird species. The much higher density of oaks at the lower elevations provide important habitat for California spotted owl and Pacific fisher, as well as wintering mule deer.

Snag recruitment and creation is desired where they are lacking. Opportunities exist to create artificial nesting structures for great gray owls tied to nearby high quality meadows of approximately 20 acres or more and designed to extend to the northwest.

Aquatic Habitats

The desired conditions for aquatic habitats are to provide areas suitable and capable of maintaining self-sustaining populations of native aquatic species. At all spatial scales, improving streamflow and sediment regimes and interconnectedness of habitats, and reduction of disturbance factors and competition from non-native invasive species can move the YSS Landscape towards a desired condition. In some habitats, the improvement of streamflow and sediment regimes would allow for population and distributional expansions of native species into areas that may be unsuitable at present. An example of this would be an improved interconnectedness of habitats above and below dams and modification of hydroelectric releases to allow for the reintroduction of federally threatened Chinook salmon (*Oncorhynchus tshawytscha*) and

steelhead trout (*Oncorhynchus mykiss*) to formerly occupied habitats. A reduction in non-native and invasive species in the YSS Landscape would also have the potential to allow for population growth and expansion for the native species. An example of this could occur on Jordan Creek where a historic, presumed extinct population of California red-legged frog (*Rana draytonii*) occurred. If the hyper-competitive bullfrogs were eradicated from this watershed, upland habitats could be restored to conditions suitable for the California red-legged frog.

5. Collaborative Process and Implementation

Yosemite-Stanislaus Solutions was established to restore and maintain healthy forests and watersheds, fire-safe communities, and sustainable local economies using a science-based approach. This is a collaborative partnership working toward improved forest health, in addition to expanded economic activity and broader opportunities for communities in the project area and beyond.

YSS is a collaborative formed in an all-lands approach to landscape restoration. The YSS collaborative includes a broad cross-section of nearly thirty stakeholders from many sectors, including private industry, environmental non-governmental organizations, utility providers, and State and local government organizations. Stakeholders include BLM, Yosemite National Park, City and County of San Francisco – Hetch Hetchy Water and Power, Central Sierra Environmental Resource Center, Sierra Club, Sierra Pacific Industries, Sierra Resource Management, Sierra Nevada Conservancy, Clavey River Watershed Council, Tuolumne River Trust, Tri-County Offroad Club, Tuolumne County Alliance for Resources and Environment, California Forestry Association, American Forest Resource Council, Tribal interests, Tuolumne County, Mariposa County, Tuolumne County Farm Bureau, Tuolumne County Resource Conservation District, Range Permittees, Construction and Logging Contractors, California Department of Fish & Game, Pacific Gas & Electric Company, Tuolumne County Sportsmen, Yosemite Deer Herd Advisory Council members and South West Interagency Team (SWIFT) – whose members include the Fire Safe Council, CalFire, FS, BLM and other private landowners.

5.1 Land Ownership Patterns

The YSS Landscape is located within both Tuolumne and Mariposa Counties. Ownership patterns reflect a diverse array of jurisdictions, with National Forest, National Park and BLM public land being predominant. Private land holdings, large and small, are interspersed throughout the project area, and agencies such as Bureau of Reclamation and City and County of San Francisco – Hetch Hetchy Water and Power San Francisco are important entities within the Landscape. Generally, the Landscape area consists of overlapping jurisdictions, often with compatible management goals and resource objectives (Tables 4 and 5).

The variety of ownerships coupled with a distinct need to conduct management activities within the Landscape area creates an ideal setting for collaboration. A large, landscape-scale approach is critical to addressing fire risk, forest health, and social and economic implications associated with an increase in the

pace and scale of restoration and management activities. When working with such a diverse group of landowners, this landscape scale approach is clearly necessary to accomplish meaningful improvements in ecological, social, and economic health of communities.

Table 4. Land Ownership within the YSS Landscape.

Entity	Acres	Percent of YSS Area
Bureau of Land Management	31,368	7.3
Local Government	1,179	0.3
National Forest	268,481	62.8
National Park	32,265	7.5
Private	93,971	21.9
Tuolumne Band of Me-Wuk	651	0.2
Total	427,915	100.0

Table 5. YSS Landscape Acres by County.

County	Acres	Percent of YSS Area
Mariposa	145,092	33.9
Tuolumne	282,824	66.1
Total	427,915	100.0

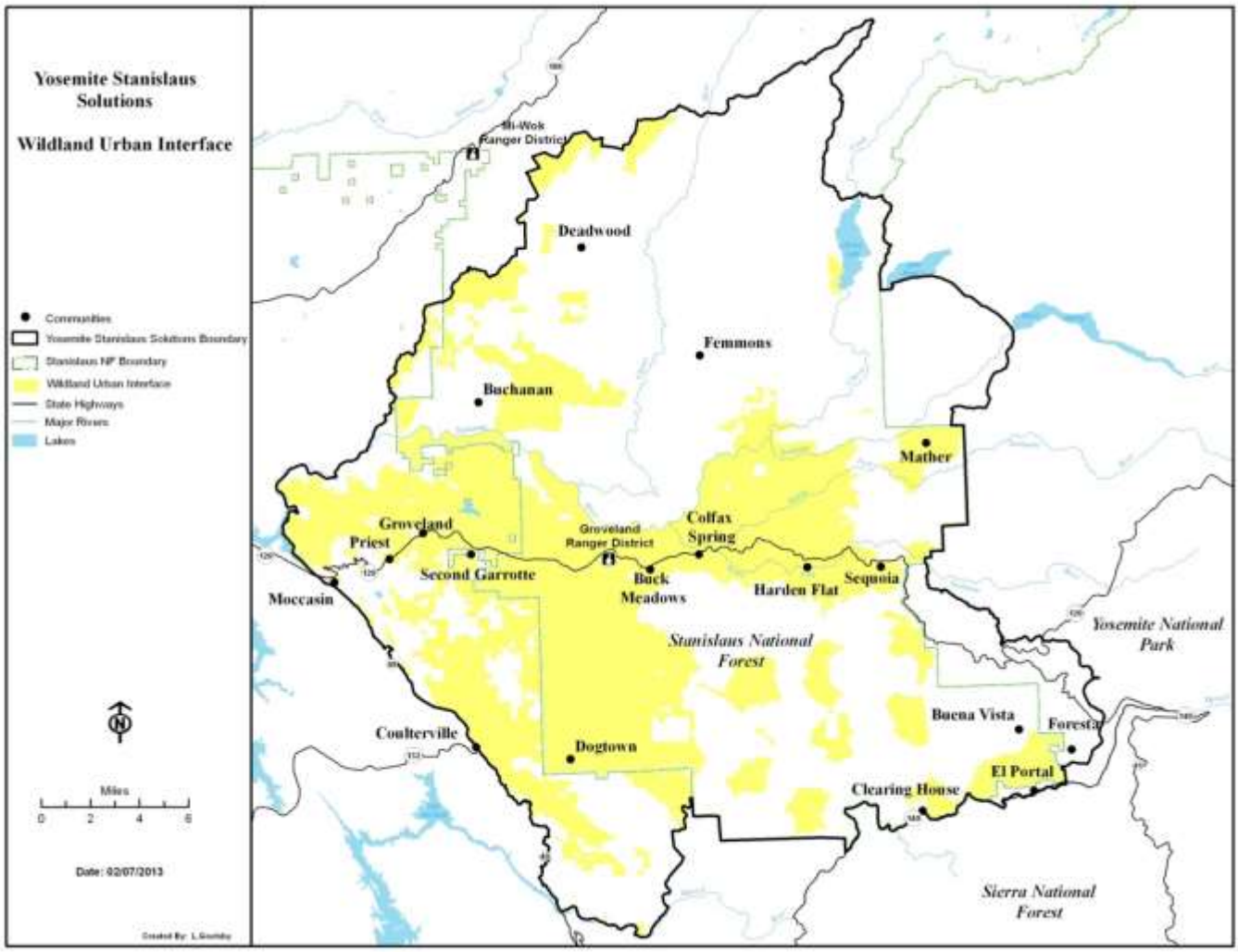
5.2 Wildland Urban Interface

The wildland urban interface (WUI) refers to areas where wildland vegetation meets urban developments, or where forest fuels meet urban fuels (such as houses). These areas encompass not only the areas immediately adjacent to urban development, but also the continuous slopes and fuels that directly threaten urban developments.

Twenty-two percent of the Stanislaus National Forest lands within the YSS Landscape are WUI. For the entire YSS Landscape, 28% are classified as WUI.

The majority of the WUI designated areas are in and adjacent to major populated areas (Figure 10). Although the majority of the WUI is concentrated in these areas, there are some isolated areas of WUI throughout the YSS landscape in association with private land inholdings and high use recreation areas.

Figure 10. Primary communities and WUI distribution within the YSS landscape.



5.3 Community Protection Plans

Within the YSS landscape there are 3 distinct and influential Fire Safe Councils. Since 1999, the Southwest Interface Team (SWIFT) has cooperatively planned and implemented wildfire protection activities within their 132,000 acre area of influence. The boundaries of the YSS Landscape were designed so that the SWIFT area resides entirely within the southwest portion of the Landscape. Additionally, portions of the Highway 108 Fire Safe Council, the Mariposa County Fire Safe Council, and the Yosemite Foothill Fire Safe Council fall within the YSS Landscape.

All of these organizations represent County, State, and Federal Fire Protection Agencies, and large private landowners (cooperators) who have worked together in a unified, collaborative planning effort in the development and implementation of community wildland fire protection plans, a strategic fire defense system designed to reduce the loss of life, property, and natural resources wildland urban interface.

6. Current Condition Threats to Forest Ecosystem Sustainability

There are many different types of disturbances common to forest ecosystems in the YSS landscape, such as insects, diseases, drought, and of course fire. Common insects include bark beetles, defoliators, and wood bores. Of particular importance to the YSS landscape are two diseases caused by fungi: one native and one exotic. The native fungus is *Heteobasidion* root disease and effectively kills white fir trees by rotting the roots. It spreads to nearby trees by growing through root grafts between neighboring trees. The exotic fungus causes white pine blister rust in sugar pine and other five needle pines. It infects trees through the needles and will girdle and kill trees when infections reach the main stem. High blister rust-related mortality in smaller trees has reduced the abundance of sugar pine regeneration because smaller trees have a much lower chance of surviving than larger trees once infected. Bark beetles (e.g. western pine beetle, pine engraver, or the fir engraver) are also a concern in YSS forest ecosystems. They are always present in scattered pockets of weakened trees, or recently dead trees. It is also common to find them in trees infected by a disease. Bark beetle populations often buildup following fires that leave freshly killed or damaged trees. Populations can also spike during periods of drought when trees are experiencing increased stress.

Historically, native disturbances acted as important ecological processes that shaped and maintained YSS forest ecosystems. Insects, diseases, fire, and drought all influenced pre-European forest structure, composition, and successional dynamics. Today, however, many of these same natural processes now pose a threat to forest ecosystem sustainability. This threat is largely a result of recent human activities that has degraded the balance between disturbance processes and forest structure and composition. The effects of logging (most notably railroad logging), fire suppression, and the introduction of the exotic white pine blister rust have resulted in increased tree density and shifts in species composition. Historically, variation in the spatial arrangement of tree sizes, group sizes and densities, and species composition were such that a disturbance would rarely overwhelm an entire stand. Today, however, forests have become more homogenous in age, species composition, and vertical and horizontal structure. These larger areas of homogenous conditions are more likely to result in undesirable disturbance processes (e.g. stand replacing wildfires) that perpetuate the same homogeneous conditions.

Tree density has become a ubiquitous problem throughout all of the forested ecotypes of the YSS landscape. Lack of fire has contributed to naturally established mixed-conifer forests becoming ingrown with shade-tolerant species such as white fire and incense cedar. Plantations were commonly planted at higher densities with the expectation that trees would be thinned-out as they matured and required more growing space; however, many of these plantations were never thinned and are now overstocked. Growing space becomes limited as tree density increases and results in increased stress to trees because they must compete with each other more intensely for resources. These stressful conditions weaken trees and leave stands vulnerable to waves of insect-, disease-, and drought-related mortality. Tree crowns also interlock, creating continuous canopies and ladder fuels that are more likely to sustain a stand-replacing crown fire.

Species composition also poses a significant threat to the mixed-conifer forests. These forests have experienced decreases in the proportion of pine and black oak as a result of fire suppression, logging, and the introduction of the exotic white pine blister rust. White fir and incense cedar, however, have successfully increased in abundance and now dominate many stands. Dense conditions created from ingrown shade-tolerant conifers inhibit establishment of shade-intolerant pine and oak, which require open conditions with plenty of sunlight. In addition, white pine blister rust continues to prevent the recovery of sugar pine in these mixed-conifer forests. Much of the sugar pine volume is carried in larger trees (>29 inches in diameter) and there is a reduced frequency of smaller size classes. This trend indicates that sugar pine is in decline and will continue to decline as a component of the mixed-conifer forest type since replacement trees are not present in the younger age classes (Ahlstrom 1996). This shift in species composition can contribute to changes in fire behavior. The presence of pine make stands more capable of withstanding natural fire events because pine has adapted a thick, fire-resistant bark and open canopy that retards aerial fire spread more than shade-tolerant associates that have thin bark and drooping lower branches (Habeck 1992; Zouhar 2001). Given the increased abundance of white fir, the effect of Heteobasidion root disease has become increasingly evident. Often acting in concert with the fir engraver bark beetle and dwarf mistletoe, white fir dominated stands experience high levels of mortality. Unfortunately, such heavily infected stands typically lack the presence of non-host species (e.g. pine and oak) that can sustain stands with long-lived mature trees.

7. Proposed Treatments and Their Connection with Ecological Restoration Needs

Appendix 1 is a copy of a spreadsheet displaying proposed treatments by type, year to be implemented and desired outcomes.

8. Highest Priority Desired Outcomes of the Landscape Strategy

Increasing heterogeneity on multiple spatial scales in the Landscape will provide sustainable, diverse ecosystems across the Landscape. Restoration which increases the resiliency of these ecosystems will utilize a full array of treatment options including prescribed fire leading to restored conditions over time. Promoting ecosystem processes such as nutrient cycling, hydrologic patterns, and fire across the landscape, will result in a resilient landscape in the long-term.

9. Desired Social and Economic Outcomes

The Tuolumne River watershed is a significant physical aspect of the YSS Landscape, in that it supplies extremely clean, high-quality drinking water to the citizens of one of California's largest cities, San Francisco. The value of National Forests such as the Stanislaus to drinking water quality and reliability cannot be underestimated, as they support valuable ecological communities including wetlands, meadows, lakes and streams. Throughout the nation, National Forests supply approximately 20 percent of Americans with a reliable supply of cool, clean water. A recent U.S. Forest Service study conservatively estimated the value of watershed services from National Forests and Grasslands at 3.7 billion annually. While watershed protection is a primary goal of the Stanislaus National Forest, current funding

constraints limit the agency's capacity to address the staggering restoration need. Accomplishing watershed restoration in our key areas will require significant funding in the near future. As land managers realize this need and see the benefit of preventing expensive runoff and damage to public water supplies, emerging models of public/private partnerships, such as this one, are being realized in order to augment funding for restoration work and provides valuable cost savings for some utilities and corporations.

A unique aspect of the YSS Landscape, when compared to others in the Sierra Nevada, is that Tuolumne County and Mariposa County are dominated by public lands, accounting for approximately 77% of Tuolumne County and 34% of Mariposa County. The public lands provide a variety of significant benefits to local communities, including creating expansive tourism opportunities which support a vibrant economy. This makeup of land ownership is one of many important characteristics of the YSS Landscape which makes it an ideal place to utilize restoration activities to improve not only ecological, but social and economic health of a region and the communities which rely so heavily on public land activities and healthy landscapes. This relationship between public land and communities has significant benefits for a variety of reasons, including expansive tourism opportunities, but also poses certain challenges, such as the absence of property tax receipts.

Tuolumne County has a rich and storied history of putting people to work on sustainably managed public lands. The communities throughout the area have a strong history and tradition of working in the forest, and the economic viability of the forest sector in Tuolumne County is particular strong, with several wood processing facilities including a large timber mill, a fencing plant, two biomass (small log) electric power generating plants, a shavings processor, and a landscaping bark plant. To date, the county remains a major hub of forest sector infrastructure remaining in the Sierra Nevada region of California. This status was bolstered in 2011 when the well-known Standard Mill was re-opened. Unfortunately, with the downturn in log prices over the last two decades, demand and price for dimensional lumber has come down as much as 30% from historic highs. In addition, relative to fire risk, it is actually small-diameter trees and brush which present the greatest problem, but also have the least economic value. The Standard Mill was able to reopen because it was retooled to handle small diameter logs. This also makes the Mill an important component of infrastructure needed to support increased restoration activities on the Stanislaus National Forest and the YSS Landscape. The mills and the other businesses in the county, such as the wood shavings plant, a biomass burning electric generation plant and a fencing plant rely on forest products from this Landscape to achieve economic growth and stability. Additionally, there are ample small businesses providing the skills to complete thinning and other restoration work.

Given this recent progress, maintaining a viable forest economy in the area and surrounding landscape is a key motivator for YSS. Restoration of up to 10,000 acres per year in the event collaborative funding is procured would help ensure that the mills remain viable, the associated jobs remain available, all while the local business and economy grow to support this revived industry. The general feeling among the group is that a balanced approach, incorporating both timber harvest and ecological restoration, is the best course moving forward to address the issues at hand.

In addition to the forest sector, rural communities in the project area thrive on tourism, with 40% of the economic activity in Mariposa County being attributed to visitors from outside the area. In Tuolumne County over 3,000 residents are employed in the tourism industry and latest figures suggest that visitor spending in Tuolumne County accounts for $172.9 million in revenue. The realities of compromised forest health and increased fuel loading on public lands have the potential to negatively affect this industry in both counties. Large, damaging fires could severely impact the visual and recreational aesthetics of the Landscape, and as such are a major concern for the tourism industry. Over the last three decades, over 250,000 acres have burned in wildfires, and not only was there loss in terms of timber value, but the ecological and scenic attributes of those burn areas were greatly diminished, undoubtedly impacting past and prospective visitors.

Through improvements in both the forest sector and tourism industries, there is great potential for job growth if this collaborative proves successful. The current unemployment rates in the project area are 10.8% in Mariposa County and 11.2% in Tuolumne County, both of which are above the 9.8% average for California as a whole. With so many people and so much valuable experience out of work, there is a great opportunity to empower area residents through collaborative funding.

10. Monitoring

Multi-party monitoring will occur throughout the life of treatments implemented to achieve the YSS Landscape Strategy. Collaborative field trips on the Landscape will continue with the intent of sharing information relative to opportunities for achieving the Landscape Strategy.

11. Adaptive Management

It's the intent of the Collaborative that the Landscape Strategy be a working, adaptable document. To this end, additional research such as that being concluded by Conservation Biology Institute (CBI) related to the Pacific fisher, and other work would be incorporated as it becomes available.

Appendix 1 Yosemite Stanislaus Solutions Landscape Strategy - Treatments

Date 1/29/2013

Note:	District #	District Name
	51	Mi-Wok
	54	Groveland

IRTC = Integrated Resource Timber Contract (Stewardship,combined commercial and some non-commercial)
IRSC = Integrated Resource Service Contract (Stewardship, non-commercial exceeds commercial)
SC = Service Contract (non-commercial exceeds commercial)
TS = Timber Sale (commercial) FR = Fuels Reduction
HFRA = Healthy Forest Restoration Act FA = Force Account
FH = Forest Health Stew = Stewardship WUI = Wildland Urban Interface

Program of Work for FY	District	Project Name	Yearly Accomp. Type of Treatment Thin, PCT, Shred, Underburn, etc	Type of Implementation	Name of Parent NEPA Document	Date of (Actual or Projected)	Project Contact	Non-WUI Acres	WUI Acres	ADDITIONAL INTEGRATED ACCOMPLISHMENTS (TS, IRTC) Thinning Acres	(SC, IRSC) Thinning Masticate Acres	(SC, FA) Thinning Hand Pile Burn	Rx Burn Follow-up Acres	Rx Burn Only Acres	Masticate or Shred Brush	Machine Pile	Aspen Treatment	Wildlife Hab.Impr	Watershed Restoration Rehab Roads	Watershed Restoration Decom Roads	Watershed Restoration Recon/Close Rds	Watershed Restoration Mdw.	Noxious Weed Treatment	Site Prep
NEPA Ready	54	Bear Mountain	Underburn	FA	Bear Mountain	7/11/06	A.Lane	249					249.0											
NEPA Ready	54	China Flat Biomass	Precom Thin/Biomass	IRSC	China Flat	7/11/08	J.Dierberg		430	X														
NEPA Ready	54	China Flat Mastication	Shred	SC	China Flat	7/11/08	K.Williams		389		X													
NEPA Ready	54	Monotti Roads	Road Watershed Imp.	SC	Monotti	5/1/11	J.Dierberg		12 miles										X	X	X			
NEPA Ready	54	Monotti Biomass	Precom Thin/Biomass	IRSC	Monotti	5/1/11	J.Dierberg		689	X														
NEPA Ready	54	Monotti Mastication	Precom Thin/Shred	SC	Monotti	5/1/11	K.Williams		1,200		X													
NEPA Ready	54	Monotti Noxious Weed Treatment	Hand/Herb Weed Treat	FA	Monotti	5/1/11	J.Haas		5														5	
NEPA Ready	54	Soldier Hand Thin	Thin	SC	Soldier Creek	6/5/09	K.Romberger		50			50												
NEPA Ready	54	Soldier Cr. PCT/shred	Thin	SC	Soldier Creek	6/5/09	K.Williams		208		X													
NEPA Ready	54	Middle Fork PCT/Shred	Precom Thin/Shred	SC	Middle Fork	7/20/10	K.Williams		220		X													
NEPA Ready	54	Merced Noxious Weed Treatment	Hand/Herb Weed Treat	FA	Merced Canyon Invasive Plant	5/25/04	J.Clines	15															15	
NEPA Ready	54	Granite Noxious Weed Treatment	Hand Weed Treat	FA	Granite	5/6/02	J.Haas	75															75	
NEPA Ready	54	Jordan Prescribe Burn	Prescribe Burn	FA	China Flat	7/11/08	A.Lane		150					150										
NEPA Ready	54	Jenkins Prescribe Burn	Prescribe Burn	FA	North Mtn + Telegraph Weeds	4/6/10	A.Lane		15					15										
NEPA 2012	51/54	Funky (Twomile Stewardship)	Thin	IRTC	Twomile Ecological Restoration	3/1/12	Marty Gmelin	960	117	X														
NEPA 2012	51/54	Groovy (Twomile Stewardship)	Thin	IRTC	Twomile Ecological Restoration	3/1/12	Marty Gmelin	1,753	0	X														
2013																								
NEPA Ready	54	Bear Mountain	Underburn	FA	Bear Mountain	7/11/06	A.Lane	300					X											
NEPA Ready	54	Peach Growers Underburn	Underburn	FA	Peach Growers				300															
NEPA Ready	54	Monotti Mastication	Precom Thin/Shred	SC	Monotti	5/1/11	K.Williams		1,200		X													
NEPA Ready	54	Soldier Cr. PCT/shred	Thin	SC	Soldier Creek	6/5/09	K.Williams	200			X													
NEPA Ready	54	Middle Fork PCT/Shred	Precom Thin/Shred	SC	Middle Fork	7/20/10	K.Williams		200		X													
NEPA Ready	54	Merced Noxious Weed Treatment	Hand/Herb Weed Treat	FA	Merced Canyon Invasive Plant	5/25/04	J.Clines	15															X	
NEPA Ready	54	Monotti Noxious Weed Treatment	Hand/Herb Weed Treat	FA	Monotti	5/1/11	J.Haas		20														X	
NEPA 2012	54	Pilot	Fuels treatments	SC	Pilot/Early Fire Restoration	7/1/12	K.Castro		370		200	170												
NEPA 2012	54	Pilot	Site Prep	SC	Pilot/Early Fire Restoration	7/1/12	K.Williams	315																320
NEPA 2012	54	Pilot/Early Noxious Weeds	Hand/Herb Weed Treat	FA	Pilot/Early Fire Restoration	7/1/12	J.Haas		80														X	
NEPA 2012	51/54	Campy (Twomile Stewardship)	Thin	IRTC	Twomile Ecological Restoration	3/1/12	Marty Gmelin	1,200	0															
NEPA 2012	51/54	Looney (Twomile Stewardship)	Thin	IRTC	Twomile Ecological Restoration	3/1/12	Marty Gmelin	1,000	0															
NEPA 2012	54	Reynolds Creek Stew.	Thin	IRTC	Reynolds Creek	6/30/12	K.Romberger	1,040	0	x	x		x	x	x		x							
NEPA 2013	51	Mi-Wok Complex FR/FH Pt. 1	Precom Thin/Shred	IRSC/SC	MI-Wok Complex Thin	10/1/12	Marty Gmelin	500	500															
NEPA 2013	51	Mi-Wok Complex FR/FH Pt. 2	Precom Thin/Shred	IRSC/SC	MI-Wok Complex Thin	10/1/12	Marty Gmelin	2,000	2,000															
								2,500	**2,500**															
2014																								
NEPA Ready	54	Soldier Cr. PCT/shred	Thin	SC	Soldier Creek	6/5/09	K.Williams	200			X													
NEPA Ready	54	Middle Fork PCT/Shred	Precom Thin/Shred	SC	Middle Fork	7/20/10	K.Williams		200		X													
NEPA Ready	54	Merced Noxious Weed Treatment	Hand/Herb Weed Treat	FA	Merced Canyon Invasive Plant	5/25/04	J.Clines	15															X	
NEPA Ready	54	Monotti Noxious Weed Treatment	Hand/Herb Weed Treat	FA	Monotti	5/1/11	J.Haas		20														X	
NEPA 2013	51	Mi-Wok Complex FR/FH Pt.3	Precom Thin/Shred	SC	Mi-Wok Complex Thin	10/1/12	Marty Gmelin	2,000	3,000															
NEPA 2013	54	Scott Ridge Mastication	Precom Thin	SC	Scott Ridge	3/1/13	K.Romberger	0	500															
NEPA 2012	54	Pilot	Planting	SC	Pilot Fire Reforestation	7/15/12	K.Williams	0	800															
								2,215	**4,520**															
2015	51	Cottonwood/Thompson	Thin	TS	Basin FR	7/1/14	Marty Gmelin	1,037	500															
								1,037	**500**															
2015	51	Mi-Wok Complex Thin Pt. 4	Precom Thin/Shred	SC	Mi-Wok Complex Thin	10/1/12	Marty Gmelin	1,000	3,000															
2015	54	Ascension/Abernathy	Thin	IRSC	Ascension/Abernathy	6/7/14	K.Romberger	0	500															
2015	54	Scott Ridge	Precom Thin	SC	Scott Ridge	3/1/13	K.Romberger	0	500															
2015	54	Pilot	Release	SC	Pilot Fire Reforestation	8/15/12	K.Williams	0	800															
								1,000	**4,800**															
2016	51	Basin	Thin	TS/SC	Basin FR	7/1/14	Marty Gmelin	169	300															
2016	51	Faust	Thin	TS/SC	Basin FR	7/1/14	Marty Gmelin	1,441	0															
2016	51	Bourland 1	Thin	TS	Bourland FR	9/1/15	Marty Gmelin	1,270	0															
								2,880	**300**															
2017	51	Bourland 2	Thin	TS	Bourland 2 FR	9/1/15	Marty Gmelin	960	0															
								960	**0**															