Bigcone Douglas-Fir Mapping and Monitoring Report Angeles National Forest



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January, 2017

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CALIFORNIA NATIVE PLANT SOCIETY

FOREST SERVICE U S DEPARTMENT OF AGRICULTURE

Photo on cover page: *Pseudostuga macrocarpa* in the
San Gabriel Wilderness, Angeles National Forest

All photos by Michael Kauffmann unless otherwise noted
All figures by Michael Kauffmann unless otherwise noted

Acknowledgements:

- CNPS field staff including Daniel Hastings, Josyln Curtis, and Kendra Sikes
- TEAMS biological technicians including Zya Levy, Jim Dilley, and Erica Lee who helped with the field work.
- TEAMS Field Operations Supervisor Jeff Rebitzke.
- USDA Forest Service Southern Province Ecologist Nicole Molinari for project design considerations and re viewing drafts of the document.

Special thanks to Shaun and RT Hawke, Stuart Baker, Mike Radakovich, Sylas Kauffmann and Allison Poklemba for adventuring into the wilds and helping with field work.

Suggested citation:
Kauffmann, M., J. Ratchford, J. Evens, K. Lindke, J. Barnes. 2017. Angeles National Forest: Bigcone Douglas-fir Mapping and Monitoring Report. Unpublished report. California Native Plant Society Vegetation Program, Sacramento, CA.

WEB ADDRESS - http://cnps.org/cnps/vegetation/pseudotsuga-macrocarpa/

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Bigcone Douglas-fir
Pseudotsuga macrocarpa
A natural history

Bigcone Douglas-fir has had a diverse history of common and scientific nomenclature. Jepson called it the desert fir and Munz the bigcone spruce. This variety in name reflects the species' ecological amplitude across its range as well as its morphological resemblance to other conifers. Previous scientific names included *Abies douglasii* var. *macrocarpa, Tsuga macrocarpa,* and *Pseudotsuga douglasii* var. *macrocarpa*. It was originally "discovered" in 1858 in San Felipe Canyon near Julian in San Diego County and was perplexing to early taxonomists because of its similarities to Douglas-fir. Ultimately ecology, wood characteristics and cone size defined it as its own species (Gause 1966).

The genus *Pseudotsuga* has a present-day range that is quite discontinuous. The species within the genus are confined to western North America and eastern Asia. Unlike the large, continuous range of *Pseudotsuga menziesii* across the western United States, *Pseudotsuga* in Asia are limited to a few isolated mountainous regions. Bigcone Douglas-fir is found in the Transverse Ranges and Pinensular ranges of Southern California (figure 1).

The fossil record for the genus begins in the early Tertiary, about 50 million years ago (MA). Since that time, the morphological characteristics of *Pseudotsuga* have changed little; with cones, seeds and needles of extant members difficult to distinguish from the fossil remains. An early form of *P. macrocarpa* is found in the fossil record for the first time in the late Pliocene, about 3 MA (Axelrod 1950). The character of the accompanying flora is distinct from the flora that contained the now-extinct relative *P. sonomensis* and similar to today's flora in the Transverse Range. This suggests that *P. macrocarpa* may have always been restricted in range (Hermann 1985).

More recent fossil evidence indicates that in the early Pleistocene a forest flora that included *P. menziesii* extended further south than it does today, inhabiting the Transverse Ranges concurrently with *P. macrocarpa* (Axelrod 1961). It is also possible that during that time *P. macrocarpa* ranged further south into what is now Baja California. Undoubtedly, the range of at least *P. menziesii* underwent repeated changes throughout the Pleistocene across both the southern Coast Range and southern Sierra Nevada. During this time it is possible that the two species repeatedly overlapped in range—though, like today, never hybridized.

The Asian *Pseudotsuga* and *P. macrocarpa* are the more ancient species within the genus. The Pleistocene appears to have been the time that the modern *P. menziesii* evolved. Since that evolution, the common Douglas-fir has gone on to establish itself as a major component of the forest vegetation in western North America, as well as one of the most important lumber trees in the world while *P. macrocarpa* continues to survive in a highly restricted range and has little economic value beyond ecosystem services—including shade creation and food and habitat source.

The California endemic bigcone Douglas-fir spans the Transverse and Peninsular ranges across Santa Barbara, Ventura, Kern, Los Angeles, San Bernardino, Orange, Riverside, and San Diego counties. They range 135 miles from north to south and 210 miles east to west. Northern range limits include areas around Mount Pinos in Kern County and the headwaters of Labrea Creek in Santa Barbara County. Western limits include Zaca Peak in the San Rafael Mountains. The southern and eastern limits are east of Julian along Highway 78 in San Diego County.

Across this region the species ranges in elevation from 1,000-7,000 feet where it generally occurs on cooler north facing slopes at lower elevations shifting to south facing slopes in the higher elevations. The most vigorous stands occur on the north slopes, which retain more moisture and lower average temperatures. Habitats including shrublands, chaparral, riparian canyons, mixed-conifer woodlands, and desert slopes, all of which offer rough terrain and steep aspects, often over 50°.

Although the wood is suitable for coarse lumber, stands are so scattered that they have more value for the ecosystem services provided and are rarely utilized commercially (Burns and Honkala 1999). The tall stature of the species compared to the plants with which it associates makes it quite distinct, especially large specimens. The two largest documented trees grow in the San Gabriels. The largest recorded, near Mount Baldy Village, was measured in 2005 to 165 feet tall, 269 inches in girth, with a 94 foot canopy.

It has been proposed that *P. macrocarpa,* unlike other members of the genus *Pseudotsuga*, has adapted to xeric conditions through changes in morphological characteristics. With an increase in cone and seed size, a functional shift in the mode of seed dispersal has occurred. Such shifts have been documented in pines—from ancestral wind dispersed species like *Pinus contorta*, through a combination of wind and animals in species like *Pinus lambertiana*, and to species that are exclusively animal dispersed like *Pinus albicaulis*. Species that have evolved characteristics like well-defended cones and larger seeds have shown a closer relationship to animals as dispersers (Lanner 1982). It has also been shown that wind-dispersed pines often occur in

more mesic environments while animal-dispersed pines have evolved in more xeric environments (Vander Wall and Balda, 1977). Bigcone Douglas-fir seed have been show to be cached and eaten by Merriam chipmunks (*Tamias merriami*), mice (*Peromyscus* sp.) (Vander Wal and Balda 1977) and most likely woodrats (*Neotoma* sp.).

The ancestral and current mode for seed dispersal for all *Pseudotsuga* species, besides *P. macrocarpa*, is wind—with winged seed that are shed when seeds are mature in the fall. *P. macrocarpa* is distinct from the other *Pseudostuga* species because they occupies relatively dry sites and have uniquely large cones and seeds (Table 1).

Table 1. Characteristics of cones and seeds of Douglas-fir (*P. menziesii*) and bigcone Douglas-fir (*P. macrocarpa*)*

Cone or seed trait	*P. menziesii*	*P. macrocarpa*
Seed mass (mg)	24.8 ± 3.7	132.6 ± 23.8
Seed length (mm)	7.3 ± 0.7	10.9 ± 1.0
Wing area (mm^2)	52.0 ± 14.1	97.3 ± 32.0
Descent velocity (m/s)	1.28 ± 0.22	2.47 ± 0.62

***From Vander Wall 2006**

Bigcone Douglas-fir inhabits a zone generally between the lower elevation chaparral and the higher elevation mixed-conifer forest. Within the chaparral zone, the species is often found in small patches. In mature forests, bigcone Douglas-fir forms the upper canopy while canyon live oak (*Quercus chrysolepis*) forms the mid-canopy. They occur on gravelly soils that are usually shallow, often with a sparse understory of Mediterranean-type chaparral species. On these poorer growing sites, the sparse understory limits the encroachment of fire and more competitive species.

Pseudotsuga macrocarpa is one of the most fire resistant and adapted conifers in the world. The species has an uncanny ability to survive fires of high intensity and severity because of the prolific resprouting of new needles and branches from boles and branches. The species also has unusually thick bark—between 15-20cm in mature trees. Within one to three years of fire events, buds that are not killed in a fire will typically sprout new shoots (Vander Wall et al. 2006). These adaptations suggest bigcone Douglas-fir has evolved to survive multiple fire events that arrive via surrounding chaparral (Lombardo 2009).

Lombardo et al. (2009) cross-dated 85 trees from 15 sites across Los Padres National Forest and looked at fire scars at the tree's bases. They were able to take the fire history in this region to the year 1600 and found that the mean fire intervals using both fire-scar and growth change indicators, was nearly 30 years, with a range of 22-45 years. If a tree lives to 400 years it will see, on average, 13 fires in its lifetime.

In moderately burned stands, it is believed that regeneration can take several decades based on seed availability. However after stand-replacing events, because most seed trees are lost, long distance dispersal is not as possible because dispersal occurs by wind and small animals. These stand-replacing events extirpate the species from the landscape, but forests of snags can remain for >50 years.

Across the Angeles National forest bigcone Douglas-fir occur in some of the highest densities for anywhere in the range of the species. The heart of this range is in the San Gabriel Mountains though a smaller, disjunct population occurs in the Sierra Pelona Mountains to the northwest. These two ranges explore quite dichotomous ecologies.

The San Gabriel Mountains stands are in four general regions classified from south to north across the range (figure 6). The lowest elevation sites occur in the front-range, generally in north-facing canyons or on steep slopes. The interior slope populations inhabit river drainages and higher elevation peaks like within the San Gabriel River and the Tujunga Canyon regions. The mixed conifer stands includes areas where the species grows at the highest elevations and overlaps with montane conifers. The north-slope stands comprises interesting habitats where mixed-evergreen species mix with Mojave desert flora.

In the Sierra Pelona Mountains, the species occupies a small percentage of acreage for the entire forest. Here, the species mixes with black oak (*Quercus kelloggii*) in open grasslands on the ridgeline of Liebre Mountain down into the canyons of the north slopes of the range into the upper elevations of the Antelope Valley near Neenach. Elsewhere in the range, the species persists in isolated, relict stands on rocky summits or in sheltered north-facing river canyons. Stand here consist of trees at low densities that persist because stand-replacing fires have not occurred in these small pockets.

It appears that the major threats to bigcone Douglas-firs are drought, increased fire severity and frequency, coupled with beetle attack. While we saw little beetle evidence across the ANF, some was seen in the San Dimas Experimental Forest in lower elevations.

Even before human-induced climate change, fossil evidence suggests that the range of the species has been in decline. The species is highly valued across the mountains of southern California as an endemic species, for its aesthetic beauty, wildlife habitat, and influence on regional biodiversity with the habitat it creates. These are relict habitats where

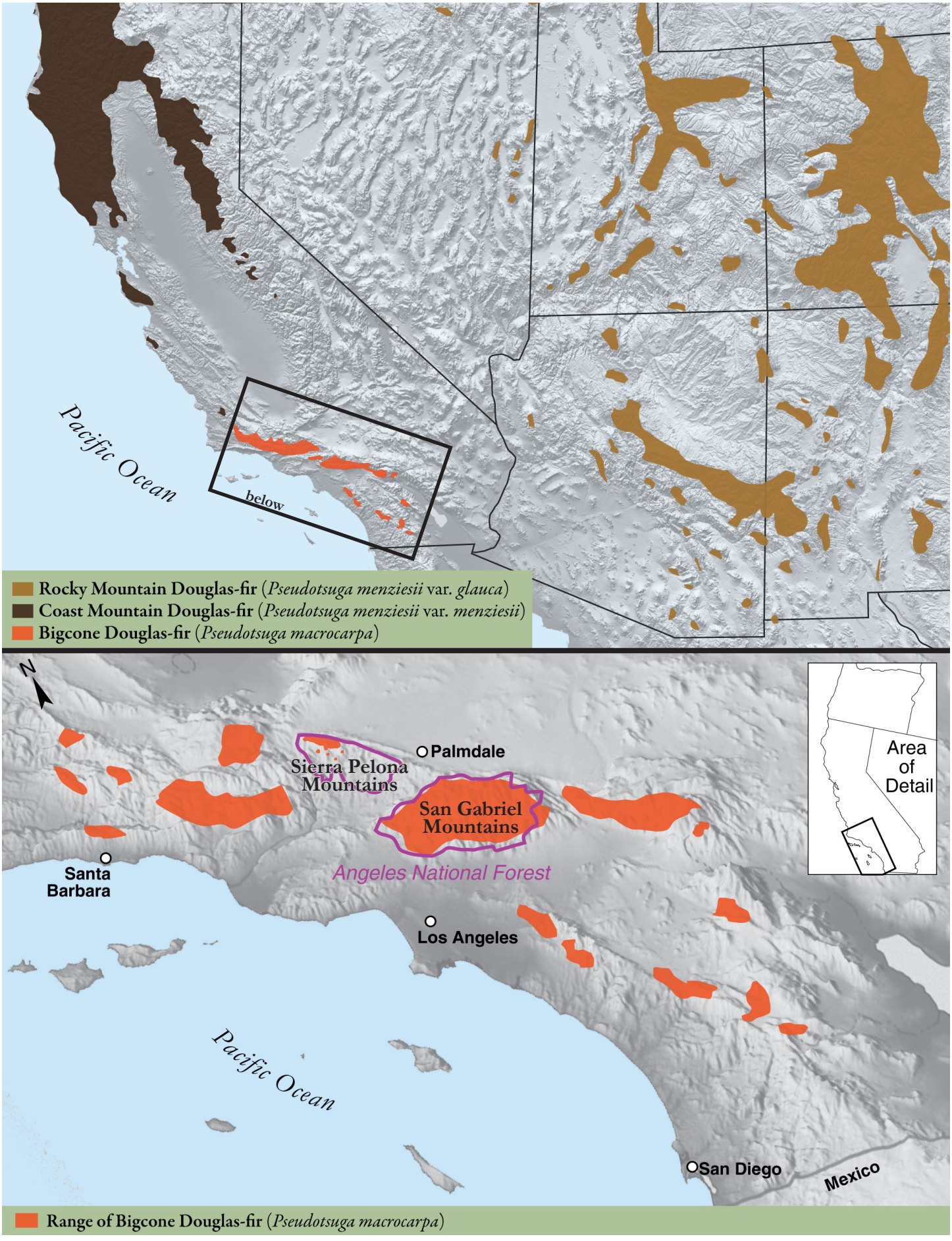


Figure 1. Range of Pseudostuga in southwestern North America.

high severity fires have been excluded but other disturbances like landslides and lower intensity fires have remained a common part of the species' ecology—allowing them to continue to flourish, for now, across the Angeles National Forest.

Introduction to the project

In general, mapping and monitoring of bigcone Douglas-fir (PSMA) occurrence and status/threat has been done primarily remotely in the National Forests of California by the US Forest Service through the Remote Sensing Lab's California Vegetation (CALVEG)system. CALVEG is a vegetation mapping tool, but isn't used for monitoring the status or threats to bigcone. This is why this work is so valuable—we were able to assess the health of stands with heads-up digitizing followed by ground-truthing to confirm its presence, abundance, and status. The California Native Plant Society (CNPS), working in collaboration with the US Forest Service, Angeles National Forest, Pacific Southwest Regional Office, Above & Beyond Ecosystems Enterprise Unit, and TEAMS Enterprise Unit initiated field surveys in the summer/fall of 2015 to assess the extent and status of Bigcone Douglas-fir in the Angeles National Forest.

The goals of the field assessments were to verify distribution and status of Bigcone Douglas-fir, ground-truth polygons designated by CALVEG as Bigcone Douglas-fir Regional Dominant, and conduct modified rapid assessments and reconnaissance on bigcone Douglas-fir stands.

The intent of the report that follows is to assist land managers in prioritizing goals for a regional management plant for bigcone Douglas-fir. Within the database also provided, one can find access to layers indicating health and alliance data for the species. This will provide valuable information for seed harvesting, restoration after fire or disturbance, fuels treatment targets, and potentially, fire suppression avoidance areas. The surveys and mapping provide important baseline data to track the effects of altered fire regime and changes in climate.

Methods and Materials

The California Native Plant Society (CNPS) obtained existing GIS data from various sources including the USFS Pacific Southwest - Region Remote Sensing Lab's CALVEG maps (USFS 2013c), USFS Forest Health Technology Enterprise Team's National Insect and Disease Risk Model (USFS 2013a) Host species layers, USFS Pacific Southwest Regional Forest Health and Monitoring Aerial Detection Survey Data (USFS 2013b), USFS Forest Health Protection Margins dataset (Bokach 2013), and USFS Forest and Inventory Analysis database (USFS 2013d), The Consortium of California Herbaria (UC Berkeley 2013), California Department of Fish and Wildlife (CDFW). In addition, we used older sources of bigcone Douglas-fir distribution in the state for context (Griffin and Critchfield 1972) and for lone populations or individuals not delineated or attributed by CALVEG (Consortium of California Herbaria, 2015). A map was initially created with heads-up digitizing using 2014 satellite imagery. This offered an extent and health map of polygons that were targeted for ground-truthing. This map was continually revised over the project's duration.

Upon evaluating existing datasets and obtaining input from local National Forest staff, we identified areas to further ground-truth to better determine the distribution and health/status of Bigcone Douglas-fir on the National Forest lands. Priorities included sampling within wilderness lands and near roads.

We selected the CNPS/CDFW Vegetation Rapid Assessment protocol (see Appendix 7) to gather information on occurrence, habitat, and impacts of stands with bigcone Douglas-fir. The modified rapid assessment aimed to gather as much information on bigcone Douglas-fir health and reproduction without spending a significant amount of time establishing plots or collecting data on individual trees. As part of the protocol there were additions for bigcone Douglas-fir starting with regeneration—this information was primarily derived from an existing USFS protocol, Common Stand Exam, including a fuel model. Therefore, the survey technique was stand based to assess the extent of bigcone Douglas-fir vegetation across broad areas in a short amount of time. Sampling included pure stands and mixed stands.

The reconnaissance (recon) form used for the assessment takes pertinent information from the CNPS/CDFW Vegetation Rapid Assessment protocol to gather simplified, general information about a stand (see Appendix 7). Since the goal of the assessment was to gather information on healthy stands of PSMA over a large area.

Areas that were selected for sampling in the Angeles National Forest were based on several approaches including identifying and locating populations that were not yet verified, stand accessibility by road, and wilderness settings. These assessment areas were also based on places that had already identified as bigcone Douglas-fir (Kauffmann 2013). See recommendations section for areas that need future surveying. For each stand condition (healthy, partial mortality, complete mortality), a zonal table was created summarizing each of the parameters (elevation, aspect, slope) showing differences in averages over each condition type.

Field staff included both CNPS and USFS (TEAMS) staff.

Bigcone Douglas-fir Allocation Methodology

For the first round of sampling was selected by the intitial layers created by Kauffmann in 2015 (now the finalized layer). In order to ensure that we had coverage across the ANF, and at a variety of elevations, we selected three sub-regions which roughly correspond to high elevation (5,000'-7,000'), mid elevation (3,000'-5,000') and low elevation (<3,000') stands of bigcone Douglas-fir.

In all areas we pursued samples in vegetation types with both bigcone as the dominant plant, where bigcone is an associate, or where regeneration was present. To accomplish this, we pulled sample locations from different layers. To capture sites where bigcone Douglas-fir is a major component, we allocated a subset of polygons from the bigcone Douglas-fir distribution layer produced by Michael Kauffmann. To capture areas where bigcone might be present or regenerating we allocated polygons from the Forest Service's Strata layer that were identified as types in which bigcone sometimes occurs. Equal numbers of polygons from each veg type were selected. This type represents where bigcone has <9 percent cover, and often burned areas previously dominated by bigcone Douglas-fir. Polygons were only allocated if they were within a 150m buffer zone from a road or trail to insure efficiency of sampling and the safety of the samplers, as stands are typically very steep.

A separate allocation was carried out for the northwest portion of the forest known as the Sierra Pelona Mountains. The same criteria were used for allocation in this region but adjustments were made on the ground by the samplers as they saw fit in order to better capture the diversity of alliances.

For the May 2016 second round of sampling we chose two categories for our allocations: EVEG and PSMA (created by CNPS). EVEG layer consists of boundaries for the ecological tile units and CALVEG zone units currently being used to tile the EVEG (existing vegetation) dataset. Attributes from Ecological Units of California (Ecological Domain, Division, Province, Section and Subsection) have been incorporated into this layer by the Forest Service. This layer was developed as a tiling system to serve out logical portions of vegetation data for use in land management issues such as forest-wide planning efforts, wildlife habitat mapping and fire risk assessment. PSMA layer was created and revised by Michael Kauffmann over the previous year (2015-16) through heads-up digitizing and ground-truthing.

In order to have exclusivity between the data, areas with overlapping EVEG and PSMA were removed from the EVEG layer. This resulted in an EVEG layer that showed presence where the PSMA layer did not, and a PSMA layer that both intersected and differed from the original EVEG layer. Because of the topography of the area, sampling sites had to be constrained to keep sampling times reasonable and personal injury low. From these selected areas, a random sample of 60 EVEG, and 300 PSMA polygons were chosen for sampling.

Plot Analysis Methodology

We used logistic regression models and Akaike's Information Criterion (AIC) to evaluate the effects of elevation, slope, aspect, and four measures of fire impacts on the occurrence patterns of mortality and reproduction within big-cone Douglas fir stands in the Angeles National Forest. Each stand was classified as containing successful reproduction (i.e., a 1 in a binomial classification) if either seedlings or saplings were observed in the stand, and as not containing successful reproduction if neither was observed (a 0 in a binomial classification).

Similarly, stands were defined as containing mortality if greater than 10% of the stand contained dead PSMA. The four measures of fire impact was derived from the Burned Area Emergency Response (BAER) Imagery Support programs data on the Station Fire (http://www.fs.fed.us/eng/rsac/baer/). The four measures of fire impact are: 1) FireY/N: the presence or absence of fire evidence recorded by field surveyors during the rapid assessment surveys, 2) FireNum: the number of fire events the stand has experienced since 1950, 3)FireYrs: the number of years since the most recent fire, and 4) StationFire: the severity of the Station Fire on a scale of 0 to 4. The severity of the Station Fire was derived from the Burned Area Emergency Response (BAER) Imagery Support programs data on the Station Fire (http://www.fs.fed.us/eng/rsac/baer/). The five fire severity classes are as follows: (0) the station fire did not occur at the stand location, (1) the area after the fire was indistinguishable from pre-fire conditions, (2) means areas of surface fire with little change in cover and little mortality of the dominant vegetation, (3) means there is a mixture of effects on the dominant vegetation, and (4) represents areas where the canopy has high to complete consumption. FireNum and FireYrs were derived from fire perimeter data produced by the Fire and Resource Assessment Program (http://frap.fire.ca.gov/projects/fire_data/fire_perimeters_index).

A set of candidate models was then defined for each re-

sponse type (mortality or reproduction), which comprised all possible combinations of elevation, slope, aspect, and one each of four measures of fire impact (39 models), 12 additional models with interactions between elevation and slope or elevation and aspect, and a null model (Tables 6 and 7). All models were fit using the glm() function in the stats package of the R statistical computing environment (R Core Team 2016). Overdispersion parameters were calculated for all of the most parameterized models, and the best fit model for each response type, by dividing the residual deviance by the residual sum of squares. Models were not considered to be overdispersed if the overdispersion parameters were less than 1.5. Residual plots for the best fit models were also examined for violations of model assumptions. We used the second-order bias adjusted version of Akaike's Information Criterion (AICc) to compare the relative support for all models in the candidate sets. The model with the lowest AICc score is considered to best represent the data, relative to other models in the candidate set, and models with AICc scores approximately 2 points greater than the best ranking model are considered to have little to no support (Burnham and Anderson 2004). After fitting the initial set of candidate models for both mortality and reproduction, we added one additional model (Elevation + StationFire + Elevation:StationFire) to both candidate sets to further investigate the interaction between elevation and severity of impacts from the Station fire (see appendix 8).

Alliance Mapping Methodology

The Rapid Assessment and Reconnaissance surveys collected for this project were used to inform a heads-up digitization of polygons for the bigcone Douglas-fir alliance using ESRI's ArcGIS. Heads-up digitizing is a GIS process of manually interpreting on-screen imagery and delineating polygons to define a specific extent. The vegetation alliance and distribution maps were based on one-meter resolution 2014 NAIP imagery (though USDA 2016 CIR imagery and a dynamic ESRI basemap were used to evaluate more current site conditions when possible). The minimum mapping unit (MMU) was 1 acre. While the primary map attribute was vegetation type, additional map attributes include structural information (e.g., herbaceous, shrub and tree cover), and disturbance and site quality information. Field collected data provided the mappers with information on "signatures" (the look of a stand type from aerial imagery) for the different vegetation types. For more detailed methodology on mapping techniques see the "Vegetation Mapping and Accuracy Assessment Report for Carrizo Plain National Monument" (Stout, et al. 2013).

Mapping occurred in three forms:

1) Michael Kauffmann mapped presence/absence to start the project.
2) Alliance mapping followed with a coarse description of vegetation composition.
3) Classification mapping concluded the project and looked at fine scale vegetation classification based on more detailed species composition data from the field.

Classification Methodology

CNPS has developed a vegetation classification at the alliance level, and the association level when possible. These are the finest two levels of the National Vegetation Classification (NVC) hierarchy, following the format of the NVC (FGDC 2008) and A Manual of California Vegetation (Sawyer et al. 2009). These classification levels are floristically and environmentally defined, and are used to denote plant community types that occur within the major ecological regions of the nation. The NVC supports the development and use of a consistent national vegetation classification to produce uniform statistics about vegetation resources across the nation, based on vegetation data gathered at local, regional or national levels (FGDC 2008).

Datasets Used in Classification Analyses

In addition to the vegetation surveys collected in 2015–2016 for this project, CNPS compiled vegetation data from the Santa Ana Mountains that had a presence of bigcone Douglas-fir. This included six vegetation rapid assessment (RA) surveys collected in Orange County by AECOM in 2012 and 15 RA surveys collected in Western Riverside by CNPS in 2002. All data were collected using Survey of California Vegetation (SCV)-compliant protocols (VegCAMP 2015). These data were combined with the data from this project for classification analyses.

Floristic Classification Analyses

Species cover data was analyzed using Cluster Analysis with a hierarchical agglomerative technique using Sørenson distance and flexible beta group linkage method at -0.25 in PC-ORD 5.05 (McCune and Mefford 2006). The cluster analysis technique was based on species abundance (cover) values converted to 7 different classes using modified Braun-Blanquet (1932/1951) cover categories as follows: 1=<1%, 2=1-5%, 3=>5-15%, 4=>15-25%, 5=>25-50%, 6=>50-75%, 7=>75%. The majority of the species values fell within the first four cover classes.

Prior to the cluster analysis, outlier analysis was performed for all the surveys in the combined dataset using PC-ORD. Samples and species with Sørenson distances of

more than three standard deviations away from the mean were reviewed for removal, and rare species occurring in fewer than 5 plots were removed to reduce heterogeneity within the dataset.

In general, surveys in a cluster analysis are placed in groups that are most similar in species composition together with a resulting dendrogram output. Groups of like surveys can be generated by separating them at multiple levels of the dendogram. After the cluster analysis generated groups, Indicator Species Analysis (ISA) was employed to objectively decide at what number of "groups" or cut levels to explicitly interpret the cluster dendrogram. ISA produced indicator values for each species across different cluster group levels (ranging from 2 to 25), testing for statistical significance using a quantitative/binary response with 4999 randomizations (Dufrêne and Legendre 1997). The cluster group level that had relatively high number of significant indicators and relatively low overall mean p-value was chosen for the final evaluation of the community classification (McCune and Grace 2002). In addition, ISA was used to determine which species were characteristic indicators for the different groups.

During the classification process, samples were partitioned into groups based on cluster membership. These groupings are used to help determine where surveys are placed in the overall classification, based on existing described vegetation types and new communities that appear to group well within the cluster analysis.

The resulting floristic classification is compliant with the Manual of California Vegetation (Sawyer et al. 2009) and the USNVC (FGDC 2008). The most specific vegetation type, the association, is defined by a group of samples that have similar dominant and/or characteristic species in the overstory and other important or indicator species, whereby these species are distinctive for a particular environmental setting. A set of similar associations is grouped hierarchically to the next higher level in the classification, the alliance. These are grouped sequentially into the group, macrogroup, and division, and upwards through the formation, sub-class and class levels.

We named new associations or retained existing ones when a cluster group had a strong indicator value for species that showed up primarily in that cluster group (and rarely in other cluster groups), and when at least three surveys represented that association. If the minimum sample size requirement was not met, we named the survey only to the alliance level. Membership rules for assigning samples to vegetation types were defined by species composition, degree of constancy, indicator species, and species cover values, and these rules are reflected within the field key that we have written for alliances and associations determined in these analyses. Each survey was evaluated for consistency within a group and surveys that were misclassified in the cluster analysis were reclassified based on the membership rules.

Field Data Results

During the 2015–2016 field seasons, CNPS and TEAMS staff collected 370 vegetation rapid assessments (see p. 156) across the Angeles National Forest. An additional 80 reconnaissance surveys (see p. 160) also were collected to assist in the mapping effort. The location of each survey was marked using a GPS device and photos were taken for each survey. Photos have been sorted and archived. Survey locations were reviewed for positional accuracy.

At the completion of sampling, CNPS entered the rapid assessment data into a combined Microsoft Access database fully compatible with CNPS' state-wide vegetation classification data. The scientific names of the plant species included within the database follow the USDA-NRCS PLANTS (2015) database terminology. A secondary Access database was set up for the bigcone Douglas-fir specific data collected during this sampling effort. This database was sent to TEAMS staff, who entered those data for the surveys they collected. CNPS then entered those data from their database into that form. These databases were then rigorously quality controlled and then merged into one deliverable database.

The resulting Access database contains the field data collected in tabular format including the bigcone Douglas-fir

Table 2: Area of Bigcone Douglas-fir populations by forest region

Range	Region	Acres	Hectares	%
San Gabriel Mountains	Healthy stands	23,504	9,512	70.6%
	Mortality present (>10%)	6,046	2,447	18.2%
	Stand-replacing fire event (>90%)	3,728	1,509	11.2%
	Total within Angeles NF	**33,278**	**13,468**	**94.2%**
Sierra Pelona Range	Healthy stands	1,396	565	68%
	Mortality present (>10%)	656	265	32%
	Stand-replacing fire event (>90%)	--	--	0%
	Total within Angeles NF	**2,052**	**830**	**5.8%**
Total acreage in the Angeles National Forest		**35,330**	**14,298**	

Table 3: Average Aspect, Elevation, and Slope

Zone	Average Aspect	Std	Average Elev (m)	Std	Average Slope %	Std
Healthy	181.9	126.1	1,474.7	295.9	69.23	24.90
Mortality present (>10%)	190.7	133.3	1,321.2	247.4	62.90	22.50
Stand-replacing fire event (>90%)	204.2	132.7	1,476.8	201.1	59.19	21.97
avg	**192.3**	**130.7**	**1,424.2**	**248.1**	**63.77**	**23.12**
San Gabriels						
Healthy	180.7	125.4	1,486.1	299.7	70.3	24.7
Mortality present (>10%)	189.9	132.9	1,327.1	256.5	64.7	22.5
Stand-replacing fire event (>90%)	205.3	132.4	1,479.7	198.8	59.2	22.0
Sierra Pelonas						
Healthy	204.9	136.8	1,411.1	160.3	50.8	18.4
Mortality present (>10%)	204.6	139.1	1,237.5	145.6	50.5	17.1
Stand-replacing fire event (>90%)	None detected		None detected		None detected	

specific data along with the rapid assessment and reconnaissance data, and classification names. The database also includes derived data used during analysis and discussion including time since fire, number of fires, Station Fire severity, and HUC8 watershed. The database has been shared with the Forest Service as a final product of this project. All photographs associated with the surveys have also been shared with the Forest Service.

Plot Analysis Results

General Patterns

In our 370 plots several patterns emerged in the data. Distribution across the Angeles shows that of the approximately 35,300 acres of bigcone Douglas-fir, over 94% of those stands occur in the San Gabriel Mountains with just under 6% in the Sierra Pelona Range. Interestingly, no stand-replacing fires were documented in the Sierra Pelonas while 10% of the stands in the San Gabriels were detected to have been affected by stand-replacing fire events in, approximately, the last 10-20 years.

The most alarming numbers are the presences of >10% mortality within stands. Across the Angeles National Forest 19% of stands have mortality levels occurring between 10-90% (generally between 10-40%). As is discussed in the mortality section, most of this is being seen in the lower elevations on both the south slopes of the San Gabriels and the north-slopes of the Sierra Pelonas. Most likely this is due to the combination of drought and landscape-scale xerification but more study is needed.

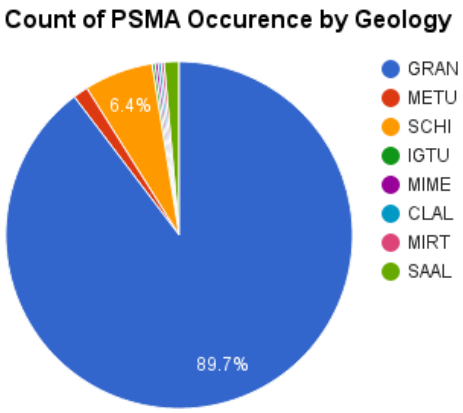


Figure 2: PSMA Plots and Geology.

Of the 370 plots, nearly 90% occurred on granite while 6.4% were on schist (Figure 2 & appendix 7 for other geological codes). This is most likely predictive of the amount of Tonalite, Granodiorite, and Mendenhall Gneiss in that makes up the majority of the western San Gabriels. While Pelona Schist comprises much of the eastern part of the range.

Fire evidence was found in 77% of our plots. Most likely, fire has occurred in the other 23% of our plots but evidence was either missed or the time interval since the last fire was long enough that evidence had been covered by forest litter or time. As reported by Lombardo et al. (2009), fire return averages 30 years but can, in some regions, be longer.

Reproduction

The top predictive model for reproduction included elevation, severity of the Station fire, and the interaction between these two variables (figures 4-7). The next highest ranking model included elevation, aspect, and severity of the Station fire and had a ΔAICc of more 0.99, suggesting that aspect may have a small influence on reproduction when also accounting for elevation and severity of the Station fire (Figure 3). All other models had ΔAICc scores of more than 2.00 (see Appendix 8 for complete modeling results). The eleven models that included severity of the Station fire comprised the top eleven models, and elevation was included in seven of these models, suggesting that the Station fire and elevation likely have the most influence on the presence or absence of reproduction (as indicated by the presence of seedlings or saplings) (Table 4).

Figure 3 shows predictions of the probability of reproduction as a function of elevation for the 5 levels of severity for the Station fire, with 0 indicating no impact from the fire and 4 indicating the most severe impact. When severity of the fire impact was low or none (1 or 0), the probability of reproduction increased as elevation increased. In contrast, when the fire impact was more severe, the probability of reproduction decreased as elevation increased.

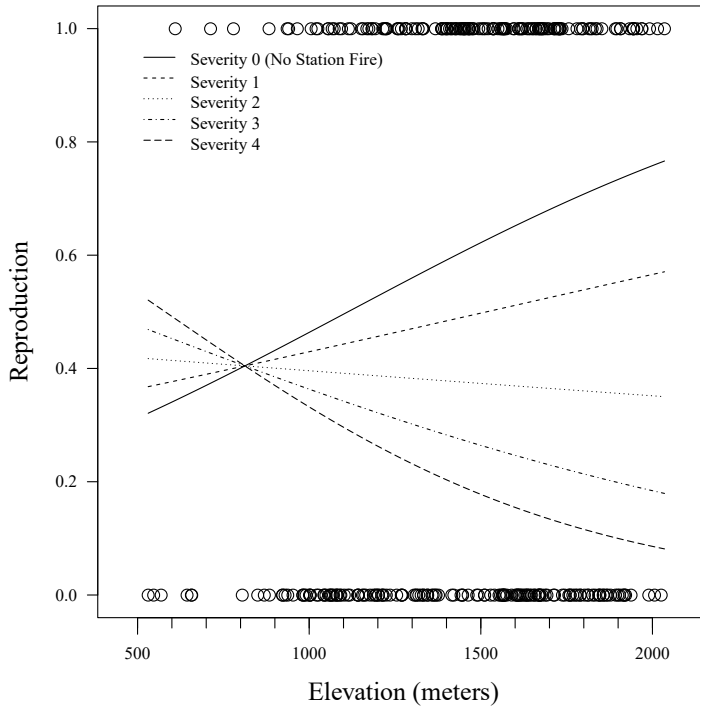


Figure 3 PSMA Reproduction.

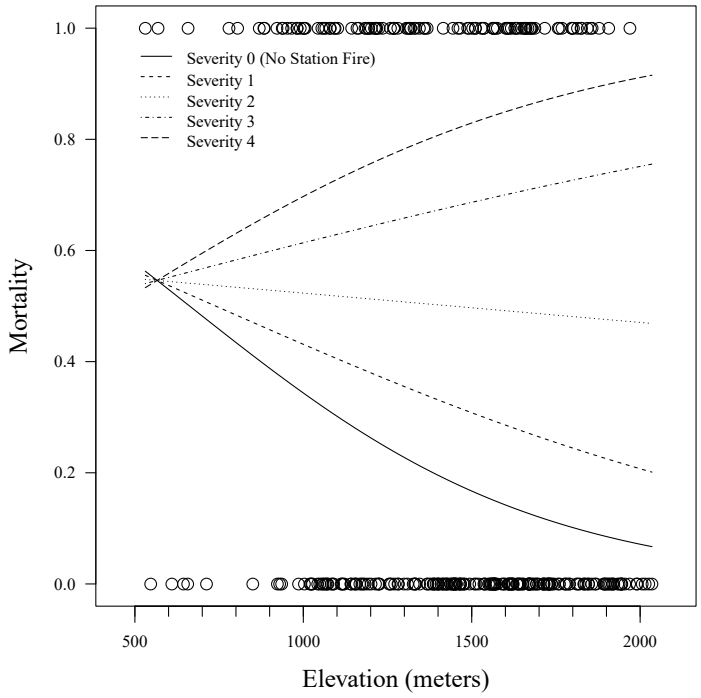


Figure 4 PSMA Mortality.

Parameter estimates for elevation and the interaction between elevation and intensity of the Station fire in the best fitting model for reproduction were significant (p-values of 0.012 and 0.033, respectively, Table 6), indicating that elevation affects reproduction and that the relationship between elevation and reproduction varies depending on the intensity of the Station fire.

Mortality

The top model for mortality included the same variables as the top ranking model for reproduction: elevation, severity of the Station fire, and the interaction between these variables. The next highest ranking model included only elevation and severity of the Station fire, and had a ΔAICc of more than 3. The large ΔAICc, and the fact that these models only differed by the interaction term, provides strong evidence for the importance of the interaction between elevation and fire severity. In addition, all models excluding severity of the Station fire had large ΔAICc values, indicating that of the Station fire is strongly related to mortality (Table 7). Like the best fitting reproduction model, the elevation and interaction terms were significant, indicating that mortality changes with elevation and that the relationship between mortality and elevation changes depending on the severity of the Station fire. Specifically, when fire severity was high (3 or 4) mortality increased as elevation increased, whereas mortality decreased with increasing elevation when severity of the fire was moderate to absent (2 to 0).

Parameter estimates for elevation and the interaction between elevation and intensity of the Station fire in the best fitting model for mortality were significant (p-values of 0.002 and 0.021, respectively, Table 9), indicating that elevation affects reproduction and that the relationship between elevation and reproduction varies depending on the intensity of the Station fire.

Classification Results

The vegetation rapid assessment data from this project along with the 21 surveys from earlier projects were combined into one database for classification analysis. Of the 391 surveys analyzed, 229 were identified within the Bigcone Douglas-fir woodland & forest alliance (see Appendix 1). Overall, the analysis resulted in 21 alliances and 39 associations being classified (Table 10). Thirteen new associations were classified during this project (indicated by an asterisk in Table 10), 11 of these associations are within the Bigcone Douglas-fir woodland & forest alliance. The indicator species analysis that assisted in this floristic classification resulted in numerous high indicators at 21 groupings, and assisted in the naming of the alliances and associations (see Table 11). However, not all surveys were classified to an association-level. Eleven surveys were classified to the alliance level only, since they fit well into the overall definition of the alliance, but did not fit into an existing association, nor were there an adequate sample size to warrant assigning a new association name.

Based on the classification results, CNPS staff wrote a dichotomous field key to the vegetation types at the alliance and association levels within Appendix 2. A summary of

Table 4: AICc results of top five logistic regression models to predict reproduction as a function of elevation, slope, aspect, and prior evidence of fire for big-cone Douglas fir stand in the Angeles National Forest. The number of fitted parameters in the model is given by df (degrees of freedom), a colon in the model description indicates a statistical interaction. (Full results in Appendix 8)

Model	df	log(Likelihood)	AICc	ΔAICc	Model weight	Cumulative weight
Elevation + StationFire + Elevation :StationFire	4	-199.1	406.33	0.00	0.28	0.28
Elevation + Aspect + StationFire	6	-197.5	407.32	0.99	0.17	0.46
Aspect + StationFire	5	-199.1	408.40	2.07	0.10	0.56
Elevation + Slope + Aspect + StationFire	7	-197.1	408.59	2.26	0.09	0.65
Elevation + StationFire	3	-201.4	408.92	2.59	0.08	0.73

Table 5: AICc results of top five logistic regression models to predict mortality as a function of elevation, slope, aspect, and prior evidence of fire for big-cone Douglas fir stand in the Angeles National Forest. The number of fitted parameters in the model is given by df (degrees of freedom), a colon in the model description indicates a statistical interaction. (Full results in Appendix 8)

Model	df	log(Likelihood)	AICc	ΔAICc	Model weight	Cumulative weight
Elevation + StationFire + Elevation:StationFire	4	-166.6	341.38	0.00	0.75	0.75
Elevation + StationFire	3	-169.3	344.76	3.38	0.14	0.88
Elevation + Slope + StationFire	4	-169.2	346.62	5.24	0.05	0.94
StationFire	2	-171.8	347.70	6.32	0.03	0.97
Slope + StationFire	3	-171.5	349.13	7.75	0.02	0.99

Table 6: Parameter estimates and associated standard errors, z-scores, and p-values for the AICc best fitting model (Reproduction = Elevation + StationFire + Elevation:StationFire, where : indicates a statistical interaction) of big-cone Douglas fir reproduction in the Angeles National Forest.

Parameter	Estimate	Standard error	z value	p-value
Intercept	-1.4332	0.7718	-1.857	0.063
Elevation	0.0013	0.0005	2.526	0.012
StationFir	0.6001	0.4923	1.219	0.223
Elevation:StationFir	-0.0007	0.0003	-2.135	0.033

Table 7: Parameter estimates and associated standard errors, z-scores, and p-values for the AICc best fitting model (Mortality = Elevation + StationFire + Elevation:StationFire, where : indicates a statistical interaction) of big-cone Douglas fir mortality in the Angeles National Forest.

Parameter	Estimate	Standard error	z value	p-value
Intercept	1.2701	0.8752	1.451	0.147
Elevation	-0.0019	0.0006	-3.165	0.002
StationFir	-0.4828	0.5198	-0.929	0.353
Elevation:StationFir	0.0009	0.0004	2.307	0.021

the suite of species that are regularly found as constant and abundant taxa in the alliances are found within a set of 'species / stand tables' Appendix 3, and a summary of the environmental variables per association are found in Appendix 4. Additionally, the suite of species that are regularly found as constant and abundant taxa in the associations are further found in Appendix 5, and a summary of the environmental variables per association are in Appendix 6.

We also inspected the associations for the watersheds within which they were sampled (Table 12). Of the five watersheds at the HUC 8 level in the Angeles National Forest (ANF), some associations were found in only one watershed. For the Bigcone Douglas-fir alliance, the *Pseudotsuga macrocarpa – Quercus kelloggii* association, *Pseudotsuga macrocarpa – Quercus chrysolepis* – mixed conifer / *Cercocarpus ledifolius* association and the *Pseudotsuga macrocarpa – Quercus chrysolepis – Pinus monophylla / Fremontodendron californicum* association were sampled only within the Antelope-Fremont Valleys Watershed. The *Pseudotsuga macrocarpa – Quercus agrifolia* association was sampled only within the Los Angeles Watershed. In contrast, the *Pseudotsuga macrocarpa – Quercus chrysolepis* association was the most widely distributed, sampled in all five watersheds.

Some associations denote a particular seral state within conifer habitats because of the post-fire and repeat fire conditions in the Angeles NF, including the *Pinus ponderosa – (Pinus lambertiana) / Bromus tectorum* association, *Pseudotsuga macrocarpa – Quercus chrysolepis / Bromus diandrus* association, and *Pseudotsuga macrocarpa – Quercus chrysolepis / Ceanothus integerrimus* association. Other post-fire seral types include the shrub associations of *Quercus chrysolepis – Ceanothus integerrimus, Ceanothus integerrimus,* and *Ceanothus leucodermis*. As expected, these two seral associations of the bigcone Douglas-fir alliance exhibited lesser amounts of regenerating *Pseudotsuga macrocarpa* (as seen in the lower to no % cover and % constancy of PSMA seedlings and saplings in Appendix 3). Additionally, the association with *Bromus diandrus* was found in relatively low elevations only in two specific watersheds, namely the Santa Clara and Los Angeles watersheds.

Additionally, of the stands classified as shrubland associations that were sampled across the range of *Pseudotsuga macrocarpa*, almost all have been noted as having medium to high fire severity and >10% mortality of PSMA (as noted in Appendix 1). Those associations of the bigcone Douglas-fir alliance that had higher mortality of PSMA (i.e., > 30% of the samples) included the / *Bromus diandrus, / Ceanothus integerrimus, / Hesperoyucca whipplei* association. Additionally, the shrubland and herbaceous associations that were sampled had lower values for average time since fire as compared to the conifer associations that had higher averages for time since fire (as noted in Appendix 6).

While some associations exhibit various seral states of the tree and shrub-dominated alliances, some associations also trend on lower versus higher elevations and in different habitat settings. In comparing the associations of the Bigcone Douglas-fir woodland & forest alliances, for example, *Pseudotsuga macrocarpa – Quercus chrysolepis – Abies concolor – Pinus* spp. (*lambertiana, jeffreyi, ponderosa*) Association is found at higher average elevations in upland settings as compared to the *Pseudotsuga macrocarpa – Quercus chrysolepis – (Acer macrophyllum)* Association that is found in lower elevation riparian settings.

Vegetation Mapping Results

The heads-up digitization of polygons resulted in 18,573 acres being mapped as bigcone Douglas-fir Forest alliance in the Angeles National Forest and in the adjacent San Bernardino National Forest (<250 acres). In contrast, the existing vegetation map (EVEG) has 34,055 acres mapped as bigcone Douglas-fir dominant stands (USDA 2014). Our alliance map identified 9,236 acres as bigcone Douglas-fir Forest that were not mapped in EVEG map. Conversely, there were 24,766 acres mapped in the EVEG map as bigcone Douglas-fir dominant stands that were not mapped as that alliance in our map. See Table 11 for the differences in acreage mapped by watershed. Although the acreage of the EVEG map is more similar in acreage to our bigcone Douglas-fir species distribution map (38,996 acres) there is still a significant difference between the areas mapped. The EVEG map includes 17,519 acres that are not within our species distribution map and 21,862 acres of our species distribution map is not mapped in the EVEG map. Of the 460 surveys collected for this project, 43 rapid assessments and 17 recons were collected within the EVEG bigcone Douglas-fir dominant mapped area but were not found by field staff to be so. Ten of these surveys did not have any bigcone Douglas-fir present, but usually in small numbers. A resulting geodatabase contains all geospatial data created during this project including the bigcone Douglas-fir alliance map, the species distribution map, and all rapid assessments and reconnaissance survey locations and data.

Conclusions and Discussion

This report is not comprehensive; it was based upon the available funding, resources and USDA Forest Service staff schedules in 2015-16. The map of bigcone Douglas-fir distribution is complete (figures 12-21) and hopefully

provides an updated version from field surveys and aerial interpretation with limited modeled data.

The bigcone Douglas-fir field work in the Angeles National Forest was important in beginning to assess the overall distribution of this vegetation. Key findings included identifying significant differences in mapped areas of bigcone Douglas-fir compared to previous delineations from remote sensing. We mapped more than 15,000 fewer acres as bigcone Douglas-fir dominant stands than what was previously mapped in EVEG. The EVEG map was produced in 2009 using imagery taken in 2009 prior to the Station Fire. It is possible that some of the acres previously mapped as bigcone Douglas-fir experienced high severity fire resulting in a type conversion. For instance, the majority of shrubland and herbaceous stands that we sampled had high fire severity and mortality of bigcone Douglas-fir which could partially explain some of this acreage that the EVEG map had as bigcone Douglas-fir dominant. However, this would not explain the more than 9,000 acres of bigcone Douglas-fir stands mapped in our map but that the EVEG map is missing. Further exploration of the data is needed to fully understand the resulting differences between these two maps.

The resulting field data contains hundred of surveys of bigcone Douglas-fir and related vegetation assemblages. The data include fuel model and tree basal area information that we did not analyze for this report. This additional information could be further explored by fire ecologist and land managers to inform future fire/fuels restoration plans. We were also able to target areas that are experiencing higher than normal levels of mortality across the ANF.

Reproduction

San Gabriel Mountains

We found recruitment to be most common in two quite different types of environments within the San Gabriel Mountains. The first was on disturbed sites, ranging from roadcuts to landslides. We hypothesize that bigcone Douglas-fir do well with seedling recruitment in these locations because the disturbance removes the seedbank and exposes mineral soils. In general, the lack of competition from other seedlings on these disturbed sites may play a role in the general success of PSMA. More study is needed, but it appears that if a PSMA seed source is nearby, the species is able to pioneer and germinate on mineral soil sites more rapidly that other associates (figure 5).

The second habitat where seedling recruitment was commonly seen was within mature forests. In general, late seral forests of the mid to upper elevations of the San



Understory recruitment in late seral forest.



Roadcut recruitment in the San Gabriels, near Crystal Lake.



An even-aged colluvial cohort recruiting in an old bed of rocks caused by a landslide in the upper San Gabriel River country.

Landscape-scale patterns in bigcone Douglas-fir recruitment

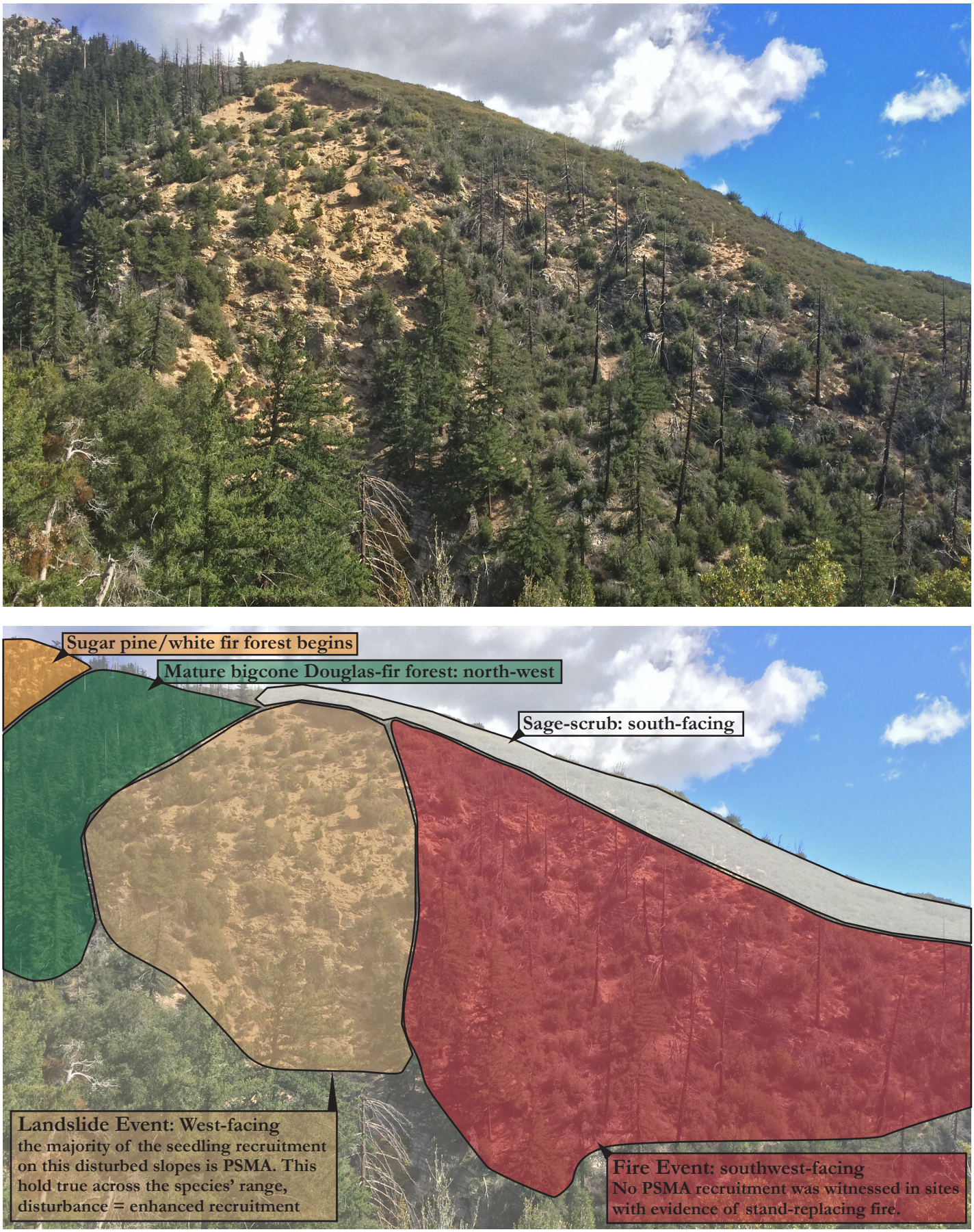


Figure 5. Patterns of recruitment for bigcone Douglas-fir.



Oak woodland and meadow encroachment was common in the upper elevations of the Sierra Pelona Mountains.



Oak woodland seedling and sapling encroachment on Libre Mountain looking north to the Piute Mountains across the Antelope Valley.



Mortality due to xerification was frequently detected in lower elevations. Here on the north slopes of the Sierra Pelona Mtns.

Gabriels have a well-developed two-tiered mature overstory consisting of canyon live oak and bigcone Douglas-fir. In these stands, there were few understory plants besides seedlings and saplings of both canyon live oak and bigcone Douglas-fir.

Our plot data showed that in the absence of fire (0) or with low severity fires (1), reproduction increases with elevation (figure 3). This could be due in part to more disturbance events on steeper, high elevation slopes as well as the nature of the forests themselves. As mentioned, PSMA appears to reproduce better in late seral forests in the understory of mature oaks and bigcone Douglas-firs and this forest type is more common with increased elevation. With higher intensity fires (2-4) there was a decrease in detected reproduction as elevation increases. This will be discussed further in the mortality section below.

Sierra Pelona Mountains

Like the San Gabriels, recruitment is occurring more often in the upper elevations. However, what is interesting about the recruitment in the Sierra Pelona range is that it is occurring in the understory of black oaks (*Quercus kelloggii*) and in open meadows adjacent to these oak woodlands. This scenario is quite different than what we found in the San Gabriels. In fact, this sort of encroachment is common across the state, particularly in the North Coast Range, for coast Douglas-fir (*Pseudotsuga menzeisii*) in middle elevations where the species grows with black and Oregon white oaks (*Quercus garryana*). In some areas of California, *Pseudotsuga menzeisii* recruitment is being mechanically managed to preserve black and white oak woodlands.

Mortality

By way of heads up digitizing, we measured mortality in two categories, present and stand-replacing. The "mortality present" category identified stands which have anywhere between 10-90% mortality. Of the 35,330 acres of bigcone Douglas-fir in the Angeles 6,702 acres are experiencing mortality between 10-90% (19% of all stands - table 2). The "stand-replacing fire event" category, which has 90-100% mortality, was identified in 3,728 acres or 11% of stands, exclusively in the San Gabriel Mountains.

In the Sierra Pelona Mountains we found 656 acres (of 2,052) that had "mortality present." This represents 32% of the total occurrence of PSMA (table 2). The average elevation of these stands was 4,082′ (1,237m - std 146m) (table 3). We detected no stand-replacing fire events within bigcone Douglas-fir stands in the Sierra Pelonas.

In the San Gabriel Mountains we found 6,046 acres (of 33,728) that had "mortality present." This represents 18%

of the total occurrence of PSMA. The average elevation for partial mortality is 4,379′ (1,327m - std 256m). "Stand-replacing fire events" occurred across 3,728 acres or 10.5% of the total PSMA acreage. Because of limitations of our heads-up digitizing, detected standing snags are estimated to be, conservatively, 30 or fewer years. The combination of ground-truthing and heads-up digitizing allowed us to estimate that, conservatively, nearly 4,000 acres of bigcone Douglas-fir has been eliminated in the past 30 years in the San Gabriels, almost entirely by the station fire. (NOTE: we have not accounted for the Blue Cut and Sand fires after our study ended in summer 2016.)

Across the Angeles National Forest the species grows at a range of 1,000′-7,000′. The average elevation for partial mortality is 4,360′ (1,321.2m - std 247.4) and we detected that all partial mortality is occurring below 5,200′. The upper elevations are not yet experiencing mortality besides from fire. Forest health in the higher elevations is most likely due to cooler average temperatures and resulting higher moisture levels. We predict that partial mortality in the lower elevations will likely continue and become more severe due to xerification and climate change. There is also a danger of ecosystem conversion to both native chaparral and non-native grassland/shrubland with increasing PMSA mortality.

Data from our plot analysis shows that as elevation increases stands have lower to no fire impacts with respect to mortality (figure 4) and have overall less partial mortality (table 3). However, there is also a correlation where high severity fires causes nearly-complete mortality in higher elevation stands (Figure 4). These patterns suggests a few possibilities. At higher elevations there are steeper slopes that fuel higher-intensity events driven by flames that easily reach un-burnt fuel at the fire's front. At lower elevations, where PMSA co-occurs with sage-scrub/chaparral, a high-intensity fire buffer may be a factor. High intensity fires in chaparral move rapidly across the landscape with fewer ladder fuels, which could limit the frequency fire enters the tree's crown.

Because the species is fire adapted, survival during lower-severity fire events should be expected. However, the implications of high mortality in the upper elevations due to high intensity fires—particularly in the upper-elevation conifer forests—is that stand replacing events, coupled with climate change, can lead to a higher probability of ecosystem conversion. It would be interesting to see if the 2002 Curve Fire affected stands of PSMA and if ecosystem conversion, or early succession, is occurring in these higher elevations. The high levels of mortality in the lower elevations is due to high-intensity fires and, more often, habitat xerification. As these stands dry and die, they are converting to sage-scrub/chaparral or to non-native grasslands or fields of Spanish broom (*Spartium junceum*).

Climate Modeling

Researchers at the University of California at Davis (Thorne et al, 2017a) used Maxent modelling to predict potential bigcone Douglas-fir distribution under four future climate scenarios and three different time periods. Current and future species distribution was mapped according to potential site suitability. Under all modelled scenarios, portions of currently suitable sites are expected to become unsuitable over time.

In warm and wet climate scenarios losses of current site suitability are predicted to increase over the long-term. Existing site suitability is most likely to persist in the northern and western extents of the species' range. A larger proportion of suitable sites on the Los Padres National Forest is expected to persist compared to the Angeles, San Bernardino, and Cleveland National Forests.

Hot and dry climate scenarios are expected to result in significant loss of currently suitable areas over the short- and long-term. It's predicted that these losses would occur across the species' current range. Site suitability may remain somewhat greater near the coast, but range reduction would be severe even in those areas.

Potential site suitability is expected to expand well north of currently suitable areas in all modelled scenarios. In warm and wet climates the greatest initial increases in site suitability would occur in the coast ranges, but could increase in the Sierra Nevada and Cascades over time. Some coast range expansion of site suitability is expected in hot and dry climates as well, however most of the predicted suitability is expected to occur in the Sierra Nevada and Cascade mountain ranges.

Despite widespread projected growth of newly suitable habitat, it is unlikely that a highly restricted species such as bigcone Douglas-fir could expand to all of those sites (Thorne, 2017b). For instance, seed dispersal mechanisms could prove to be a hindrance when confronted with obstacles such as great distances and varied terrain. Even with human intervention and dedicated resources, an assisted migration of that magnitude would undoubtedly be a herculean feat. Many modelled sites could prove to be unsuitable due to unforeseen bio-physical factors as well. (Also see Appendix 9)

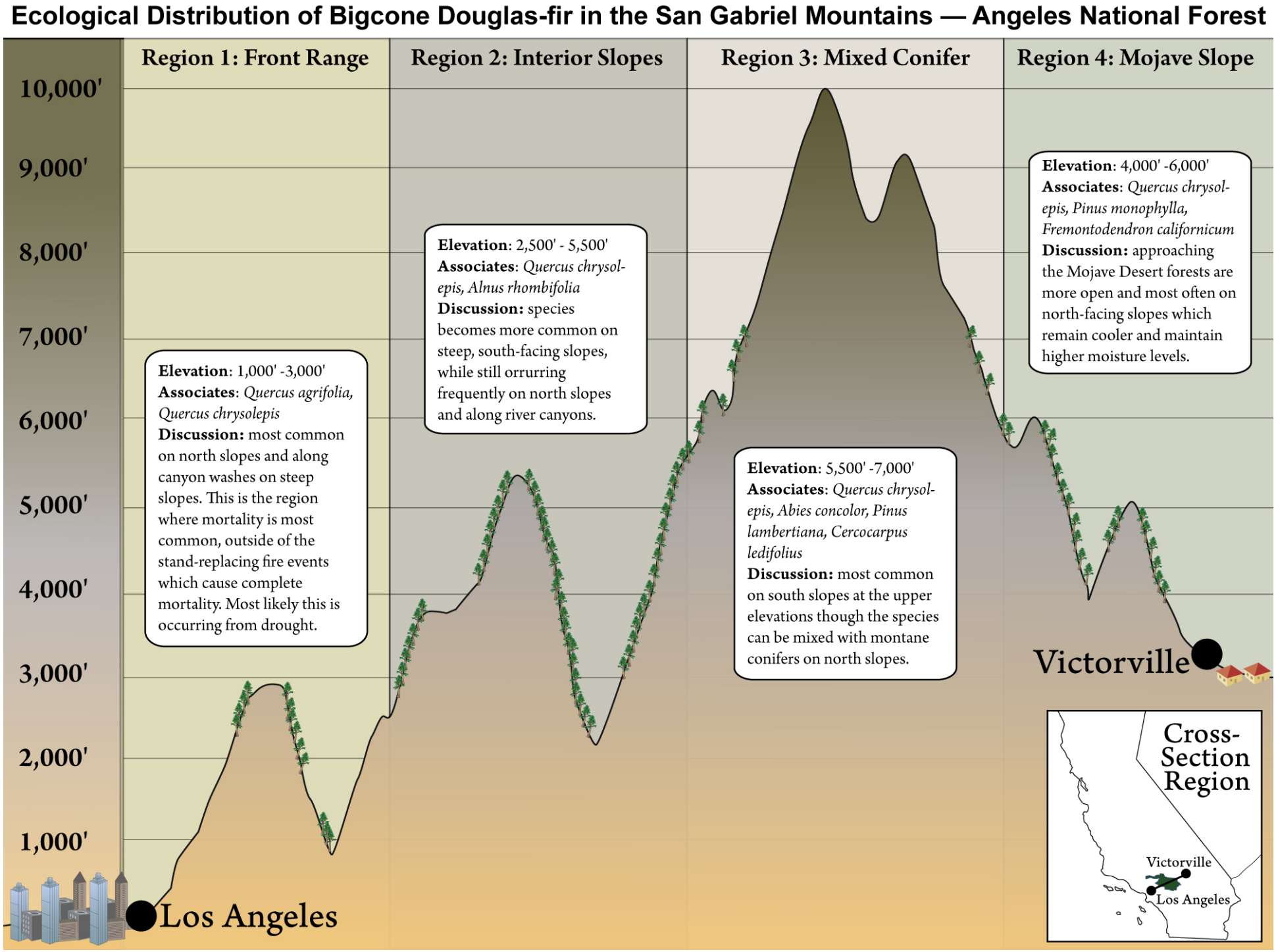


Figure 6 Bigcone Douglas-fir distribution across the San Gabriel Mountains.

Management Recommendations

Because bigcone Douglas-fir grow in two ecologically distinct regions of the ANF we offer recommendations separately for the San Gabriels and Sierra Pelona mountains. While most of the stands are within the San Gabriel Mountains some of the more immediate active management could occur in the Sierra Pelonas. We also recommend initiating long-term monitoring plots across both ranges.

Sierra Pelona Mountains

This in an interesting case for active management due to modern fire suppression. As is occurring in oak woodlands across California, conifers are encroaching into and overtopping the oaks. This is also occurring with bigcone Douglas-fir in the Sierra Pelonas, specifically in the upper elevations of Liebre Mountain in the black oak woodlands. Thickets of conifers, mostly bigcone Douglas-fir but some coulter pine (*Pinus coulteri*), have been recruiting in these open spaces that were formerly managed by the Serrano Indians (Yuhaviatam) as a food source for acorns as well as open hunting grounds (Keeley 2002). Most of the new seedling and sapling growth has occurred over the last 100 years.

We recommend that the Forest Service examine the value in oak woodland conservation versus a conservation emphasis on bigcone Douglas-fir. Treating conifer encroachment (including PSMA) via burning or mechanical removal could help maintain the cultural and habitat values provided by shrinking oak woodlands. I could also reduce the likelihood of severe/stand-replacing fire. However, that should be weighed within the context of larger landscape patterns, management area and Forest Plan direction, as well as ongoing threats to this relatively small and disjunct population of bigcone Douglas-fir.

Low elevation mortality and a high elevation recruitment of bigcone Douglas-fir may reflect a natural response to climate change and/or other anthropogenic disturbance. Bigcone Douglas-fir regeneration beneath oak over-stories is not uncommon elsewhere within the species' range, but rather a known seral stage in plant community succession specifically with canyon live oak. Removal of what appears to be an expanding population of bigcone-Douglas-fir in the face of on-going losses within the Sierra Pelona Mountains could have long-term effects on species persistence in this part of its range. Ultimately management decisions should be made within the context of the larger mosaic of plant communities and management emphases within the Angeles National Forest.

In the lower elevation of the range, long-term monitoring plots should be put in place to track the high levels of mortality in the north-facing canyons adjacent to the Mojave Desert. Here we documented nearly 700 acres of the 2,000 in the range to be exhibiting at least 10% mortality. This is most likely do to long-term drought and habitat xerification. These stands are often adjacent to private land and along Pine Canyon Rd (N2).

San Gabriel Mountains

Compared to the Sierra Pelona Mountains, the San Gabriels have proportionately less low-level mortality but higher incidences of stand-replacing fire events—mostly due to the Station Fire. In the western San Gabriels stand replacing events, within the Station Fire footprint, have occurred where bigcone Douglas-fir associate with Coulter pine. In this region, mountain slopes are less dramatic than in the central and eastern parts of the range.

Mega-fires like the Station are most likely due to proximity to roads—which were easier to construct through this region of the mountains. In addition to roads creating a higher chances for accidental anthropogenic fire ignition, they also vector invasive species, which are also vectors for fire. Our data suggests that high severity fire at high elevations has the largest impact on mortality and reproduction, meaning that these populations are at the greatest risk from stand-replacing fire. From a management perspective this could translate into more active management to reduce fuel loads in high elevation stands. This acts as a way to avoid high severity fires in areas with the potential for low mortality and high reproduction.

Ironically, bigcone Douglas-fir recruitment is occurring at unprecedented rates in road cuts. It appears the species does well in these situations because of the newly-exposed mineral soil (no seed bank) and the lack of competition from other plant species on these steep slopes. Recruitment is happening on disturbed slopes because there is a seed bank nearby. Across the San Gabriels we recommend the Forest Service disperse collected seeds in road cuts or new landslides between 4,000-7,000'. This management approach will repopulate and stabilize slopes while promoting the persistence of bigcone Douglas-fir.

While fire is not an uncommon component of bigcone Douglas-fir natural history, use of fire may be limited, or should at least warrant careful consideration and planning in the management of the species. Frequent and severe fires have caused a great deal of mortality across the species' range. This is in part due to the prevalence of invasive annual grasses in some areas. Because fire may perpetuate the dominance of these novel invasive plant communities,

burning is not a recommended management option.

In the opinion of the authors, management of low elevation stands may not be a justifiable priority given the high likelihood of stand replacing events and ongoing xerification. Resource expenditures would likely have the most value between 4,000′ and 7,000′ because mortality is relatively low and regeneration relatively high at these elevations. Annual grasses aren't as prevalent, and stand replacing fires are not as common. Plant communities at these elevations may not be as resilient to fire either, therefore its use in stand management should likely occur in concert with other measures. Where appropriate, initial thinning efforts could be conducted mechanically so as to reduce potential fire severity and preserve an over-story "nurse crop" commonly associated with successful recruitment. After site-preparation, fire could then be used in the maintenance of desirable stand characteristics.

Other recommendations include environmental education and public outreach to promote fire safety and noxious weed awareness. We recommend directing some resources to youth education. There are several active environmental education centers in the San Gabriel Mountains including the Los Angeles County Outdoor Science School in Wrightwood and Clear Creek Outdoor School run by LA Unified along Angeles Forest Highway near La Cañada. Money could be earmarked for use in educating students about fire ecology and prevention as well as the dangers of invasive species.

Away from roads, most often in the wilderness setting, recruitment appears to be most common in wilderness areas that have not been managed due to their remote nature. With lack of management, fires have remained unconfined, of generally low-intensity, and frequent. This has maintained conditions that mimic those to which this species has adapted over the past 5 million years. Steep slopes in the interior mountains have also offered long-term refugia from high-intensity fires due to exclusion. Recruitment is also common on these steep, rocky slopes as well as in the washes where, after landslide events, bigcone Douglas-fir rapidly regenerates in even-aged colluvial cohorts. Recommendations in remote areas of the forest include adding wilderness designation and eliminating roads or other actions that could preserve refugia, where possible.

General Recommendations

Since we have found several seral states of PSMA, it will be worthwhile to conduct detailed long-term monitoring through an array of plots placed across the range and variation of bigcone Douglas-fir, and our vegetation Rapid Assessment data could assist Forest Service staff and partners in guiding where to place plots.

We recommend that additional fine-scale mapping and surveying of vegetation across the entire forest would be beneficial for assisting the Forest Service with short-term and long-term management actions in this highly diverse region of southern California. The forest contains many rare vegetation associations, of which we were only able to sample a few that related to *Pseudotsuga macrocarpa*. This project did allow us to identify rare associations of this conifer vegetation, which were previously not discerned, and it also allowed us to identify a rare association of A*rctostaphylos parryana* as a montane chaparral type occurring on calcareous soils in the forest. Both the common and rare vegetation could benefit from having more sampling to identify the range and variation, and to identify those vegetation types that may continue to be at risk for fire and fuels loading, such as seen in certain areas of the montane zone.

If research was conducted across the forests of the Transverse Ranges there is a high potential for stress in certain portions of the range of PSMA due to climate-water deficit factor. By 2100, climate modelers are finding that areas in the Angeles National Forest such as the San Gabriel Mountains, will likely undergo a higher climate-water deficit as compared to areas in the Los Padres NF due to a greater distance from the Pacific Ocean. Bigcone Douglas-fir is likely to find refugia along the higher, north facing elevations in the Angeles NF over the next 85+ years, though lower elevation sites are likely to continue to be severely impacted (by repeat fires and/or higher climate-water deficit). Bigcone Douglas-fir may be able to persist more extensively in the Los Padres because it has a smaller climate-water deficit.

In some of the PSMA dominant surveys, *Bromus diandrus* and *B. tectorum* appear to be high in cover. To evaluate the long-term variation and change in cover of herbaceous plants, LANDSAT data could potentially be evaluated on an annual basis to determine cover for herbaceous species. Areas with higher herbaceous cover may be more at risk of fires, as a management consideration in the present and future.

Lastly, we recommend running an intersect that looks at our alliance layer compared with fire severity over time. With the establishment of long-term data sets that include distribution and fire severity, patterns might develop that can predict where the species will survive in this newly available habitat. These locations can be pro-actively planted with bigcone Douglas-fir to keep up with accelerated warming due to climate change.

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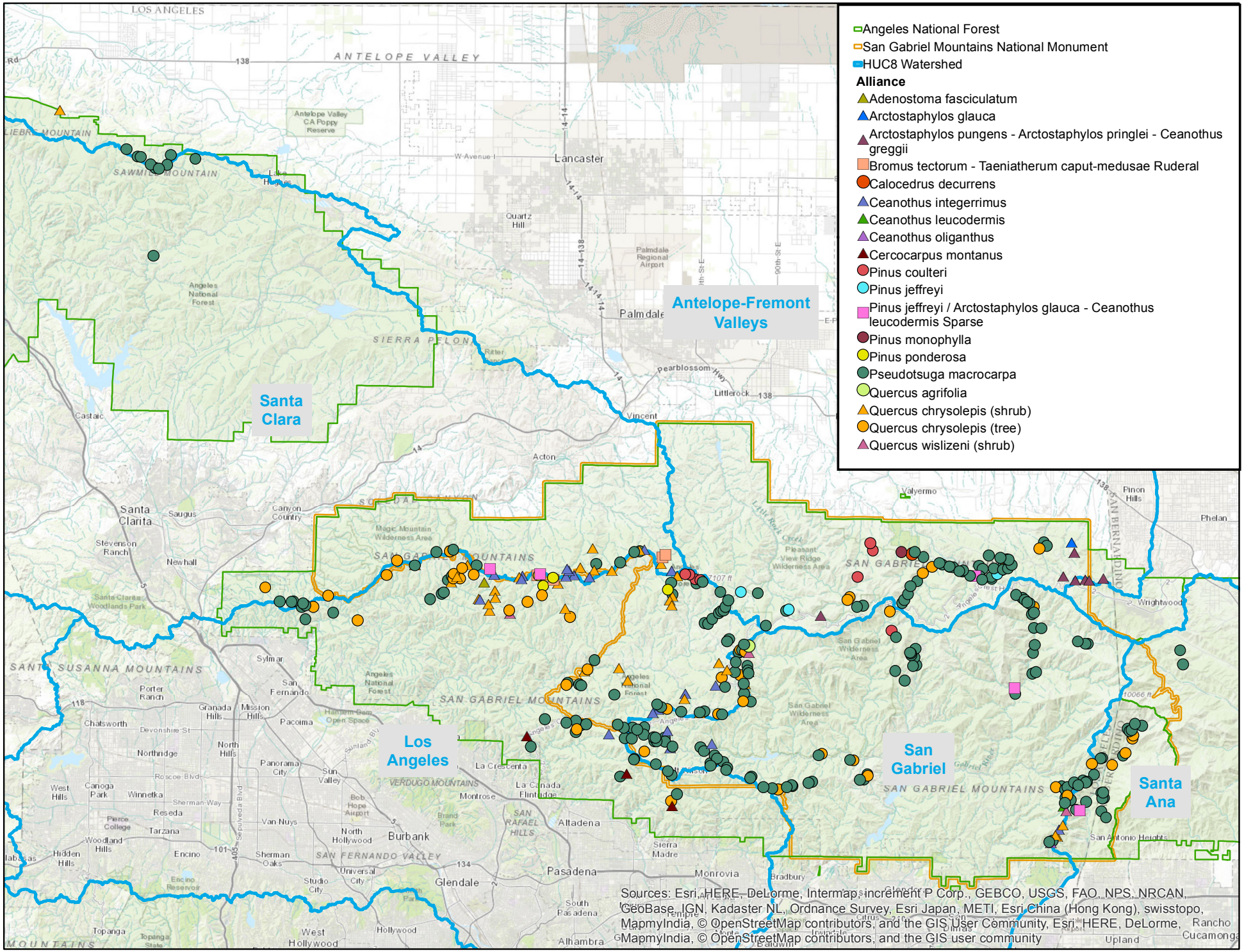


Figure 7. HUC Watersheds and PSMA Alliances in the Angeles National Forest

Table 8. The floristic classification of alliances and associations organized by woodland & forest, shrubland, and herbaceous & sparsely vegetated types. Newly defined associations are designated with an asterisk (*) in this table.

Lifeform	Alliance	Association	# Surveys
Woodland & Forest			
	Alnus rhombifolia		
		Alnus rhombifolia – Acer macrophyllum	1
	Calocedrus decurrens		
		Calocedrus decurrens – Alnus rhombifolia	1
	Pinus coulteri		
		Pinus coulteri – Quercus chrysolepis	9
	Pinus jeffreyi		
		Pinus jeffreyi (alliance)	3
	Pinus monophylla		
		Pinus monophylla (alliance)	1
	Pinus ponderosa		
		*Pinus ponderosa – (Pinus lambertiana) / Bromus tectorum**	4
	Pseudotsuga macrocarpa		
		Pseudotsuga macrocarpa – Quercus agrifolia	3
		Pseudotsuga macrocarpa – Quercus chrysolepis	54
		*Pseudotsuga macrocarpa – Quercus chrysolepis – (Acer macrophyllum)**	14
		Pseudotsuga macrocarpa – Quercus chrysolepis – Abies concolor – Pinus spp. *(P. lambertiana, jeffreyi, ponderosa)**	17
		Pseudotsuga macrocarpa – Quercus chrysolepis – mixed conifer / *Cercocarpus ledifolius**	4
		*Pseudotsuga macrocarpa – Quercus chrysolepis – Pinus coulteri**	25
		*Pseudotsuga macrocarpa – Quercus chrysolepis – Pinus monophylla / Fremontodendron californicum**	14
		*Pseudotsuga macrocarpa – Quercus chrysolepis – Quercus wislizeni / Arctostaphylos glandulosa**	6
		*Pseudotsuga macrocarpa – Quercus chrysolepis / Bromus diandrus**	14
		*Pseudotsuga macrocarpa – Quercus chrysolepis / Ceanothus integerrimus**	35
		*Pseudotsuga macrocarpa – Quercus chrysolepis / Cercocarpus montanus**	17
		*Pseudotsuga macrocarpa – Quercus chrysolepis / Hesperoyucca whipplei**	14
		*Pseudotsuga macrocarpa – Quercus kelloggii**	5
		Pseudotsuga macrocarpa (alliance)	7
	Quercus agrifolia		
		Quercus agrifolia – Quercus engelmannii / Eriogonum fasciculatum	1
		Quercus agrifolia – Umbellularia californica	1
	Quercus chrysolepis (tree)		
		Quercus chrysolepis – Pseudotsuga macrocarpa	37

Lifeform	Alliance	Association	# Surveys
		Quercus chrysolepis – Pseudotsuga macrocarpa – Acer macrophyllum	7
		Quercus chrysolepis – Quercus wislizeni	1
		Quercus chrysolepis / Ceanothus integerrimus	6
		Quercus chrysolepis (tree)	4
		Quercus chrysolepis (alliance)	1
	Quercus wislizeni (tree)		
		Quercus wislizeni – Quercus chrysolepis	1
		Quercus wislizeni – Quercus chrysolepis – Pinus coulteri	1
Shrubland			
	Adenostoma fasciculatum		
		Adenostoma fasciculatum – Eriogonum fasciculatum	1
	Arctostaphylos glauca		
		Arctostaphylos glauca	1
	Arctostaphylos pungens - Arctostaphylos pringlei - Ceanothus greggii		
		Arctostaphylos parryana	7
	Ceanothus integerrimus		
		Ceanothus integerrimus	20
	Ceanothus leucodermis		
		Ceanothus leucodermis	1
	Ceanothus oliganthus		
		Ceanothus oliganthus	1
	Cercocarpus montanus		
		Cercocarpus montanus – Eriogonum fasciculatum	3
	Quercus chrysolepis (shrub)		
		Quercus chrysolepis – Ceanothus integerrimus	30
		Quercus chrysolepis (shrub)	6
	Quercus wislizeni (shrub)		
		Quercus wislizeni – Quercus chrysolepis (shrub)	1
		Quercus wislizeni (shrub)	3
Herbaceous & Sparsely Vegetated			
	Bromus tectorum - Taeniatherum caput-medusae Ruderal		
		Bromus tectorum Ruderal	4
	Pinus jeffreyi / Arctostaphylos glauca - Ceanothus leucodermis Sparse*		
		Pseudotsuga macrocarpa (sparse)*	5
TOTAL SURVEYS ANALYZED			391

Table 9. Results of the indicator species analysis of the cluster analysis grouping level of 21 groups. Bolded taxa are included as diagnostic plants in alliance and association names.

Code	Scientific Name	Max Group	Indicator Value	p-value
QUAG	***Quercus agrifolia***	1	98.7	0.0002
PLRA	*Platanus racemosa*	1	17.5	0.0058
ARGL3	***Arctostaphylos glandulosa***	2	35.7	0.0002
KECO	*Keckiella cordifolia*	2	14.1	0.0118
ADFA	***Adenostoma fasciculatum***	2	12.2	0.0296
QUCH2	***Quercus chrysolepis***	2	7.9	0.0002
DRAR3	*Dryopteris arguta*	4	21.8	0.0018
TODI	*Toxicodendron diversilobum*	4	19.9	0.0004
POIM	*Polystichum imbricans*	4	19.1	0.0024
ALRH2	***Alnus rhombifolia***	4	10.1	0.0534
TUPA2	*Turricula parryi*	8	33.9	0.0002
SNAG	*Standing snag*	8	18.7	0.0002
BRTE	***Bromus tectorum***	8	17.5	0.0002
CEIN3	***Ceanothus integerrimus***	8	14.4	0.0024
CELE2	***Ceanothus leucodermis***	12	40.5	0.0002
ERPA24	*Ericameria parishii*	12	15.6	0.011
BRDI3	***Bromus diandrus***	13	28.1	0.0002
SOXA	*Solanum xanti*	13	20.2	0.0012
KETE	*Keckiella ternata*	13	9.7	0.0426
CAREX	*Carex*	14	12.9	0.0226
PSMA	***Pseudotsuga macrocarpa***	14	7.6	0.0042
ACHNA	*Achnatherum*	25	39.9	0.0004
RHIL	*Rhamnus ilicifolia*	25	32.8	0.0002
AGROS2	*Agrostis*	25	30.8	0.0004
POCA12	*Polypodium californicum*	25	29.8	0.0006
HEAR5	*Heteromeles arbutifolia*	25	24.7	0.001
PETR7	*Pentagramma triangularis*	25	16.5	0.0116
ACMA3	***Acer macrophyllum***	25	13.2	0.012
FESTU	*Festuca*	25	10.9	0.0436
PICO3	***Pinus coulteri***	27	32.3	0.0002
PILA	***Pinus lambertiana***	27	26.5	0.0002
CASTI2	*Castilleja*	40	12.1	0.0302
CEMOG	***Cercocarpus montanus var. glaber***	51	17.1	0.0008
ABCO	***Abies concolor***	59	27.5	0.0004
PIPO	***Pinus ponderosa***	59	23.3	0.001
ARTR2	*Artemisia tridentata*	59	12	0.0256
2LICHN	*Lichen*	72	16.1	0.0102
GAAN2	*Galium angustifolium*	72	12	0.0126
CRYPT	*Cryptantha*	84	32.7	0.0004
QUWI2	***Quercus wislizeni***	84	20.1	0.0034
ARGL4	***Arctostaphylos glauca***	84	11.3	0.025
HEWH	***Hesperoyucca whipplei***	114	16.9	0.0002
CECO	***Ceanothus cordulatus***	114	10.7	0.041
PIMO	***Pinus monophylla***	184	21.2	0.001
ERNU3	*Eriogonum nudum*	184	16.3	0.011
POA	*Poa*	184	12.9	0.0068
QUKE	***Quercus kelloggii***	207	66.6	0.0002
RIBES	*Ribes*	207	13.8	0.0102
AVBA	*Avena barbata*	240	25	0.0028
ERFA2	***Eriogonum fasciculatum***	240	20.8	0.0008
DIAU	*Diplacus aurantiacus*	240	17.7	0.008
CLPE	*Claytonia perfoliata*	266	87.6	0.0002
GAAP2	*Galium aparine*	266	56.3	0.0002
NEMOP	*Nemophila*	266	23.4	0.0024
ERCA14	*Erysimum capitatum*	266	16.1	0.0094
ARPA4	***Arctostaphylos parryana***	368	81	0.0002
PIJE	***Pinus jeffreyi***	368	68.8	0.0002
CEGRV	***Ceanothus greggii var. vestitus***	368	64	0.0002
ELEL5	*Elymus elymoides*	368	62	0.0002
ERSA6	*Eriogonum saxatile*	368	48	0.0002
FRCA6	***Fremontodendron californicum***	368	34.4	0.0002
ERDE2	*Eriastrum densifolium*	368	21.9	0.0034
ERWR	*Eriogonum wrightii*	368	20.6	0.006
ERCO25	*Eriophyllum confertiflorum*	368	11	0.0186

Table 10. The associations organized by woodland & forest, shrubland, and herbaceous & sparsely vegetated types and the five HUC 8 level watersheds in which they were sampled. Abbreviations for HUC8 watersheds are: AFV = Antelope and Fremont Valley, LA = Los Angeles, SG = San Gabriel, SA = Santa Ana, SC = Santa Clara. Those associations containing bigcone Douglas-fir that were not sampled in in the Angeles but were in the Cleveland NF are denoted with N/A.

Lifeform	Association	AFV	LA	SG	SA	SC
Woodland & Forest						
	Alnus rhombifolia – Acer macrophyllum N/A					
	Calocedrus decurrens – Alnus rhombifolia	X				
	Pinus coulteri – Quercus chrysolepis	X	X	X		
	Pinus jeffreyi (alliance)	X				
	Pinus monophylla (alliance)	X				
	Pinus ponderosa – (Pinus lambertiana) / Bromus tectorum		X			X
	Pseudotsuga macrocarpa – Quercus agrifolia		X			
	Pseudotsuga macrocarpa – Quercus chrysolepis	X	X	X	X	X
	Pseudotsuga macrocarpa – Quercus chrysolepis – (Acer macrophyllum)	X		X		X
	Pseudotsuga macrocarpa – Quercus chrysolepis – Abies concolor – Pinus spp. *(lambertiana, jeffreyi, ponderosa)*	X		X		
	Pseudotsuga macrocarpa – Quercus chrysolepis – mixed conifer / *Cercocarpus ledifolius*	X				
	Pseudotsuga macrocarpa – Quercus chrysolepis – Pinus coulteri	X	X	X		X
	Pseudotsuga macrocarpa – Quercus chrysolepis – Pinus monophylla / Fremontodendron californicum	X				
	Pseudotsuga macrocarpa – Quercus chrysolepis – Quercus wislizeni / Arctostaphylos glandulosa		X	X		
	Pseudotsuga macrocarpa – Quercus chrysolepis / Bromus diandrus		X			X
	Pseudotsuga macrocarpa – Quercus chrysolepis / Ceanothus integerrimus		X	X	X	X
	Pseudotsuga macrocarpa – Quercus chrysolepis / Cercocarpus montanus	X	X	X		
	Pseudotsuga macrocarpa – Quercus chrysolepis / Hesperoyucca whipplei	X		X	X	X
	Pseudotsuga macrocarpa – Quercus kelloggii	X				
	Pseudotsuga macrocarpa (alliance)	X	X	X	X	
	Quercus agrifolia – Quercus engelmannii / Eriogonum fasciculatum			X		
	Quercus agrifolia – Umbellularia californica					
	Quercus chrysolepis – Pseudotsuga macrocarpa	X	X	X	X	X
	Quercus chrysolepis – Pseudotsuga macrocarpa – Acer macrophyllum	X	X			X
	Quercus chrysolepis – Quercus wislizeni					
	Quercus chrysolepis (tree)	X	X	X		X
	Quercus chrysolepis (alliance)					
	Quercus chrysolepis / Ceanothus integerrimus		X	X		
	Quercus wislizeni – Quercus chrysolepis N/A					
	Quercus wislizeni – Quercus chrysolepis – Pinus coulteri N/A					
Shrubland						
	Adenostoma fasciculatum – Eriogonum fasciculatum		X			
	Arctostaphylos glauca					
	Arctostaphylos parryana					
	Ceanothus integerrimus		X	X		X
	Ceanothus leucodermis			X		
	Ceanothus oliganthus			X		
	Cercocarpus montanus – Eriogonum fasciculatum		X			
	Quercus chrysolepis – Ceanothus integerrimus	X	X	X		X
	Quercus chrysolepis (shrub)		X		X	
	Quercus wislizeni – Quercus chrysolepis (shrub) N/A					
	Quercus wislizeni (shrub)		X	X	X	
Herbaceous & Sparsely Vegetated						
	Bromus tectorum		X			X
	Pseudotsuga macrocarpa (sparse)	X		X	X	X

Table 11. Comparative analysis of the acreage of areas mapped in our map as Bigcone Douglas-fir Forest alliance and the areas mapped in Eveg as bigcone Douglas-fir dominant stands. The difference in acres is shown by the five HUC 8 level watersheds.

Watershed (HUC8)	Acreage in Eveg not within Alliance map	Acreage in Alliance map not within Eveg	Net Difference in acreage
Antelope-Fremont Valley	2947	1875	1072
Los Angeles	8595	940	7655
San Gabriel	1399	5070	-3671
Santa Ana	2607	830	1777
Santa Clara	9218	521	8697
Total	24766	9236	15530

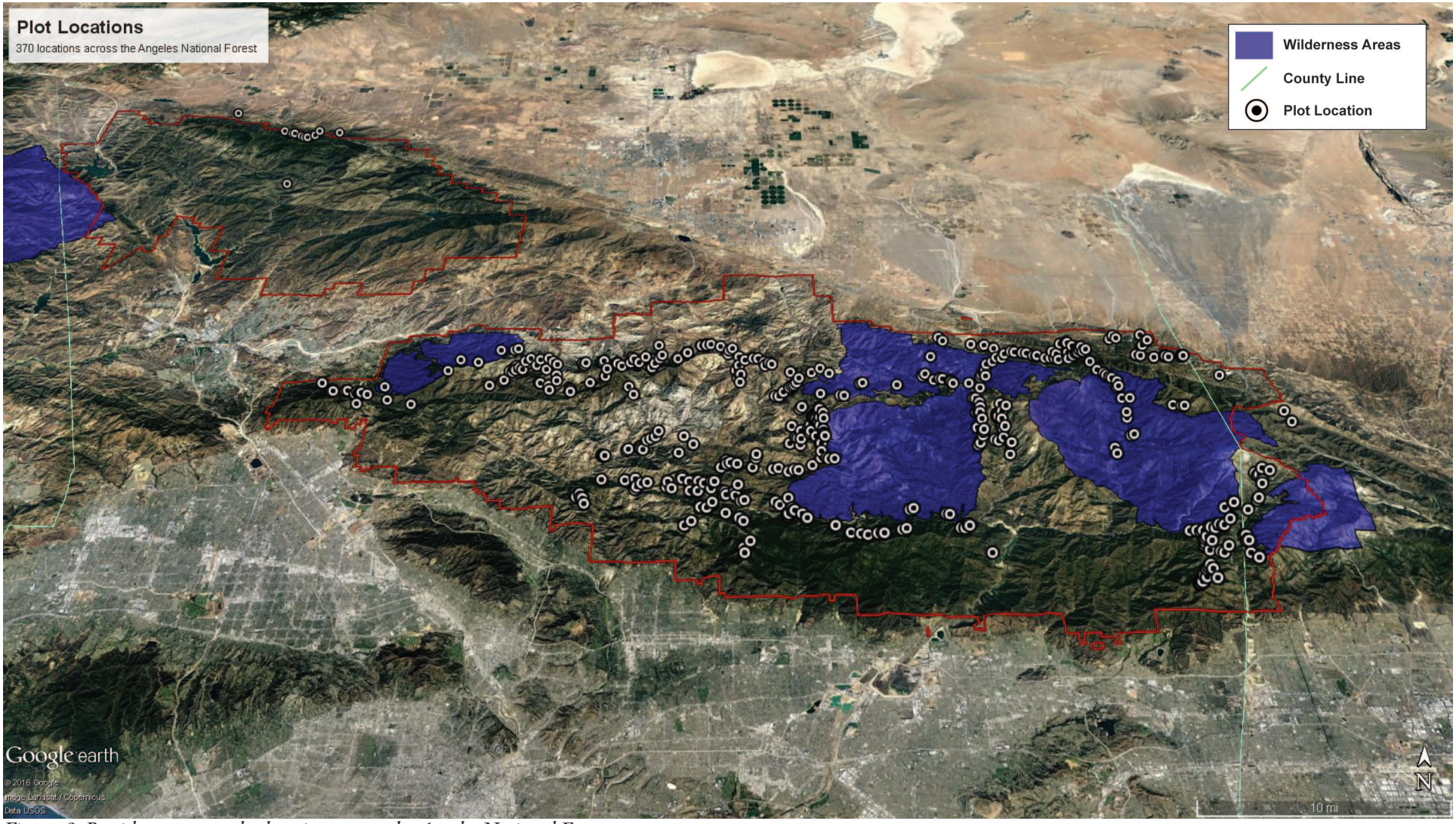


Figure 8. Rapid assessment plot locations across the Angeles National Forest..

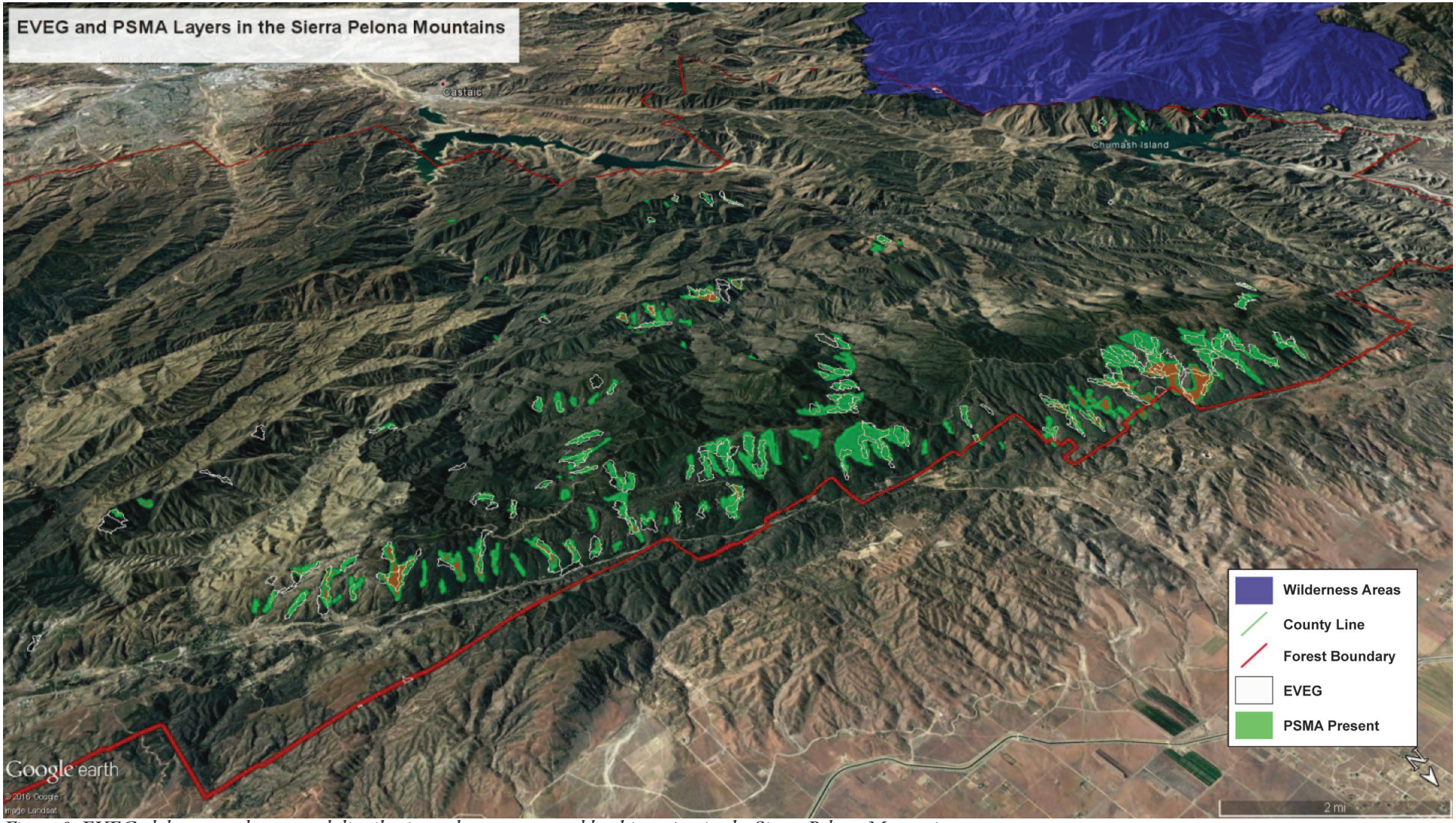


Figure 9. EVEG plolygons and generated distribution polygons generated by this project in the Sierra Pelona Mountains.

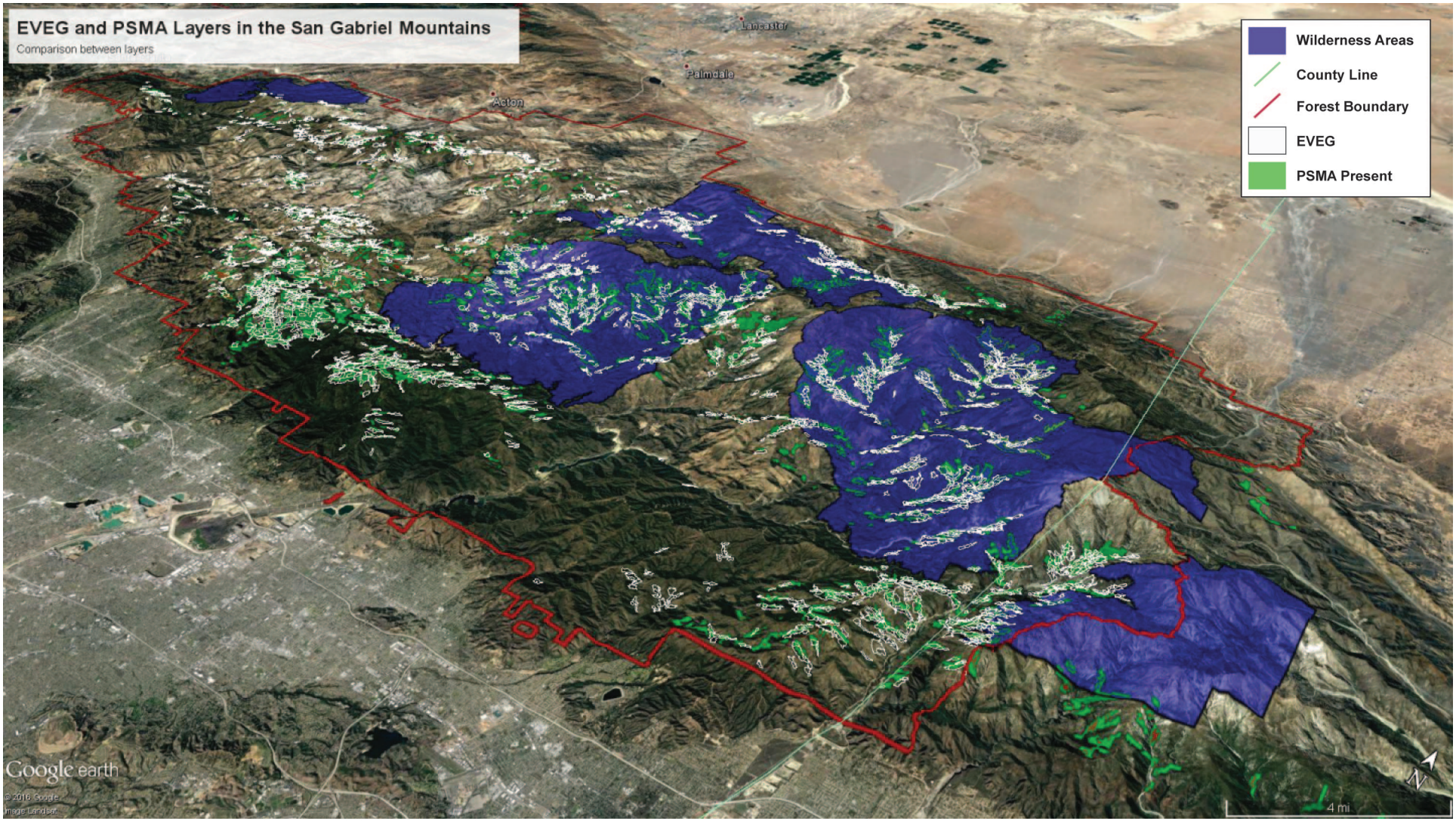


Figure 10. EVEG plolygons and generated distribution polygons generated by this project in the San Gabriel Mountains.

Photographic Field Guide to Bigcone Douglas-fir



Image 0.1: Typical branching pattern in old trees.



Image 0.2: Maturing seed cone photographed in May 2016. Seeds will reach maturity in time for fall rains.



Image 0.3: Maturing seed cone of bigcone Douglas fir (left) and Douglas-fir (right).



Image 0.4: Epicormic trunk budding occurs from dormant buds embedded at the base of branches and allows new branches, and ultimately leaves often as an injury response.

Image 0.5 : Brooming is uncommon.





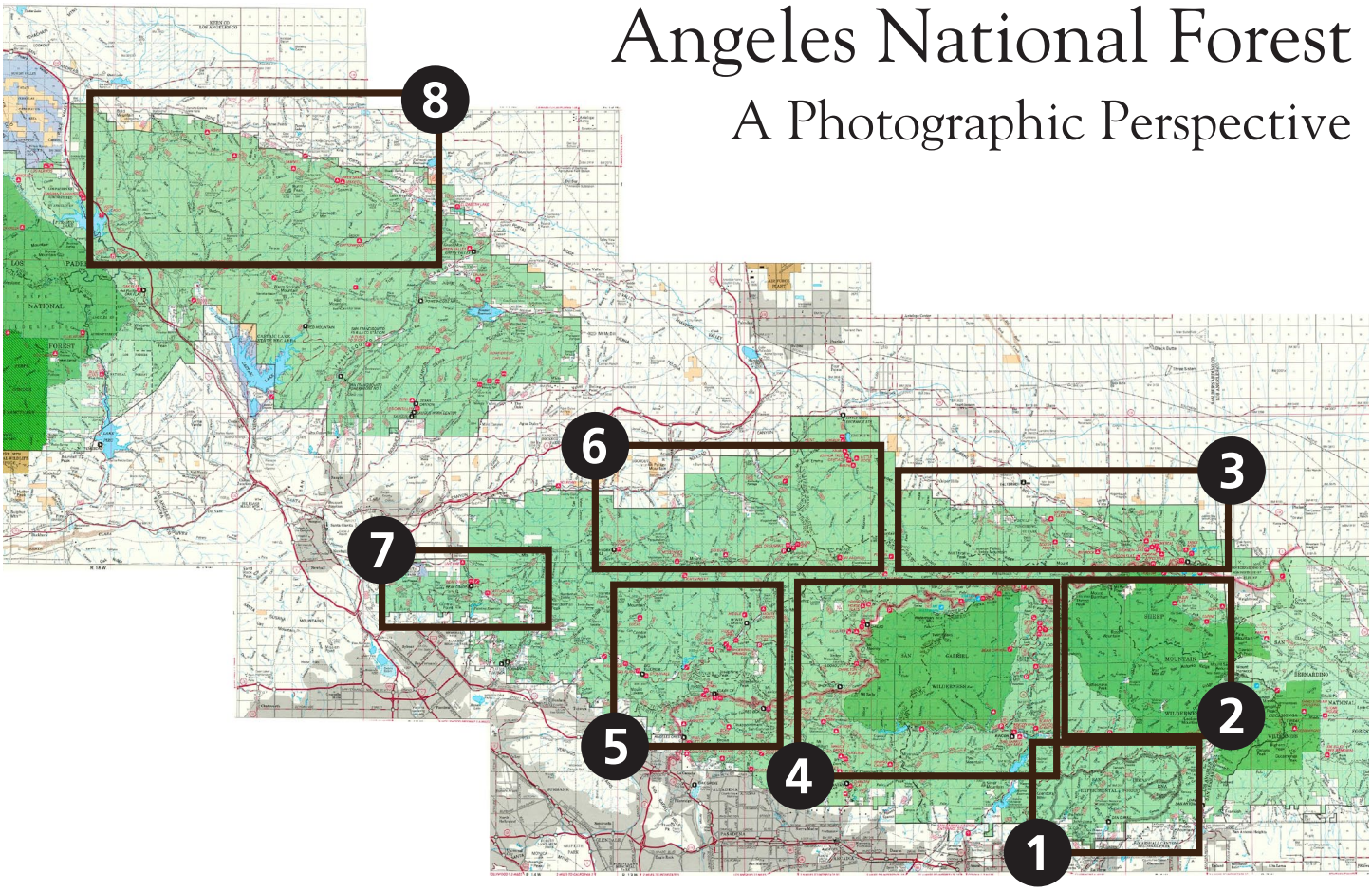
Image 0.6 : Bark is deeply furrowed, often with fire scars in older trees.



Image 0.7: Recruitment was most common on disturbed sites or mature north-facing forests with evidence of low-intensity fires.

Bigcone Douglas-fir across the Angeles National Forest

A Photographic Perspective



1. San Dimas Experimental Forest
2. Sheep Mountain Wilderness
3. North Slopes
4. San Gabriel Wilderness - Chilao and Crystal Lake Regions
5. Tujunga Canyon Region
6. Mount Gleason Region
7. Pacoima Region
8. Sierra Pelona Mountains

Figure 11. Map regions of the Angeles National Forest.

1. San Dimas Experimental Forest



Image 1.1: Overview of the San Dimas Experimental Forest.



Image 1.2: Small pockets of PSMA survive on south-facing slopes, here overlooking Ontario.

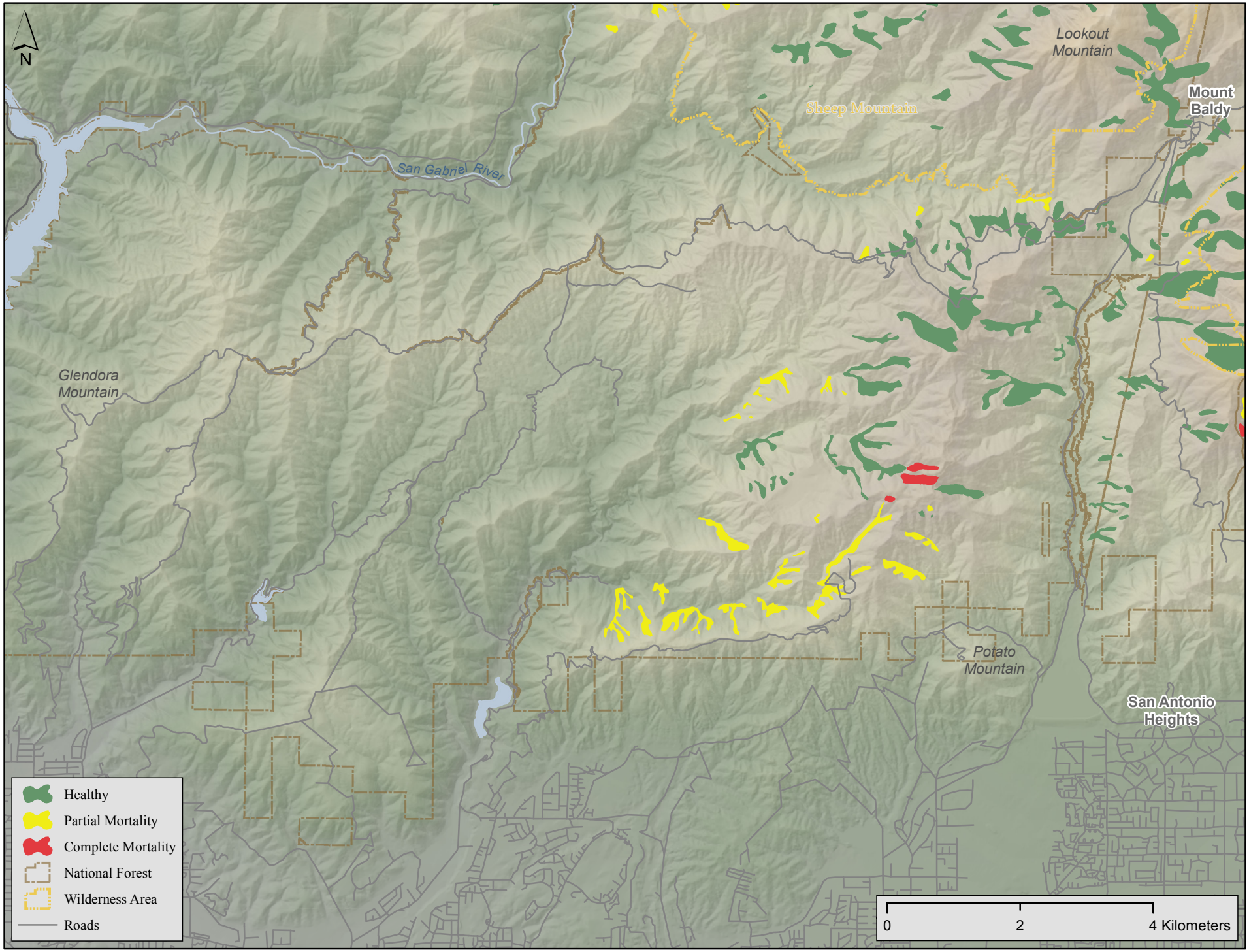


Figure 12 Distribution in San Dimas Experimental Forest region.



Image 1.3: High mortality is occurring (>50%) in the lower elevations and canyons of the region. Most likely due to the synergistic effects of xerification and beetle infestation.



Image 1.4: Evidence of a complete, stand-replacing fire. The vegetation is converting to Canyon Oak woodland.

2. Sheep Mountain Wilderness



Image 2.1: Overview of the San Gabriel River Country.



Image 2.2: Even-aged colluvial cohort within a ~30 year-old rock slide in the headwaters of the San Gabriel River.

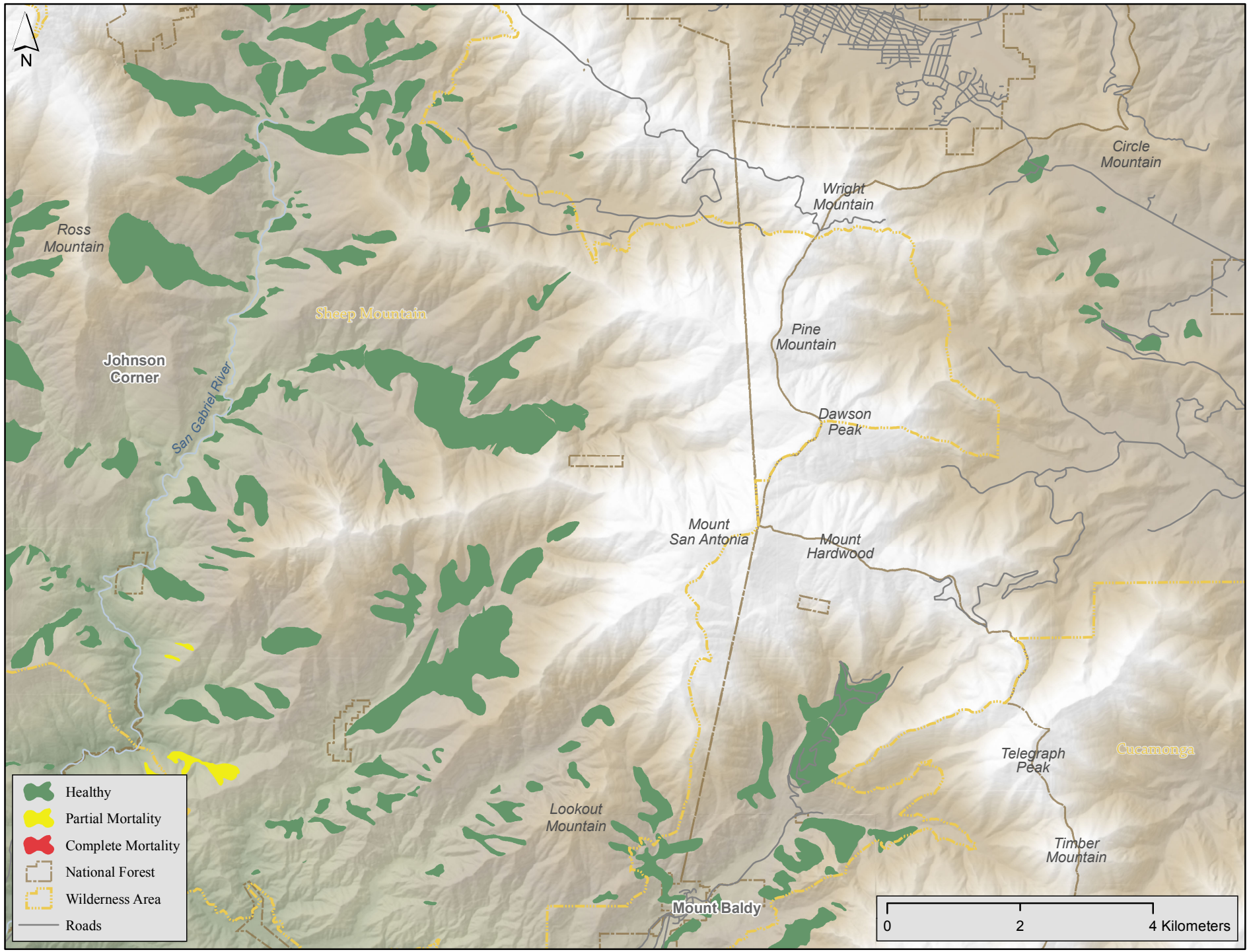


Figure 13.Distribution in the Sheep Mountain Wilderness region.



Image 2.3: In the upper -reaches of the San Gabriel River, sparse stands of bigcone Douglas-fir mix with coastal sage-scrub on south-facing slopes.



Image 2.4: PSMA covers the north-facing slopes in the upper San Gabriel River, Sheep Mountain Wilderness .



Image 2.5: Drainage below Vincent Mine, San Gabriel River.



Image 2.6: Clinging to eroding north-facing cliff faces on slopes approaching 90° in the mid-elevations of the San Gabriel River.

3. North Slopes



Image 3.1: Along the South Fork Trail in the Pleasant View Ridge Wilderness.



Image 3.2: Below Vincent Gap along the Manzanita Trail.

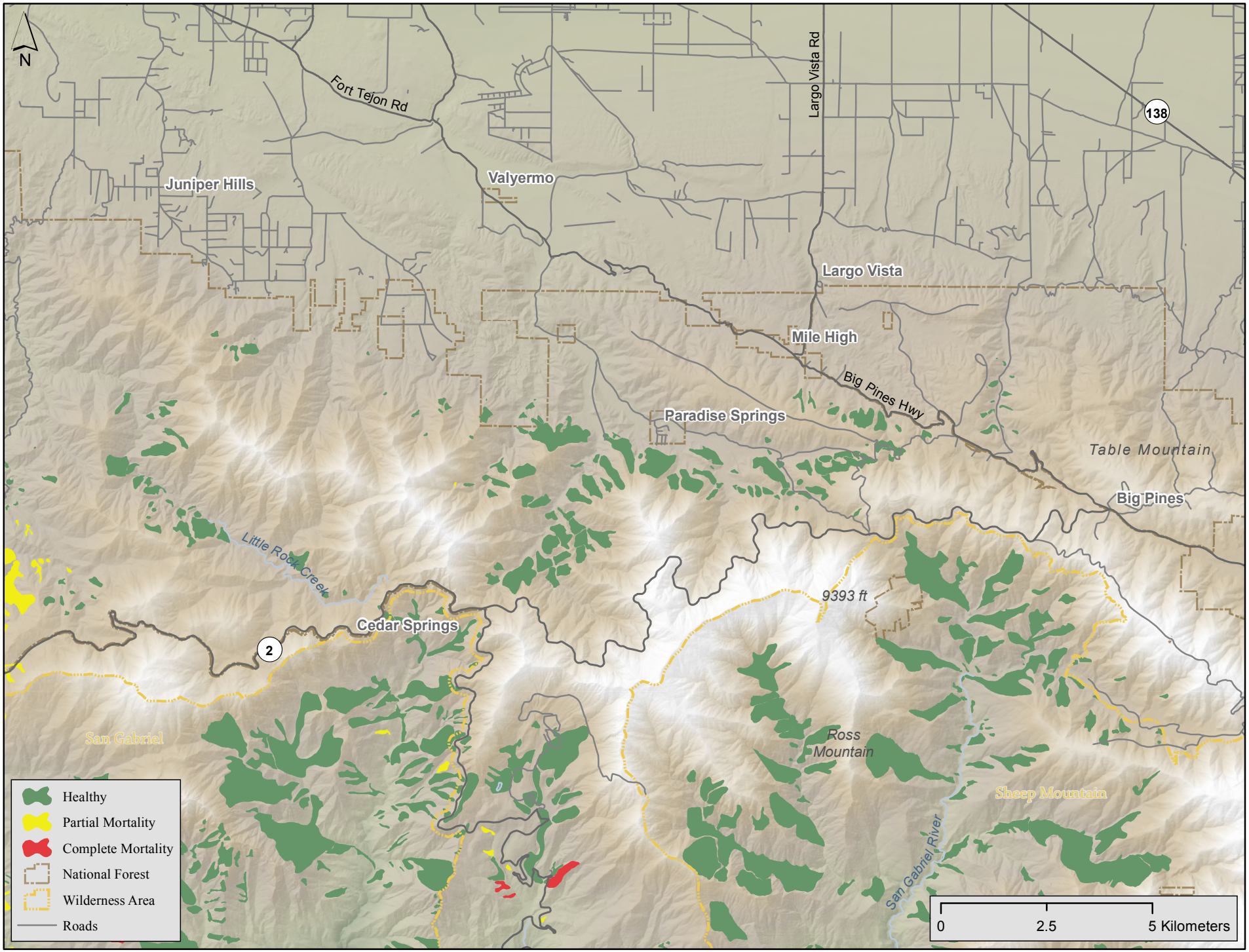


Figure 14. Distribution along the north slopes..



Image 3.3: Dense stands on the north-slopes above the Mojave Desert.



Image 3.4: While uncommon, sparse stands occasionally inhabit the south-facing slopes at desert's edge.

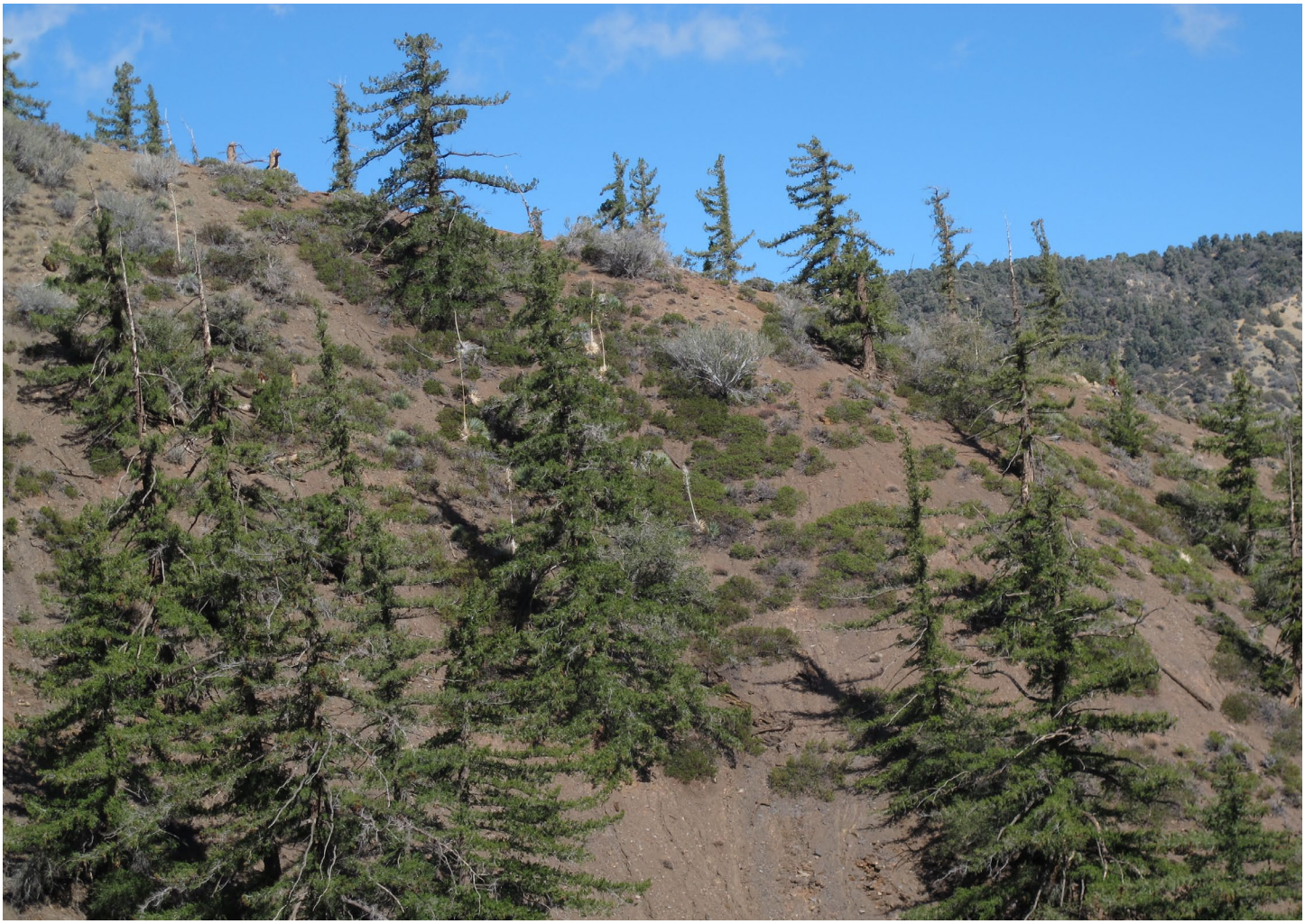


Image 3.5: Close-up of a south-facing stand with Arctostaphylos parryana in the understory.



Image 3.6: Relic populations remain in canyons of Lone Pine Canyon after the 2009 Sheep Fire.



Image 3.7: Lone bigcone Douglas-fir in Lone Pine Canyon.



Image 3.8: Fuels management may have saved this stand of PSMA after the 2009 Sheep Fire in Lone Pine Canyon.

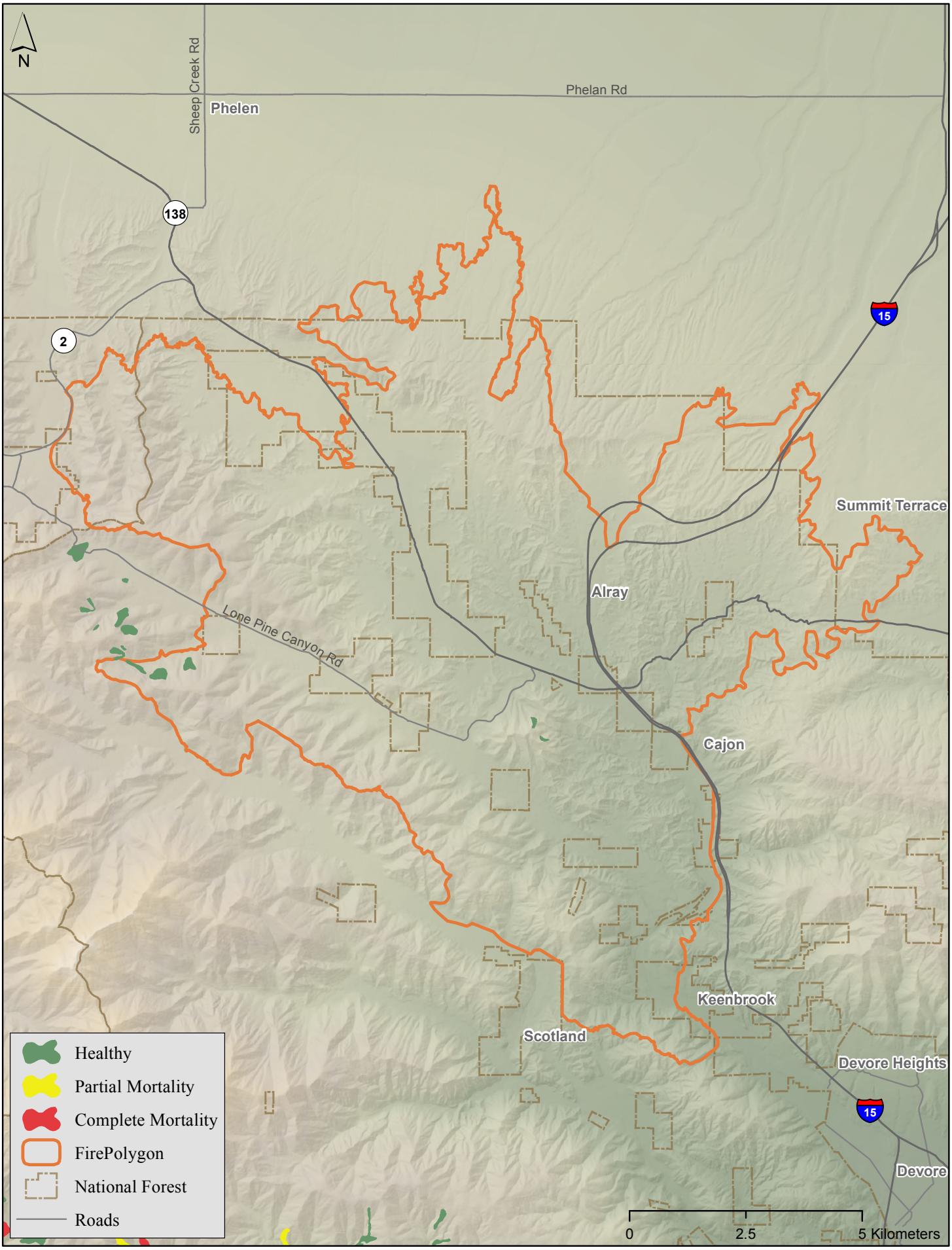


Figure 15. Bluecut Fire (2016) footprint -- populations were mapped before the fire.

4. San Gabriel Wilderness - Chilao - Crystal Lake Regions



Image 4.1: Along the Devil's Canyon Trail forested pockets survived on north slopes after the Station Fire.



Image 4.2: Undiagnosed mortality (probably from drought) along the Devil's Canyon Trail in the San Gabriel Wilderness.

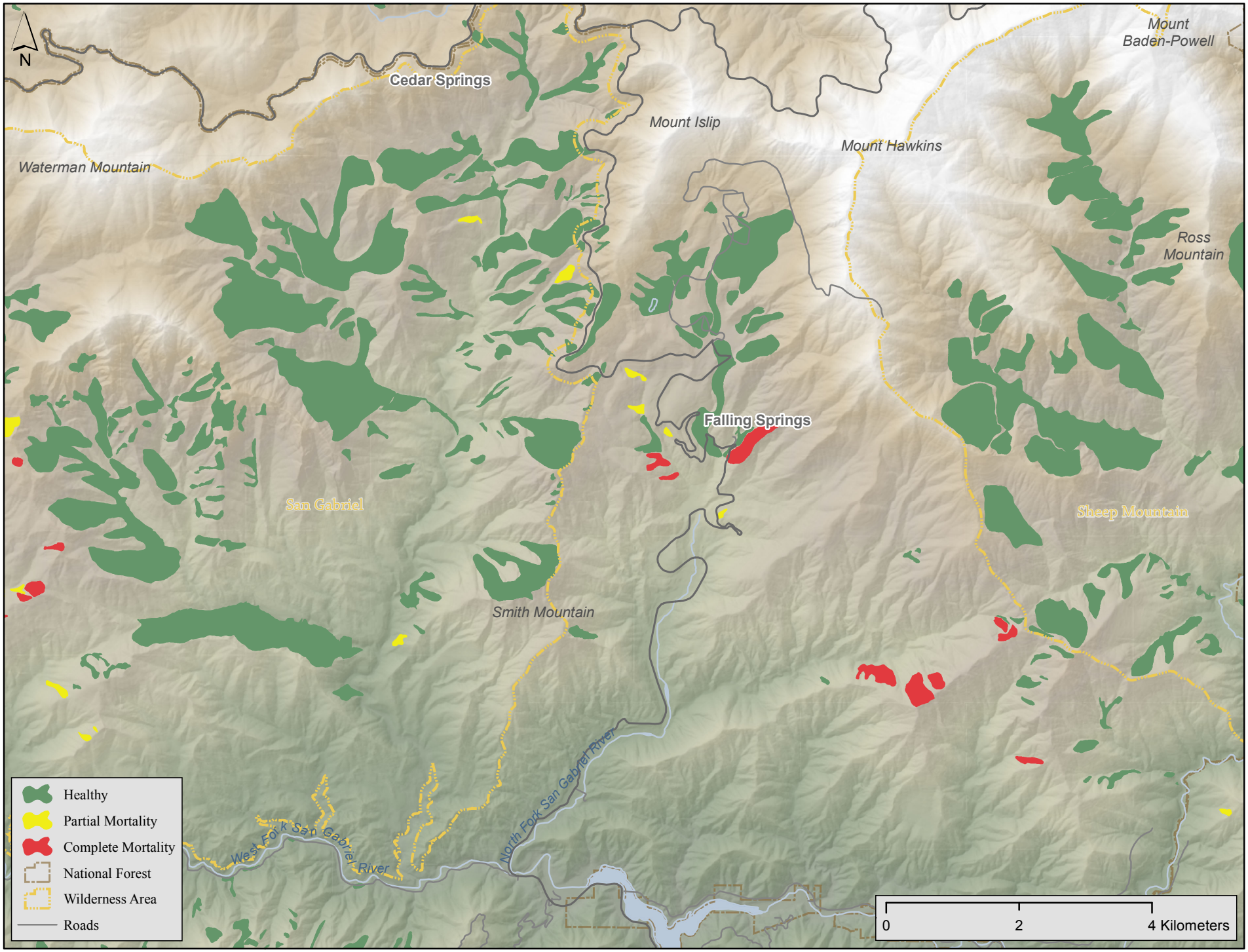


Figure 16. San Gabriel Wilderness - Chilao - Crystal Lake region distribution.



Image 4.3: On the forested flats in the Crystal Lake Recreation Area bigcone Douglas-fir mix with mix-evergreens like Cercocarpus betuloides.



Image 4.4: A view of the west-facing stands, mixed with Coulter Pine (Pinus coulteri), along the upper reaches of Highway 39.



Image 4.5: Pockets of survival after the Station Fire below Crystal Lake Recreation Area.



Image 4.6: Epicormic sprouting after the Station Fire.



Image 4.7: Healthy stands on the north and east facing slopes of Mount Disappointment.



Image 4.8: Stand-replacing event after the station fire now with and understory of Spanish broom (Spartium junceum).



Image 4.9: An exquisite stand found looking toward Mount Markham along the Mount Wilson Toll Road.



Image 4.10: The Station Fire footprint extends up the slopes of Bear Canyon toward Tom Sloane Saddle where the fire stopped, leaving unburned forest on the left (NE facing) side of the picture.

5. Tujunga Canyon Region



Image 5.1: Stand-replacing stations fire evidence along the Colby Canyon Trail.



Image 5.2: Stand-replacing event from the Stations Fire on the north slopes of Strawberry Peak.

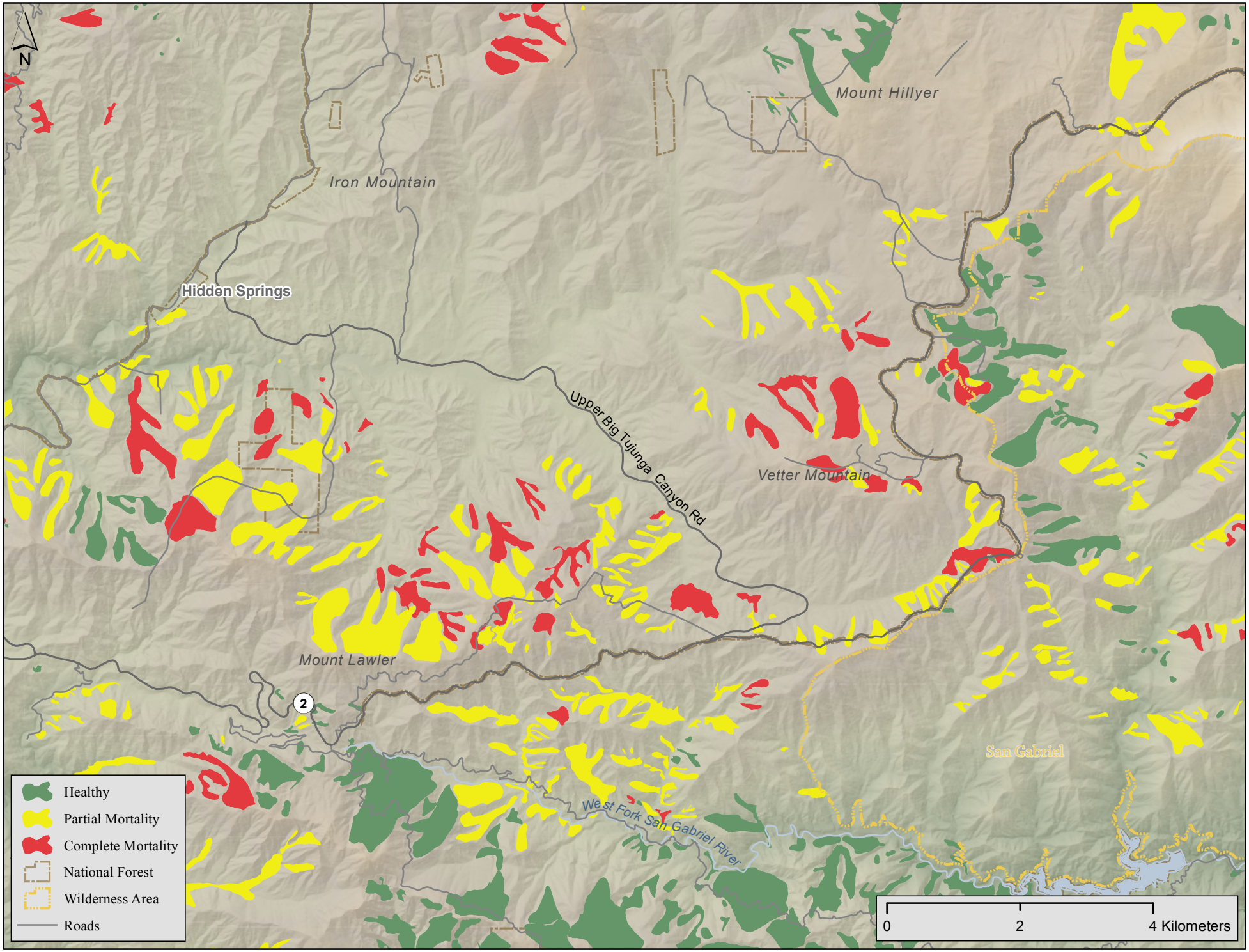


Figure 17. Tujunga Canyon distribution.

6. Mount Gleason Region



Image 6.1: Desert-facing slopes on the northface of Mount Gleason, mostly subjected to stand-replacing fire.



Image 6.2: Remains after the Station Fire at Camp 16 near the summit of Mount Gleason.

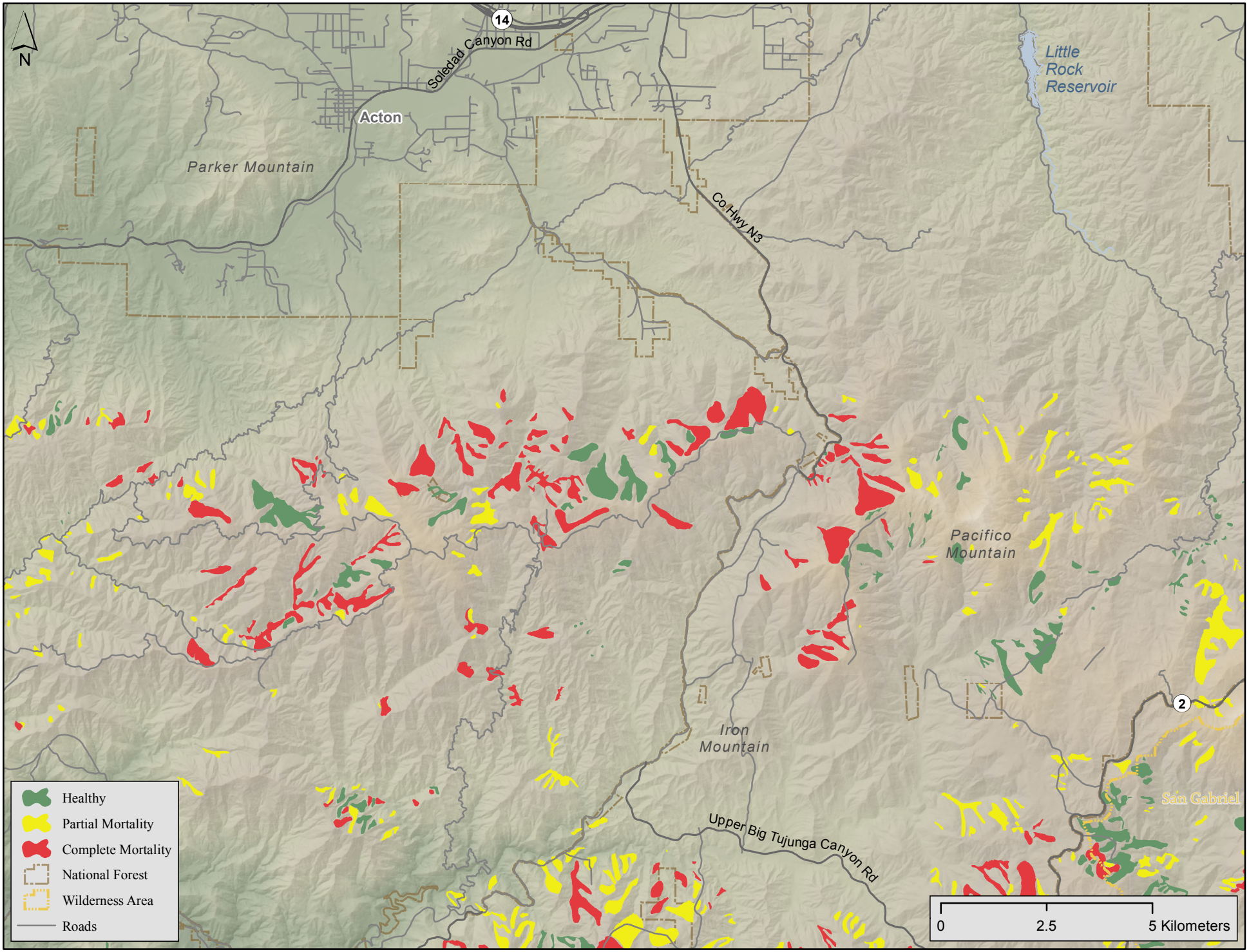


Figure 18. Mount Gleason regional distribution.

7. Pacoima Region



Image 7.1 Spotty, fire-touched bigcone Douglas-fir typify the stands in the Bear Divide region near Pacoima Canyon.

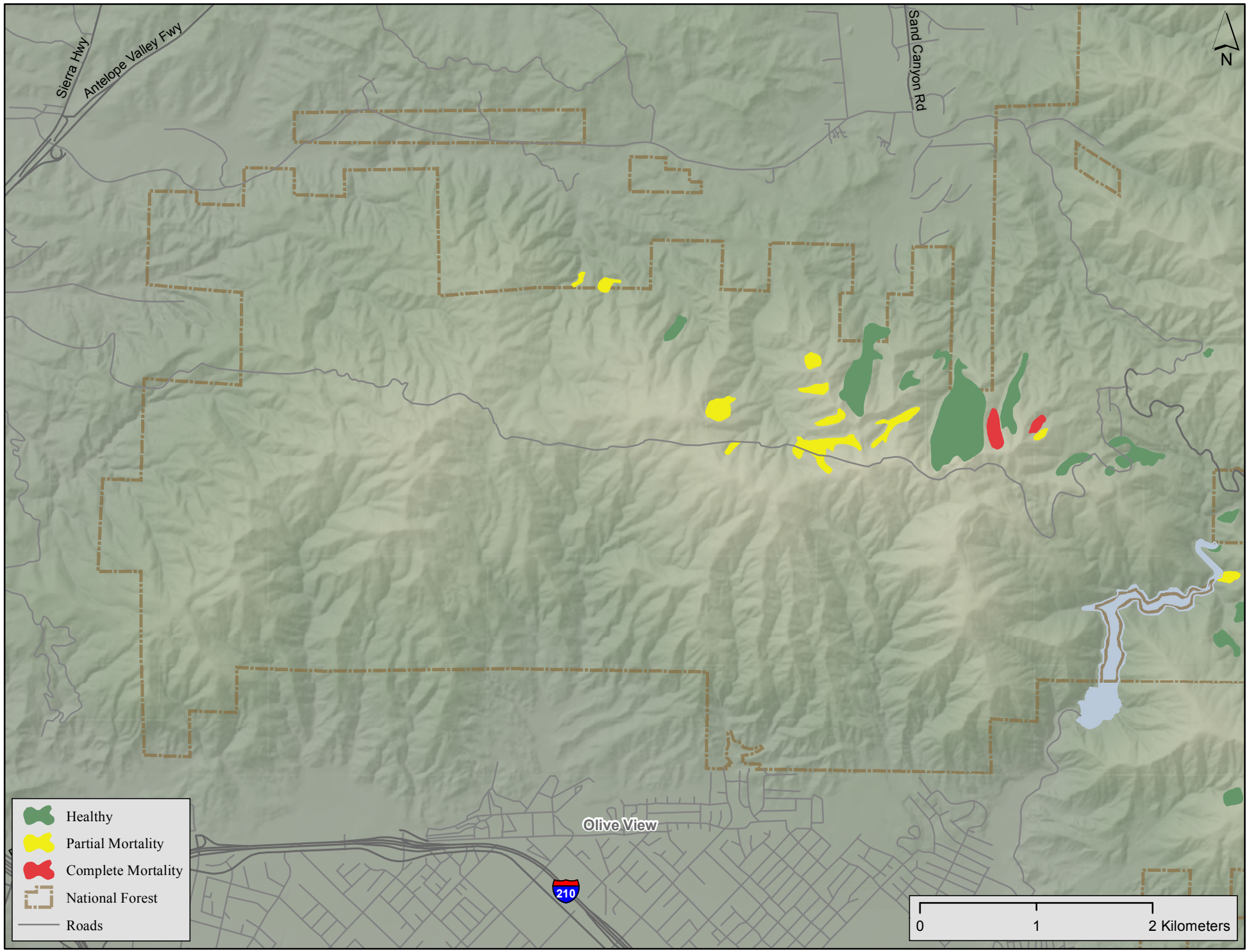


Figure 19 Pacoima regional distribution.

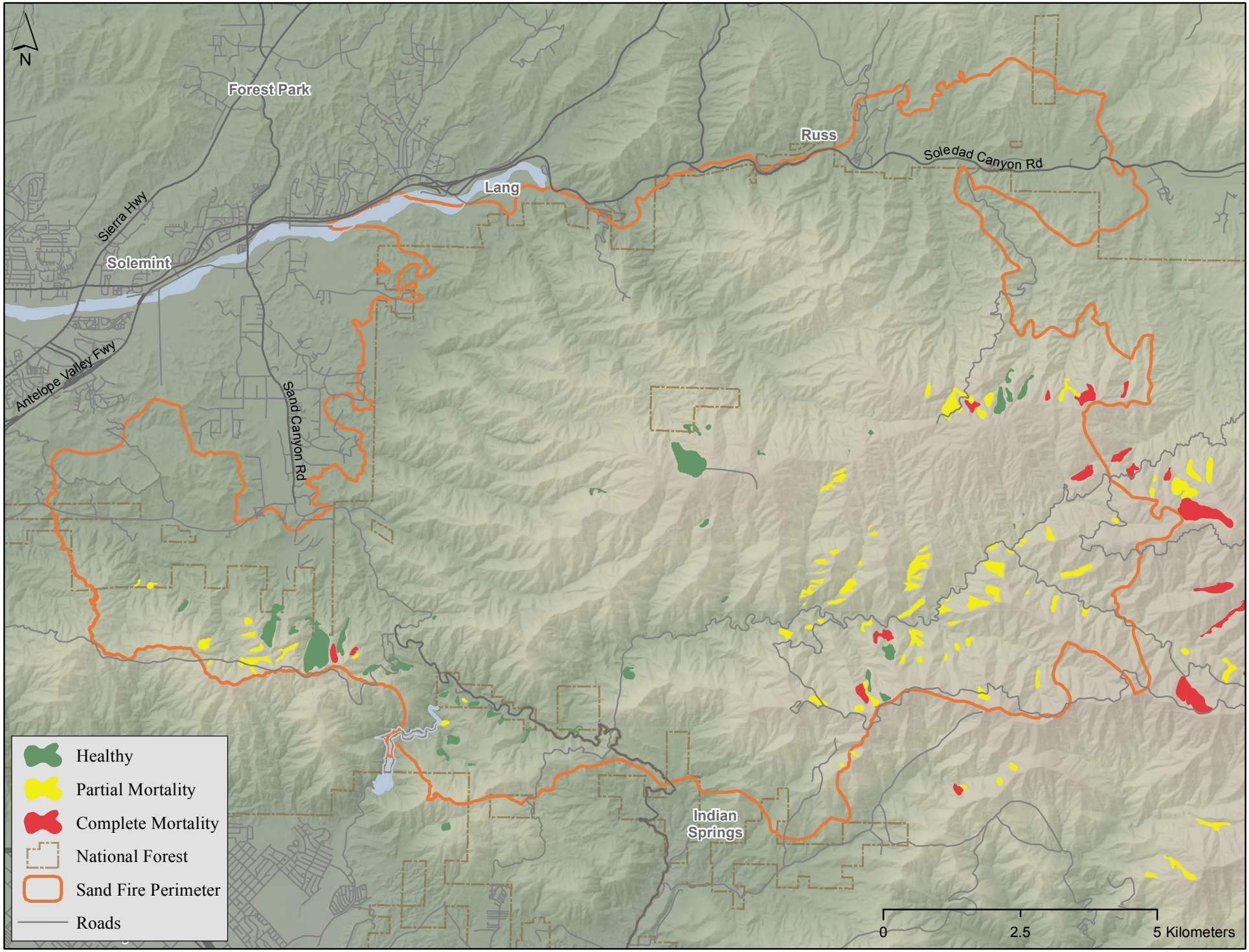


Figure 20. Sand Fire (2016) footprint - populations were mapped before the fire.

8. Sierra Pelona Mountains



Image 8.1: The northeastern Sierra Pelona mountains hold a mixed chaparral, ghost pine (Pinus sabiniana) woodland, and bigcone Douglas-fir.

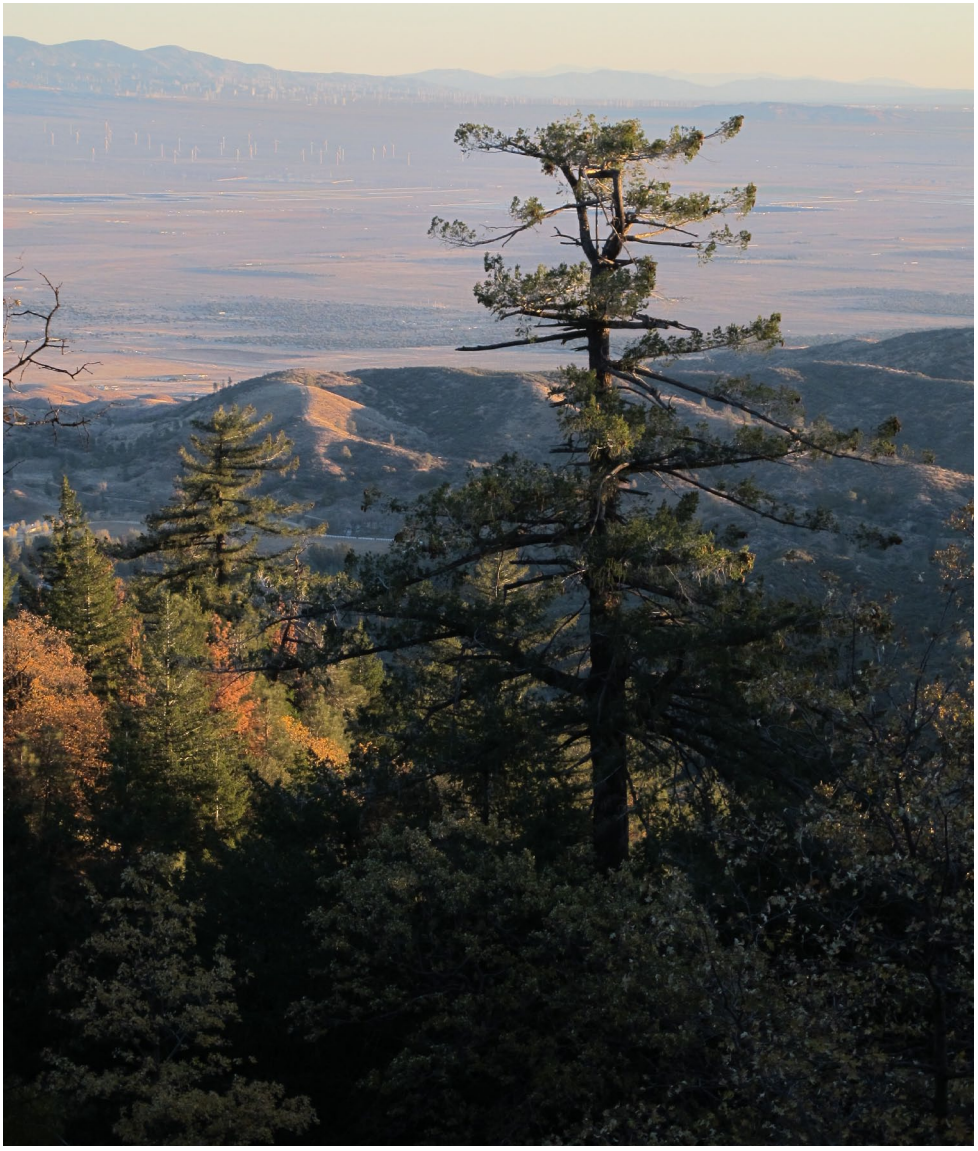


Image 8.2: The highest slopes along Liebre Mountain offer north-slopes with mixed conifer forest including bigcone Douglas-fir and Ponderosa and Coulter pines interspersed with black oak woodlands.

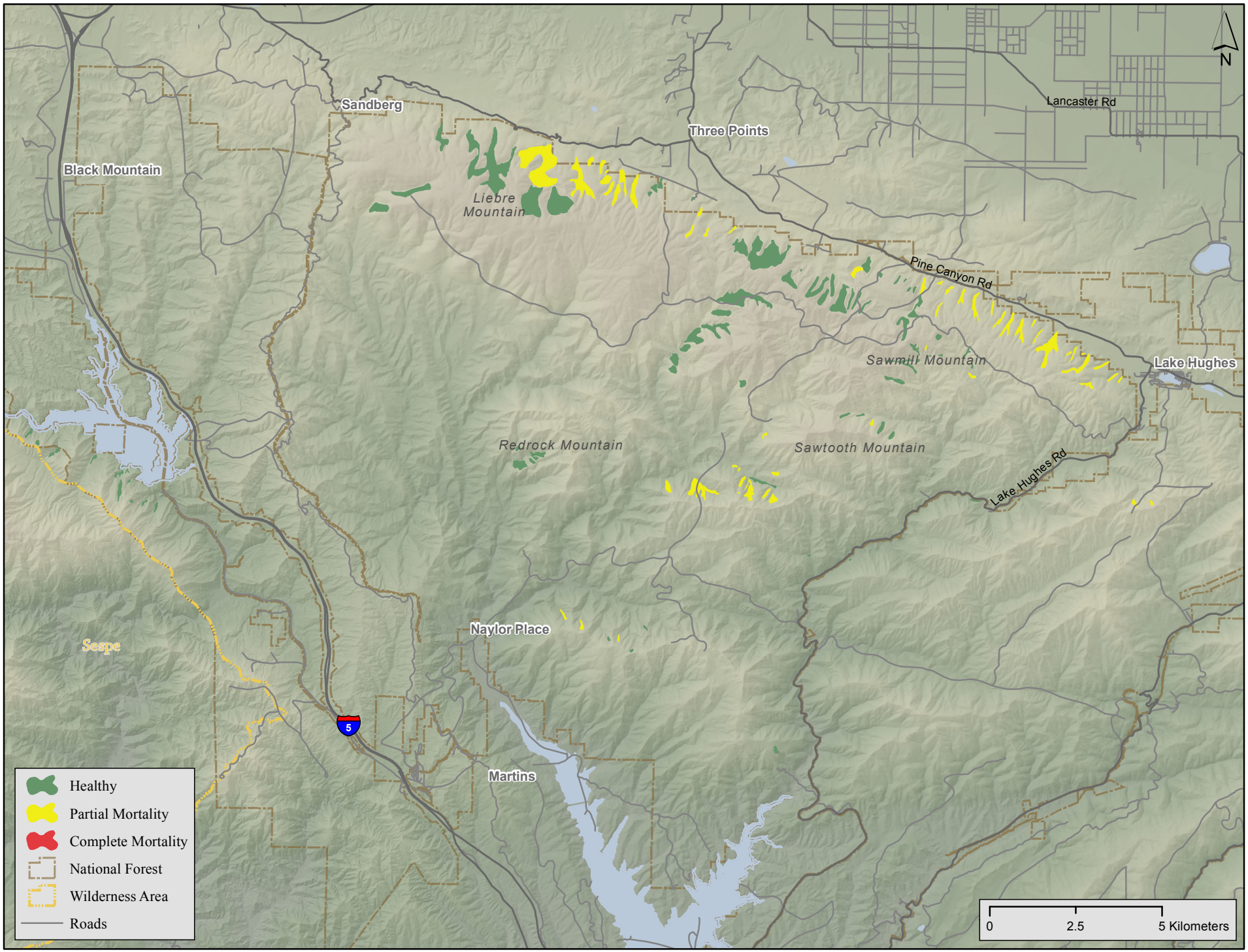


Figure 21. Distribution across the Sierra Pelona mountains.



Image 8.3: Bigcone Douglas-fir encroaching into a black oak woodland.



Image 8.4: Bigcone Douglas-fir thickets are common along Liebre Mountain due to fire suppression, here in the understory of mature black oak and mixed conifers.



Image 8.5: Libre Mountain summit forests as seen from the lower-elevation mixed chaparral.



Image 8.6: Mortality is common in the lower-elevation stands of the Sierra Pelonas.

Appendix 1. Table of Rapid Assessment surveys collected during this project that were included in the classification analysis and a summary of environmental variables. Table includes the percent cover of bigcone Douglas-fir (PSMA Cover %), HUC8 watershed name, fire evidence noted by field staff, number of historical fires, number of years since fire, Station Fire severity (if applicable), If reproduction of bigcone Douglas-fir was present (seedlings and saplings present), and mortality if more the 10% of the bigcone Douglas-fir trees in the stand were dead.

Fire severity codes 0=not within the Station Fire perimeter, 1+unchanged, 2=low, 3=medium, 4=high

Survey ID	Alliance	Association	PSMA Cover (%)	Aspect	Slope (°)	Elevation (m)	Watershed (HUC8)	Fire Evidence Present	No. of Fires	Year(s) Since Fire	Fire Severity	Reproduction	Mortality
PSMA0001	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Quercus wislizeni / Arctostaphylos glandulosa*	8	NW	30	1547	Los Angeles		2	6	1		
PSMA0002	*Ceanothus integerrimus*	*Ceanothus integerrimus*	0	SE	22	1680	San Gabriel	Yes	3	6	4		Yes
PSMA0003	*Ceanothus integerrimus*	*Ceanothus integerrimus*	0	NE	25	1663	Santa Clara	Yes	3	6	4		Yes
PSMA0004	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Pinus coulteri*	4	NE	32	1675	Santa Clara		3	6	2	Yes	
PSMA0005	*Ceanothus integerrimus*	*Ceanothus integerrimus*	0	NE	20	1648	Santa Clara	Yes	2	6	4		Yes
PSMA0006	*Quercus chrysolepis* (shrub)	*Quercus chrysolepis – Ceanothus integerrimus*	0	NW	33	1561	Santa Clara	Yes	2	6	4		Yes
PSMA0007	*Ceanothus integerrimus*	*Ceanothus integerrimus*	5	NE	30	1678	Santa Clara	Yes	2	6	3		Yes
PSMA0008	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Ceanothus integerrimus*	32	NW	40	1506	Los Angeles	Yes	4	6	1	Yes	
PSMA0009	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Pinus coulteri*	50	NE	34	1684	San Gabriel	Yes	1	6	2		
PSMA0010	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Ceanothus integerrimus*	6	NW	27	1632	Los Angeles	Yes	2	6	3		Yes
PSMA0011	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis*	50	NE	24	1659	San Gabriel	Yes	1	6	1	Yes	
PSMA0012	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis*	20	NE	28	1569	Los Angeles	Yes	0		1		
PSMA0013	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis*	25	NW	34	1401	San Gabriel		2	6	1	Yes	
PSMA0014	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – (Acer macrophyllum)*	8	SE	28	1101	San Gabriel	Yes	3	6	3	Yes	
PSMA0015	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Ceanothus integerrimus*	30	NE		1010	San Gabriel	Yes	2	6	3		
PSMA0016	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis*	32	NE	33	1088	San Gabriel	Yes	2	6	2		
PSMA0017	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis*	20	SW	46	937	San Gabriel		3	6	1		

Survey ID	Alliance	Association	PSMA Cover (%)	Aspect	Slope (°)	Elevation (m)	Watershed (HUC8)	Fire Evidence Present	No. of Fires	Year(s) Since Fire	Fire Severity	Reproduction	Mortality
PSMA0018	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis*	22	NE	31	1055	San Gabriel	Yes	2	6	1		
PSMA0019	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – (Acer macrophyllum)*	15	SE	14	849	San Gabriel	Yes	2	6	1		
PSMA0020	*Quercus chrysolepis* (shrub)	*Quercus chrysolepis – Ceanothus integerrimus*	3	NE	36	1511	Los Angeles	Yes	1	6	4		Yes
PSMA0021	*Pinus coulteri*	*Pinus coulteri – Quercus chrysolepis*	5	SE	32	1920	Los Angeles	Yes	3	6	1	Yes	
PSMA0022	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis*	28	NE	40	1434	San Gabriel	Yes	2	6	3	Yes	
PSMA0023	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Ceanothus integerrimus*	20	NE	36	1315	Los Angeles	Yes	3	6	3	Yes	
PSMA0024	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus agrifolia*	12	NW	50	1018	Los Angeles	Yes	3	6	2		
PSMA0025	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis*	35	SE	40	1629	Santa Ana	Yes	3	13	0		
PSMA0026	*Quercus chrysolepis* (shrub)	*Quercus chrysolepis – Ceanothus integerrimus*	0	NW	37	1490	San Gabriel	Yes	5	13	0		Yes
PSMA0027	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Ceanothus integerrimus*	4	SW	28	1322	San Gabriel	Yes	5	13	0		Yes
PSMA0028	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa* (alliance)	25	NW	37	1241	Santa Ana	Yes	2	12	0		
PSMA0029	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis*	22	NE	34	1222	Santa Ana	Yes	2	12	0	Yes	
PSMA0030	*Quercus chrysolepis* (tree)	*Quercus chrysolepis* (tree)	0	NE	20	1565	San Gabriel		3	13	0	Yes	
PSMA0031	*Quercus chrysolepis* (shrub)	*Quercus chrysolepis – Ceanothus integerrimus*	0	NW	32	1600	San Gabriel	Yes	4	13	0		Yes
PSMA0032	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Ceanothus integerrimus*	20	NE	35	1457	San Gabriel		4	12	0	Yes	
PSMA0033	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Ceanothus integerrimus*	6	NE	38	1301	Los Angeles	Yes	3	6	3		Yes
PSMA0034	*Quercus chrysolepis* (tree)	*Quercus chrysolepis / Ceanothus integerrimus*	5	NW	37	1031	San Gabriel	Yes	5	16	0	Yes	
PSMA0035	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis*	15	NW	40	1067	San Gabriel	Yes	5	16	0		
PSMA0036	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis*	10	SW	38	1344	San Gabriel		4	47	0		
PSMA0037	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis*	12	NE	40	523	San Gabriel	Yes	3	47	1		
PSMA0038	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – (Acer macrophyllum)*	10	NE	35	585	San Gabriel		3	47	1	Yes	
PSMA0039	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – (Acer macrophyllum)*	12	NW	43	1059	San Gabriel		2	61	1	Yes	
PSMA0040	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Quercus wislizeni / Arctostaphylos glandulosa*	12	NE	14	1221	Los Angeles		3	61	0	Yes	

Survey ID	Alliance	Association	PSMA Cover (%)	Aspect	Slope (°)	Elevation (m)	Watershed (HUC8)	Fire Evidence Present	No. of Fires	Year(s) Since Fire	Fire Severity	Reproduction	Mortality
PSMA0041	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis*	20	NE	32	1384	San Gabriel		2	47	1	Yes	
PSMA0042	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis*	30	NW	30	1399	San Gabriel		3	61	1	Yes	
PSMA0043	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis*	27	NW	40	1170	San Gabriel	Yes	4	6	1	Yes	
PSMA0044	*Quercus chrysolepis* (tree)	*Quercus chrysolepis – Pseudotsuga macrocarpa – Acer macrophyllum*	2	NE	4	1002	Los Angeles	Yes	3	6	4		Yes
PSMA0045	*Quercus chrysolepis* (tree)	*Quercus chrysolepis – Pseudotsuga macrocarpa*	5	NW	37	884	Los Angeles	Yes	3	6	3	Yes	Yes
PSMA0046	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Ceanothus integerrimus*	20	NW	28	1654	Los Angeles	Yes	3	6	2		Yes
PSMA0047	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Ceanothus integerrimus*	15	NW	38	1578	Los Angeles	Yes	4	6	4		
PSMA0101	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Ceanothus integerrimus*	5	NW	50	1596	Santa Clara	Yes	2	6	4		Yes
PSMA0102	*Ceanothus integerrimus*	*Ceanothus integerrimus*	0	NW	28	1628	Santa Clara	Yes	1	6	4		Yes
PSMA0103	*Quercus chrysolepis* (tree)	*Quercus chrysolepis* (tree)	0	NW	40	1453	Los Angeles		3	6	1		
PSMA0104	*Quercus chrysolepis* (tree)	*Quercus chrysolepis / Ceanothus integerrimus*	5	NW	34	1641	San Gabriel	Yes	1	6	1		
PSMA0105	*Quercus chrysolepis* (tree)	*Quercus chrysolepis / Ceanothus integerrimus*	2	NE	28	1568	Los Angeles	Yes	1	6	2	Yes	
PSMA0106	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Abies concolor – Pinus* spp. *(lambertiana, jeffreyi, ponderosa)*	12	NW	22	1665	San Gabriel	Yes	1	6	1	Yes	
PSMA0107	*Quercus chrysolepis* (tree)	*Quercus chrysolepis – Pseudotsuga macrocarpa*	5	NW	29	1458	San Gabriel	Yes	2	6	1	Yes	
PSMA0108	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Ceanothus integerrimus*	12	NW	38	1217	San Gabriel	Yes	3	6	3		
PSMA0109	*Ceanothus integerrimus*	*Ceanothus integerrimus*	0	Flat	2	1014	San Gabriel	Yes	2	6	2	Yes	Yes
PSMA0110	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis*	31	NW	34	1115	San Gabriel	Yes	2	6	2	Yes	
PSMA0111	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Ceanothus integerrimus*	17	NW	40	1055	San Gabriel	Yes	2	6	1		
PSMA0112	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis*	13	NW	45	1155	San Gabriel		3	62	1	Yes	
PSMA0113	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – (Acer macrophyllum)*	6	Variable	30	896	San Gabriel	Yes	2	6	2	Yes	
PSMA0114	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Pinus coulteri*	6	SE	12	1615	Los Angeles		1	87	1		

Survey ID	Alliance	Association	PSMA Cover (%)	Aspect	Slope (°)	Elevation (m)	Watershed (HUC8)	Fire Evidence Present	No. of Fires	Year(s) Since Fire	Fire Severity	Reproduction	Mortality
PSMA0115	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Pinus coulteri*	13	NE	23	1590	Los Angeles		0		1		
PSMA0116	*Ceanothus integerrimus*	*Ceanothus integerrimus*	0	NW	34	1750	Santa Clara	Yes	2	6	3		Yes
PSMA0117	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Pinus coulteri*	3	NE	28	1906	Los Angeles	Yes	4	6	2		
PSMA0118	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Ceanothus integerrimus*	12	NE	36	1438	San Gabriel	Yes	3	6	1		
PSMA0119	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Ceanothus integerrimus*	21	NW	34	1369	Los Angeles		3	6	1		
PSMA0120	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Ceanothus integerrimus*	16	NW	28	987	Los Angeles	Yes	3	6	1		
PSMA0121	*Quercus chrysolepis* (shrub)	*Quercus chrysolepis* (shrub)	3	NE	39	1456	Santa Ana	Yes	4	13	0		
PSMA0122	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis*	7	NE	38	1419	Santa Ana	Yes	4	13	0	Yes	
PSMA0123	*Ceanothus oliganthus*	*Ceanothus oliganthus*	3	SW	38	1355	San Gabriel	Yes	5	13	0		Yes
PSMA0124	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis*	13	NW	45	1329	Santa Ana		3	12	0		
PSMA0125	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa* (alliance)	9	NE	37	1356	Santa Ana	Yes	4	12	0		Yes
PSMA0126	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis*	15	NW	42	1283	Santa Ana	Yes	2	12	0	Yes	
PSMA0127	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis*	28	SW	37	1212	Santa Ana	Yes	2	12	0	Yes	
PSMA0128	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis*	6	NW	7	1398	San Gabriel	Yes	2	40	0	Yes	
PSMA0129	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis*	22	NW	38	1548	San Gabriel	Yes	4	13	0	Yes	
PSMA0130	*Ceanothus integerrimus*	*Ceanothus integerrimus*	0	NW	32	1569	San Gabriel	Yes	4	13	0		Yes
PSMA0131	*Quercus wislizeni* (shrub)	*Quercus wislizeni* (shrub)	0	SE	30	1559	Santa Ana	Yes	3	13	0		
PSMA0132	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis*	15	NW	41	1500	San Gabriel	Yes	3	13	0	Yes	
PSMA0133	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Cercocarpus montanus*	11	SW	43	992	San Gabriel		5	16	0		Yes
PSMA0134	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Cercocarpus montanus*	13	NW	43	1070	San Gabriel		5	16	0	Yes	
PSMA0135	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis*	17	NW	39	1282	San Gabriel		3	47	0	Yes	
PSMA0136	*Quercus chrysolepis* (tree)	*Quercus chrysolepis – Pseudotsuga macrocarpa*	4	NW	35	527	San Gabriel	Yes	3	47	1		

Survey ID	Alliance	Association	PSMA Cover (%)	Aspect	Slope (°)	Elevation (m)	Watershed (HUC8)	Fire Evidence Present	No. of Fires	Year(s) Since Fire	Fire Severity	Reproduction	Mortality
PSMA0137	*Quercus chrysolepis* (tree)	*Quercus chrysolepis – Pseudotsuga macrocarpa*	2	NW	55	564	San Gabriel		2	58	1		Yes
PSMA0138	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis*	22	NW	38	1029	San Gabriel		1	61	1	Yes	
PSMA0139	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Quercus wislizeni / Arctostaphylos glandulosa*	17	NE	56	1166	San Gabriel		2	58	2	Yes	Yes
PSMA0140	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Pinus coulteri*	16	NE	16	1338	Los Angeles	Yes	3	6	3	Yes	Yes
PSMA0141	*Quercus chrysolepis* (shrub)	*Quercus chrysolepis – Ceanothus integerrimus*	1	Variable	35	1338	Los Angeles	Yes	3	6	3		Yes
PSMA0142	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Cercocarpus montanus*	4	SE	50	1413	San Gabriel		1	47	1		
PSMA0143	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Cercocarpus montanus*	7	SE	48	1373	San Gabriel	Yes	3	47	0	Yes	
PSMA0144	*Quercus chrysolepis* (tree)	*Quercus chrysolepis – Pseudotsuga macrocarpa*	8	NW	24	1436	San Gabriel		0		0	Yes	
PSMA0145	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis*	20	NW	54	1463	San Gabriel		1	91	2	Yes	
PSMA0146	*Quercus chrysolepis* (tree)	*Quercus chrysolepis – Pseudotsuga macrocarpa*	4	NW	24	1156	San Gabriel	Yes	2	6	3	Yes	
PSMA0147	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Cercocarpus montanus*	15	SW	32	1170	San Gabriel		2	6	2	Yes	
PSMA0148	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Cercocarpus montanus*	8	NW	40	960	Los Angeles	Yes	3	6	1	Yes	Yes
PSMA0149	*Quercus chrysolepis* (shrub)	*Quercus chrysolepis* (shrub)	2	NW	55	881	Los Angeles	Yes	3	6	3		Yes
PSMA0150	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Cercocarpus montanus*	4	NW	60	933	Los Angeles		3	6	3	Yes	
PSMA0151	*Quercus chrysolepis* (tree)	*Quercus chrysolepis / Ceanothus integerrimus*	2	NW	22	1631	Los Angeles	Yes	3	6	3		
PSMA0152	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Cercocarpus montanus*	14	NE	21	1503	San Gabriel	Yes	5	6	1	Yes	
PSMA0200	*Ceanothus leucodermis*	*Ceanothus leucodermis*	0	Variable	35	1570	San Gabriel	Yes	4	13	0		Yes
PSMA0201	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Ceanothus integerrimus*	15	NW	28	1562	San Gabriel	Yes	4	13	0		
PSMA0202	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis*	5	SW	45	1435	Santa Ana	Yes	1	35	0	Yes	
PSMA0203	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis*	15	NE	28	1449	Santa Ana	Yes	1	35	0	Yes	
PSMA0204	*Quercus chrysolepis* (tree)	*Quercus chrysolepis – Pseudotsuga macrocarpa*	5	NW	8	1363	Santa Ana	Yes	1	35	0		

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PSMA0205	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis*	5	NW	30	1440	Santa Ana	Yes	1	35	0	Yes	
PSMA0206	*Quercus chrysolepis* (tree)	*Quercus chrysolepis – Pseudotsuga macrocarpa*	3	NW	38	1815	Santa Ana	Yes	1	35	0		
PSMA0207	*Quercus chrysolepis* (tree)	*Quercus chrysolepis – Pseudotsuga macrocarpa*	5	NW	22	1828	Santa Ana	Yes	1	35	0	Yes	
PSMA0208	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Hesperoyucca whipplei*	3	SW	44	1925	Santa Ana	Yes	2	35	0		
PSMA0209	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Hesperoyucca whipplei*	5	SE	38	1846	Santa Ana	Yes	1	35	0	Yes	
PSMA0210	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Hesperoyucca whipplei*	10	SE	36	1822	Santa Ana	Yes	1	35	0	Yes	
PSMA0211	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa* (alliance)	5	SE	33	1950	Santa Ana	Yes	1	35	0	Yes	
PSMA0212	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Hesperoyucca whipplei*	7	SW	36	1978	Santa Ana	Yes	1	35	0	Yes	
PSMA0213	*Quercus chrysolepis* (tree)	*Quercus chrysolepis – Pseudotsuga macrocarpa*	7	NW	5	1456	Santa Ana	Yes	1	35	0	Yes	
PSMA0214	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Hesperoyucca whipplei*	7	NE	34	1302	San Gabriel	Yes	2	40	0	Yes	
PSMA0215	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – (Acer macrophyllum)*	5	Variable	32	1361	San Gabriel		3	12	0		
PSMA0216	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis*	5	NW	52	1255	San Gabriel	Yes	1	40	0	Yes	
PSMA0217	*Quercus chrysolepis* (tree)	*Quercus chrysolepis / Ceanothus integerrimus*	3	NW	48	1383	San Gabriel	Yes	3	13	0	Yes	
PSMA0218	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Ceanothus integerrimus*	10	Variable	50	1352	San Gabriel	Yes	1	40	0		Yes
PSMA0219	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Ceanothus integerrimus*	5	Variable	41	1365	San Gabriel	Yes	1	40	0	Yes	
PSMA0220	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis*	10	Variable	35	1383	San Gabriel	Yes	4	12	0	Yes	
PSMA0221	*Quercus chrysolepis* (tree)	*Quercus chrysolepis – Pseudotsuga macrocarpa*	2	Variable	51	1461	San Gabriel	Yes	2	40	0		
PSMA0222	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Ceanothus integerrimus*	15	Variable	32	1298	San Gabriel	Yes	2	12	0		
PSMA0223	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Hesperoyucca whipplei*	3	NE	40	1031	Santa Ana	Yes	5	12	0		
PSMA0224	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Ceanothus integerrimus*	3	Variable	42	1097	Santa Ana	Yes	3	13	0		

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PSMA0225	*Pinus jeffreyi / Arctostaphylos glauca - Ceanothus leucodermis* Sparse	*Pseudotsuga macrocarpa* (sparse)	2	NW		1057	Santa Ana	Yes	4	12	0		Yes
PSMA0226	*Quercus chrysolepis* (shrub)	*Quercus chrysolepis – Ceanothus integerrimus*	0	NW	28	1611	Santa Clara	Yes	3	6	4		Yes
PSMA0227	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Ceanothus integerrimus*	5	Variable	26	1709	Santa Clara	Yes	3	6	1		Yes
PSMA0228	*Quercus chrysolepis* (shrub)	*Quercus chrysolepis – Ceanothus integerrimus*	3	Variable	30	1665	Santa Clara	Yes	2	6	2		Yes
PSMA0229	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Pinus coulteri*	5	NW	30	1677	Santa Clara	Yes	3	6	2	Yes	
PSMA0230	*Quercus chrysolepis* (shrub)	*Quercus chrysolepis – Ceanothus integerrimus*	0	Variable	38	1669	Santa Clara	Yes	3	6	4		Yes
PSMA0231	*Pinus ponderosa*	*Pinus ponderosa – (Pinus lambertiana) / Bromus tectorum*	0	SW	18	1794	Los Angeles	Yes	2	6	1		
PSMA0232	*Bromus tectorum - Taeniatherum caput-medusae* Ruderal	*Bromus tectorum*	0	Variable	16	1775	Los Angeles	Yes	2	6	2		
PSMA0233	*Pinus ponderosa*	*Pinus ponderosa – (Pinus lambertiana) / Bromus tectorum*	0	NW	29	1844	Los Angeles	Yes	3	6	1		
PSMA0234	*Quercus chrysolepis* (shrub)	*Quercus chrysolepis – Ceanothus integerrimus*	0	Variable	30	1908	Los Angeles	Yes	2	6	3		
PSMA0235	*Bromus tectorum - Taeniatherum caput-medusae* Ruderal	*Bromus tectorum*	0	Variable	29	1913	Santa Clara	Yes	1	6	2		
PSMA0236	*Pinus ponderosa*	*Pinus ponderosa – (Pinus lambertiana) / Bromus tectorum*	0	Variable	40	1880	Santa Clara	Yes	1	6	2		
PSMA0237	*Quercus chrysolepis* (shrub)	*Quercus chrysolepis – Ceanothus integerrimus*	1	Variable	34	1717	Santa Clara	Yes	2	6	3		Yes
PSMA0238	*Quercus chrysolepis* (shrub)	*Quercus chrysolepis* (shrub)	0	NE	34	1816	Los Angeles	Yes	4	6	3		Yes
PSMA0239	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Pinus coulteri*	15	NE	42	1831	Los Angeles	Yes	3	6	3		
PSMA0240	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Ceanothus integerrimus*	5	NW	32	1796	Los Angeles	Yes	3	6	2	Yes	
PSMA0241	*Quercus chrysolepis* (shrub)	*Quercus chrysolepis – Ceanothus integerrimus*	3	NE	32	1811	Los Angeles	Yes	3	6	3		Yes
PSMA0242	*Quercus chrysolepis* (shrub)	*Quercus chrysolepis – Ceanothus integerrimus*	0	NW	32	1837	Los Angeles	Yes	3	6	3		Yes
PSMA0243	*Quercus chrysolepis* (shrub)	*Quercus chrysolepis* (shrub)	0	NE	35	1841	Los Angeles	Yes	3	6	2		Yes
PSMA0244	*Pinus ponderosa*	*Pinus ponderosa – (Pinus lambertiana) / Bromus tectorum*	1	NE	28	1936	Los Angeles	Yes	3	6	3		
PSMA0245	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis*	10	NE	31	1563	Los Angeles	Yes	1	36	1	Yes	
PSMA0246	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Pinus coulteri*	13	NW	38	1653	Los Angeles	Yes	2	6	1	Yes	
PSMA0247	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Pinus coulteri*	11	NE	31	1678	Los Angeles	Yes	1	36	1	Yes	
PSMA0248	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Pinus coulteri*	7	NE	30	1730	Los Angeles	Yes	2	6	2	Yes	

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PSMA0249	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Pinus coulteri*	7	Variable	48	1724	Los Angeles	Yes	2	6	1	Yes	
PSMA0250	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa* (alliance)	5	NW	40	1740	Los Angeles	Yes	2	6	1	Yes	
PSMA0251	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Pinus coulteri*	7	NW	50	1758	Los Angeles	Yes	2	6	1	Yes	
PSMA0252	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Pinus coulteri*	3	NW	55	1709	Los Angeles		2	6	1	Yes	
PSMA0253	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Pinus coulteri*	7	SW	55	1767	Los Angeles		1	6	1		
PSMA0254	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Pinus coulteri*	3	Variable	45	1881	Los Angeles	Yes	4	6	1		
PSMA0255	*Pinus coulteri*	*Pinus coulteri – Quercus chrysolepis*	0	NW	25	1993	Los Angeles	Yes	4	6	1		
PSMA0256	*Pinus coulteri*	*Pinus coulteri – Quercus chrysolepis*	0	Variable	35	1957	Los Angeles	Yes	4	6	1		
PSMA0257	*Pinus coulteri*	*Pinus coulteri – Quercus chrysolepis*	0	Variable	31	1928	Los Angeles	Yes	4	6	2		Yes
PSMA0300	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – mixed conifer / Cercocarpus ledifolius*	5	Flat		1795	Antelope-Fremont Valleys		0		0	Yes	
PSMA0301	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis*	20	SW		1814	Antelope-Fremont Valleys	Yes	0		0	Yes	Yes
PSMA0302	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Cercocarpus montanus*	40	SW		1661	Antelope-Fremont Valleys		0		0	Yes	
PSMA0304	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Hesperoyucca whipplei*	2	SW	10	1621	Antelope-Fremont Valleys		0		0		
PSMA0305	*Quercus chrysolepis* (tree)	*Quercus chrysolepis – Pseudotsuga macrocarpa – Acer macrophyllum*	5	NE		1426	Antelope-Fremont Valleys		0		0	Yes	
PSMA0306	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Abies concolor – Pinus* spp. *(lambertiana, jeffreyi, ponderosa)*	5	NE	15	1909	San Gabriel	Yes	1	18	0	Yes	Yes
PSMA0307	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Abies concolor – Pinus* spp. *(lambertiana, jeffreyi, ponderosa)*	8	NW	20	1897	San Gabriel	Yes	1	18	0	Yes	
PSMA0308	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Abies concolor – Pinus* spp. *(lambertiana, jeffreyi, ponderosa)*	15	NE	40	1824	San Gabriel	Yes	1	18	0	Yes	
PSMA0310	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Pinus coulteri*	5	NW	20	1433	Los Angeles	Yes	1	6	1		

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PSMA0311	*Quercus chrysolepis* (shrub)	*Quercus chrysolepis* (shrub)	2	NE	15	969	Los Angeles	Yes	1	6	3		Yes
PSMA0315	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Hesperoyucca whipplei*	30	NW		1687	San Gabriel	Yes	0		0	Yes	
PSMA0316	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Hesperoyucca whipplei*	35	SE	4	1612	San Gabriel	Yes	0		0	Yes	
PSMA0317	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – (Acer macrophyllum)*	10	SW	10	1396	San Gabriel	Yes	1	18	0	Yes	
PSMA0318	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Ceanothus integerrimus*	2	SW	25	1216	San Gabriel	Yes	3	18	0		Yes
PSMA0319	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – (Acer macrophyllum)*	11	NW	5	1091	San Gabriel	Yes	2	18	0	Yes	Yes
PSMA0320	*Pinus jeffreyi / Arctostaphylos glauca - Ceanothus leucodermis* Sparse	*Pseudotsuga macrocarpa* (sparse)	3	NE	35	1045	San Gabriel	Yes	3	18	0	Yes	
PSMA0322	*Pinus jeffreyi*	*Pinus jeffreyi* (alliance)	2	SW	10	2012	Antelope-Fremont Valleys		0		0	Yes	
PSMA0323	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Pinus monophylla / Fremontodendron californicum*	5	SW	50	1754	Antelope-Fremont Valleys	Yes	0		0	Yes	
PSMA0324	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – mixed conifer / Cercocarpus ledifolius*	3	NW	55	1942	Antelope-Fremont Valleys	Yes	0		0	Yes	
PSMA0325	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Abies concolor – Pinus* spp. *(lambertiana, jeffreyi, ponderosa)*	3	NW	55	2001	Antelope-Fremont Valleys		0		0	Yes	
PSMA0326	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Pinus monophylla / Fremontodendron californicum*	2	NW	26	1916	Antelope-Fremont Valleys	Yes	0		0	Yes	
PSMA0327	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Abies concolor – Pinus* spp. *(lambertiana, jeffreyi, ponderosa)*	2	NW	40	1926	Antelope-Fremont Valleys		0		0	Yes	
PSMA0340	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Pinus monophylla / Fremontodendron californicum*	5	SW	15	1794	Antelope-Fremont Valleys		0		0	Yes	
PSMA0341	*Pinus jeffreyi / Arctostaphylos glauca - Ceanothus leucodermis* Sparse	*Pseudotsuga macrocarpa* (sparse)	3	NE	40	1718	Antelope-Fremont Valleys		0		0	Yes	

Survey ID	Alliance	Association	PSMA Cover (%)	Aspect	Slope (°)	Elevation (m)	Watershed (HUC8)	Fire Evidence Present	No. of Fires	Year(s) Since Fire	Fire Severity	Reproduction	Mortality
PSMA0342	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Pinus monophylla / Fremontodendron californicum*	4	NE	35	1672	Antelope-Fremont Valleys	Yes	0		0	Yes	
PSMA0343	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Pinus monophylla / Fremontodendron californicum*	6	NW	35	1607	Antelope-Fremont Valleys	Yes	0		0	Yes	
PSMA0344	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Pinus monophylla / Fremontodendron californicum*	6	NW	25	1621	Antelope-Fremont Valleys	Yes	0		0	Yes	
PSMA0345	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – (Acer macrophyllum)*	6	NE	50	1551	Antelope-Fremont Valleys	Yes	1	76	0	Yes	
PSMA0350	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Abies concolor – Pinus* spp. *(lambertiana, jeffreyi, ponderosa)*	3	NE	70	1933	Antelope-Fremont Valleys		0		0	Yes	
PSMA0351	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – mixed conifer / Cercocarpus ledifolius*	4	SE	30	1888	Antelope-Fremont Valleys		0		0		
PSMA0352	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Abies concolor – Pinus* spp. *(lambertiana, jeffreyi, ponderosa)*	5	SE	15	1576	San Gabriel	Yes	2	13	0		Yes
PSMA0353	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Hesperoyucca whipplei*	12	SW	8	1720	San Gabriel	Yes	2	13	0		
PSMA0354	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Abies concolor – Pinus* spp. *(lambertiana, jeffreyi, ponderosa)*	12	SW	6	1735	San Gabriel	Yes	2	13	0	Yes	
PSMA0355	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Abies concolor – Pinus* spp. *(lambertiana, jeffreyi, ponderosa)*	9	SW	3	1719	San Gabriel	Yes	2	13	0	Yes	
PSMA0360	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – mixed conifer / Cercocarpus ledifolius*	3	SE	45	1908	Antelope-Fremont Valleys		1	98	1		
PSMA0361	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Pinus coulteri*	6	SW	35	1852	Antelope-Fremont Valleys	Yes	0		1	Yes	
PSMA0362	*Quercus chrysolepis* (tree)	*Quercus chrysolepis – Pseudotsuga macrocarpa*	3	NW	60	1775	Antelope-Fremont Valleys	Yes	0		1		

Survey ID	Alliance	Association	PSMA Cover (%)	Aspect	Slope (°)	Elevation (m)	Watershed (HUC8)	Fire Evidence Present	No. of Fires	Year(s) Since Fire	Fire Severity	Reproduction	Mortality
PSMA0363	*Calocedrus decurrens*	*Calocedrus decurrens – Alnus rhombifolia*	3	NE	4	1399	Antelope-Fremont Valleys	Yes	0		0	Yes	
PSMA0364	*Pinus monophylla*	*Pinus monophylla* (alliance)	1	NW	35	1608	Antelope-Fremont Valleys	Yes	0		0		
PSMA0390	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – (Acer macrophyllum)*	5	NE	23	1189	Santa Clara		1	91	0	Yes	
PSMA0391	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis*	10	NE		1756	Santa Ana	Yes	1	6	0	Yes	
PSMA0392	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – (Acer macrophyllum)*	2	NW	50	662	Santa Clara	Yes	1	91	0		
PSMA0393	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Cercocarpus montanus*	4	NE	40	1328	Antelope-Fremont Valleys		1	91	0	Yes	Yes
PSMA0394	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus kelloggii*	3	NW	30	1611	Antelope-Fremont Valleys		1	91	0	Yes	
PSMA0395	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus kelloggii*	15	NE		1460	Antelope-Fremont Valleys	Yes	2	66	0	Yes	
PSMA0400	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis*	8	SE	45	1907	San Gabriel		0		0	Yes	
PSMA0401	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis*	14	NE	30	1719	San Gabriel		0		0	Yes	
PSMA0402	*Quercus chrysolepis* (tree)	*Quercus chrysolepis – Pseudotsuga macrocarpa*	10	SW	20	1559	San Gabriel		1	18	0	Yes	
PSMA0403	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis*	5	NE	40	1369	San Gabriel	Yes	1	18	0	Yes	
PSMA0404	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Cercocarpus montanus*	2	NW	37	1193	San Gabriel		2	18	0		
PSMA0405	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – (Acer macrophyllum)*	7	SW	7	1066	San Gabriel	Yes	2	18	0		
PSMA0406	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Cercocarpus montanus*	3	NW	45	923	San Gabriel		2	62	0		Yes
PSMA0407	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Abies concolor – Pinus* spp. *(lambertiana, jeffreyi, ponderosa)*	7	NW	20	1998	Antelope-Fremont Valleys		0		0		

Survey ID	Alliance	Association	PSMA Cover (%)	Aspect	Slope (°)	Elevation (m)	Watershed (HUC8)	Fire Evidence Present	No. of Fires	Year(s) Since Fire	Fire Severity	Reproduction	Mortality
PSMA0408	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Abies concolor – Pinus* spp. *(lambertiana, jeffreyi, ponderosa)*	10	NW	32	1883	Antelope-Fremont Valleys		0		0	Yes	
PSMA0409	*Quercus chrysolepis* (tree)	*Quercus chrysolepis* (tree)	0	SW	33	1928	Antelope-Fremont Valleys		0		0		
PSMA0410	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Pinus monophylla / Fremontodendron californicum*	4	SE	27	1906	Antelope-Fremont Valleys		0		0		
PSMA0411	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Abies concolor – Pinus* spp. *(lambertiana, jeffreyi, ponderosa)*	4	NE	65	1912	Antelope-Fremont Valleys	Yes	0		0	Yes	
PSMA0412	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Abies concolor – Pinus* spp. *(lambertiana, jeffreyi, ponderosa)*	5	NE	30	1853	Antelope-Fremont Valleys		0		0		
PSMA0413	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Pinus monophylla / Fremontodendron californicum*	7	NW	35	1657	Antelope-Fremont Valleys		0		0		
PSMA0414	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Hesperoyucca whipplei*	5	SW	39	1697	Antelope-Fremont Valleys		0		0		
PSMA0415	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Pinus monophylla / Fremontodendron californicum*	3	NW	33	1665	Antelope-Fremont Valleys		0		0		
PSMA0416	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Pinus monophylla / Fremontodendron californicum*	6	NE	31	1615	Antelope-Fremont Valleys		0		0	Yes	
PSMA0417	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Pinus monophylla / Fremontodendron californicum*	7	NE	39	1526	Antelope-Fremont Valleys		0		0		
PSMA0418	*Pinus coulteri*	*Pinus coulteri – Quercus chrysolepis*	0	NW	20	1850	San Gabriel	Yes	0		0		
PSMA0419	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Pinus coulteri*	6	NW	35	1805	San Gabriel		0		0		
PSMA0420	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Cercocarpus montanus*	8	SE	20	1537	San Gabriel	Yes	1	13	0	Yes	
PSMA0421	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis*	5	SE		1326	San Gabriel	Yes	2	13	0		Yes

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PSMA0422	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Abies concolor – Pinus* spp. *(lambertiana, jeffreyi, ponderosa)*	10	NE	35	1668	San Gabriel	Yes	1	13	0	Yes	Yes
PSMA0423	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa* (alliance)	20	SW	5	1747	San Gabriel		1	13	0		
PSMA0424	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Pinus monophylla / Fremontodendron californicum*	5	NW	33	1452	Antelope-Fremont Valleys	Yes	0		0	Yes	
PSMA0425	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – (Acer macrophyllum)*	8	NW	30	1373	Antelope-Fremont Valleys		0		0		
PSMA0426	*Pinus coulteri*	*Pinus coulteri – Quercus chrysolepis*	0	NE	32	1718	Antelope-Fremont Valleys		0		0		
PSMA0427	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa* (alliance)	3	NW	28	1875	Antelope-Fremont Valleys	Yes	1	62	1		
PSMA0428	*Pinus jeffreyi*	*Pinus jeffreyi* (alliance)	2	NE	32	1848	Antelope-Fremont Valleys	Yes	1	62	1		
PSMA0429	*Pinus jeffreyi*	*Pinus jeffreyi* (alliance)	0	NW	33	1644	Antelope-Fremont Valleys		0		1	Yes	
PSMA0430	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Pinus coulteri*	3	NE	30	1802	Antelope-Fremont Valleys	Yes	1	6	1		Yes
PSMA0431	*Quercus chrysolepis* (tree)	*Quercus chrysolepis – Pseudotsuga macrocarpa*	2	NE	38	924	Los Angeles	Yes	2	27	1		Yes
PSMA0432	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Bromus diandrus*	3	NW	32	1103	Santa Clara		3	27	0		
PSMA0433	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Bromus diandrus*	6	NW	38	1056	Santa Clara	Yes	5	7	0		
PSMA0434	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Bromus diandrus*	3	NW	47	1111	Santa Clara	Yes	4	7	0		
PSMA0435	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Hesperoyucca whipplei*	5	NE		962	Santa Clara	Yes	4	7	0		Yes
PSMA0500	*Quercus chrysolepis* (tree)	*Quercus chrysolepis / Ceanothus integerrimus*	8	NE	35	1545	Los Angeles	Yes	4	6	3	Yes	
PSMA0501	*Ceanothus integerrimus*	*Ceanothus integerrimus*	0	NE	18	1666	Los Angeles	Yes	1	6	4		Yes
PSMA0502	*Quercus chrysolepis* (shrub)	*Quercus chrysolepis – Ceanothus integerrimus*	0	Variable	35	1346	Los Angeles	Yes	2	6	4		Yes
PSMA0503	*Quercus chrysolepis* (shrub)	*Quercus chrysolepis – Ceanothus integerrimus*	0	NW	30	1477	Los Angeles	Yes	2	6	4		Yes
PSMA0504	*Quercus chrysolepis* (shrub)	*Quercus chrysolepis – Ceanothus integerrimus*	0	NE	28	1202	Los Angeles	Yes	4	6	4		Yes

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PSMA0505	*Ceanothus integerrimus*	*Ceanothus integerrimus*	2	NE	28	1201	Los Angeles	Yes	4	6	3		Yes
PSMA0506	*Quercus chrysolepis* (shrub)	*Quercus chrysolepis – Ceanothus integerrimus*	2	Variable	26	1388	Los Angeles	Yes	2	6	4		Yes
PSMA0507	*Quercus chrysolepis* (shrub)	*Quercus chrysolepis – Ceanothus integerrimus*	5	NE	28	1266	Los Angeles	Yes	2	6	4	Yes	Yes
PSMA0508	*Pinus jeffreyi / Arctostaphylos glauca - Ceanothus leucodermis* Sparse	*Pseudotsuga macrocarpa* (sparse)	1	NE	48	1737	Santa Clara	Yes	2	6	1		Yes
PSMA0509	*Ceanothus integerrimus*	*Ceanothus integerrimus*	1	Variable	28	1610	Santa Clara	Yes	3	6	2		Yes
PSMA0510	*Ceanothus integerrimus*	*Ceanothus integerrimus*	0	NE	24	1624	Santa Clara	Yes	3	6	4		Yes
PSMA0511	*Quercus chrysolepis* (shrub)	*Quercus chrysolepis – Ceanothus integerrimus*	1	Variable	28	1559	Santa Clara	Yes	3	6	2	Yes	Yes
PSMA0512	*Quercus wislizeni* (shrub)	*Quercus wislizeni* (shrub)	0	SE	36	1544	Los Angeles	Yes	2	6	3		
PSMA0513	*Quercus chrysolepis* (tree)	*Quercus chrysolepis – Pseudotsuga macrocarpa*	3	NW	31	1522	Los Angeles	Yes	2	6	3	Yes	Yes
PSMA0514	*Quercus chrysolepis* (tree)	*Quercus chrysolepis – Pseudotsuga macrocarpa*	4	NE	38	1651	Los Angeles	Yes	2	6	1	Yes	Yes
PSMA0515	*Quercus chrysolepis* (tree)	*Quercus chrysolepis – Pseudotsuga macrocarpa*	2	NW	34	1755	Los Angeles	Yes	2	6	1		Yes
PSMA0516	*Ceanothus integerrimus*	*Ceanothus integerrimus*	0	Variable	30	1483	Santa Clara	Yes	2	6	4		Yes
PSMA0517	*Ceanothus integerrimus*	*Ceanothus integerrimus*	1	NW	38	1528	Santa Clara	Yes	2	6	1		Yes
PSMA0518	*Quercus chrysolepis* (shrub)	*Quercus chrysolepis – Ceanothus integerrimus*	0	Variable	42	1593	Santa Clara	Yes	2	6	4		Yes
PSMA0519	*Quercus chrysolepis* (tree)	*Quercus chrysolepis – Pseudotsuga macrocarpa*	1	NE	45	1243	Los Angeles	Yes	3	6	3		Yes
PSMA0520	*Quercus chrysolepis* (shrub)	*Quercus chrysolepis – Ceanothus integerrimus*	1	NE	36	1563	Los Angeles	Yes	3	6	3		Yes
PSMA0521	*Quercus chrysolepis* (tree)	*Quercus chrysolepis – Pseudotsuga macrocarpa*	3	NW	42	1233	Los Angeles	Yes	3	36	1	Yes	
PSMA0522	*Quercus chrysolepis* (tree)	*Quercus chrysolepis* (tree)	0	Variable	38	1299	Santa Clara	Yes	2	55	1		Yes
PSMA0523	*Quercus chrysolepis* (shrub)	*Quercus chrysolepis* (shrub)	2	NW	40	1273	Los Angeles	Yes	3	6	3		
PSMA0524	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Bromus diandrus*	3	NW	44	1276	Los Angeles	Yes	3	6	2	Yes	Yes
PSMA0525	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Bromus diandrus*	15	NE	34	1309	Santa Clara	Yes	1	55	1		
PSMA0526	*Quercus chrysolepis* (tree)	*Quercus chrysolepis – Pseudotsuga macrocarpa*	2	Variable	44	1433	Santa Clara	Yes	2	6	1	Yes	Yes
PSMA0527	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Bromus diandrus*	3	Variable	38	1339	Santa Clara	Yes	3	6	3	Yes	Yes
PSMA0528	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Bromus diandrus*	5	NW	45	1268	Santa Clara	Yes	3	6	2		Yes
PSMA0529	*Quercus chrysolepis* (shrub)	*Quercus chrysolepis – Ceanothus integerrimus*	2	NW	30	1216	Los Angeles	Yes	2	6	3		Yes
PSMA0530	*Quercus chrysolepis* (tree)	*Quercus chrysolepis – Pseudotsuga macrocarpa*	3	Variable	38	1339	Los Angeles	Yes	2	6	2		Yes

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PSMA0531	*Quercus chrysolepis* (tree)	*Quercus chrysolepis – Pseudotsuga macrocarpa*	1	NW	30	1277	Los Angeles	Yes	2	6	3	Yes	Yes
PSMA0533	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Bromus diandrus*	5	NE	22	942	Los Angeles	Yes	3	6	3		Yes
PSMA0534	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Bromus diandrus*	3	NW	35	1174	Los Angeles	Yes	3	6	2		Yes
PSMA0535	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Ceanothus integerrimus*	3	NE	35	1179	Los Angeles	Yes	3	6	4		Yes
PSMA0536	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Bromus diandrus*	7	NW	40	1077	Los Angeles	Yes	3	6	1		
PSMA0537	*Quercus chrysolepis* (shrub)	*Quercus chrysolepis – Ceanothus integerrimus*	2	NE	40	1066	Los Angeles	Yes	3	6	3		Yes
PSMA0539	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Bromus diandrus*	7	SE	25	1093	Los Angeles	Yes	2	6	3		
PSMA0540	*Quercus chrysolepis* (tree)	*Quercus chrysolepis – Pseudotsuga macrocarpa*	2	NW	40	1076	Los Angeles	Yes	2	6	3		Yes
PSMA0541	*Quercus chrysolepis* (tree)	*Quercus chrysolepis – Pseudotsuga macrocarpa*	3	NE	25	1126	Los Angeles	Yes	2	6	2	Yes	
PSMA0542	*Quercus chrysolepis* (shrub)	*Quercus chrysolepis – Ceanothus integerrimus*	1	NW	40	1096	Los Angeles	Yes	2	6	3		Yes
PSMA0543	*Quercus chrysolepis* (tree)	*Quercus chrysolepis – Pseudotsuga macrocarpa*	1	SE	20	1156	Los Angeles	Yes	2	6	3		
PSMA0544	*Adenostoma fasciculatum*	*Adenostoma fasciculatum – Eriogonum fasciculatum*	0	SE	18	1495	Los Angeles	Yes	3	6	3		
PSMA0545	*Ceanothus integerrimus*	*Ceanothus integerrimus*	0	NW	24	1598	Santa Clara	Yes	3	6	3		Yes
PSMA0546	*Pinus jeffreyi / Arctostaphylos glauca - Ceanothus leucodermis* Sparse	*Pseudotsuga macrocarpa* (sparse)	5	Variable		1382	Santa Clara	Yes	3	6	3		Yes
PSMA0547	*Quercus chrysolepis* (shrub)	*Quercus chrysolepis – Ceanothus integerrimus*	1	Variable	28	1482	Santa Clara	Yes	2	6	2		Yes
PSMA0548	*Bromus tectorum - Taeniatherum caput-medusae* Ruderal	*Bromus tectorum*	3	Variable	32	1458	Santa Clara	Yes	2	6	2		Yes
PSMA0549	*Bromus tectorum - Taeniatherum caput-medusae* Ruderal	*Bromus tectorum*	1	NE	38	1407	Santa Clara	Yes	2	6	3		Yes
PSMA0550	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis*	14	Variable	28	1579	San Gabriel	Yes	1	6	1	Yes	
PSMA0551	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Pinus coulteri*	5	Variable	32	1573	San Gabriel	Yes	1	6	2	Yes	
PSMA0552	*Quercus chrysolepis* (tree)	*Quercus chrysolepis – Pseudotsuga macrocarpa*	3	Variable	38	1577	San Gabriel	Yes	1	6	3		
PSMA0553	*Quercus chrysolepis* (tree)	*Quercus chrysolepis – Pseudotsuga macrocarpa*	2	Variable	32	1593	San Gabriel	Yes	1	6	3		Yes
PSMA0554	*Quercus wislizeni* (shrub)	*Quercus wislizeni* (shrub)	0	NE	28	1644	San Gabriel	Yes	1	6	3		

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PSMA0555	*Quercus agrifolia*	*Quercus agrifolia – Quercus engelmannii / Eriogonum fasciculatum*	0	NE	18	1675	San Gabriel	Yes	2	6	1		
PSMA0556	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Pinus coulteri*	8	Variable	28	1682	Los Angeles	Yes	0		2	Yes	
PSMA0557	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis*	12	Variable	40	1343	San Gabriel	Yes	1	6	1		
PSMA0558	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis*	12	NE	38	1402	San Gabriel	Yes	1	6	1	Yes	
PSMA0559	*Quercus chrysolepis* (shrub)	*Quercus chrysolepis – Ceanothus integerrimus*	2	NE	38	1704	San Gabriel	Yes	2	6	2	Yes	Yes
PSMA0560	*Quercus chrysolepis* (shrub)	*Quercus chrysolepis – Ceanothus integerrimus*	2	NE	34	1450	San Gabriel	Yes	1	6	2	Yes	
PSMA0561	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis*	10	NE	28	1423	San Gabriel	Yes	1	6	2	Yes	
PSMA0562	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Pinus coulteri*	5	NE	36	1704	San Gabriel	Yes	2	6	1	Yes	
PSMA0563	*Quercus chrysolepis* (shrub)	*Quercus chrysolepis – Ceanothus integerrimus*	1	Variable	40	1635	Los Angeles	Yes	1	6	3		Yes
PSMA0564	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Pinus coulteri*	20	Variable	32	1526	San Gabriel	Yes	1	6	1		
PSMA0600	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Ceanothus integerrimus*	8	NE	32	937	Los Angeles	Yes	3	6	2	Yes	
PSMA0601	*Quercus chrysolepis* (tree)	*Quercus chrysolepis – Pseudotsuga macrocarpa*	3	NW	38	937	Los Angeles	Yes	4	6	2		
PSMA0602	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Ceanothus integerrimus*	5	NE	35	1027	Los Angeles	Yes	2	6	3		
PSMA0603	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Cercocarpus montanus*	13	NW	40	999	Los Angeles	Yes	2	6	2	Yes	Yes
PSMA0604	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Ceanothus integerrimus*	10	NE	34	1521	Los Angeles	Yes	3	6	3	Yes	
PSMA0605	*Ceanothus integerrimus*	*Ceanothus integerrimus*	1	NW	30	1603	Los Angeles	Yes	3	6	4		Yes
PSMA0606	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Ceanothus integerrimus*	7	NE	36	1428	Los Angeles	Yes	2	6	1	Yes	Yes
PSMA0607	*Ceanothus integerrimus*	*Ceanothus integerrimus*	1	NE	24	1192	Los Angeles	Yes	2	6	3		Yes
PSMA0608	*Quercus chrysolepis* (shrub)	*Quercus chrysolepis – Ceanothus integerrimus*	0	NE	28	1201	Los Angeles	Yes	2	6	4		Yes
PSMA0609	*Quercus chrysolepis* (shrub)	*Quercus chrysolepis – Ceanothus integerrimus*	0	SE	23	1265	Los Angeles	Yes	2	6	4		Yes
PSMA0610	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Ceanothus integerrimus*	6	SW	45	1268	San Gabriel	Yes	2	6	3	Yes	
PSMA0611	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Hesperoyucca whipplei*	4	NW	40	1344	San Gabriel	Yes	2	6	2	Yes	
PSMA0612	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Ceanothus integerrimus*	8	NE	41	1171	San Gabriel	Yes	2	6	3	Yes	

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PSMA0613	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Ceanothus integerrimus*	8	NW	34	1174	San Gabriel	Yes	2	6	2		
PSMA0614	*Ceanothus integerrimus*	*Ceanothus integerrimus*	0	NE	30	1339	San Gabriel	Yes	2	6	3		Yes
PSMA0615	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Bromus diandrus*	8	NW	30	1326	Los Angeles		1	6	1	Yes	
PSMA0616	*Cercocarpus montanus*	*Cercocarpus montanus – Eriogonum fasciculatum*	0	SW	34	1525	Los Angeles	Yes	2	6	1		Yes
PSMA0617	*Ceanothus integerrimus*	*Ceanothus integerrimus*	3	NE	41	1299	Los Angeles	Yes	3	6	3		Yes
PSMA0618	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis*	5	NW	37	1226	Los Angeles	Yes	5	6	2	Yes	
PSMA0700	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis*	13	NE	35	1549	Antelope-Fremont Valleys	Yes	2	88	0	Yes	
PSMA0701	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis*	10	NW	30	1439	Santa Clara		1	91	0	Yes	
PSMA0702	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Bromus diandrus*	9	NW	35	1122	Santa Clara	Yes	5	27	0		
PSMA0703	*Cercocarpus montanus*	*Cercocarpus montanus – Eriogonum fasciculatum*	1	NE	45	869	Los Angeles	Yes	2	6	3		Yes
PSMA0705	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Abies concolor – Pinus* spp. *(lambertiana, jeffreyi, ponderosa)*	9	NE	32	1559	Antelope-Fremont Valleys	Yes	1	91	1	Yes	
PSMA0706	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Pinus monophylla / Fremontodendron californicum*	7	NW	34	1891	Antelope-Fremont Valleys	Yes	0		0		
PSMA0707	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Abies concolor – Pinus* spp. *(lambertiana, jeffreyi, ponderosa)*	7	SE	39	1830	Antelope-Fremont Valleys	Yes	0		0	Yes	
PSMA0708	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Cercocarpus montanus*	7	NE	40	1711	Antelope-Fremont Valleys		0		0	Yes	
PSMA0709	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis*	9	NE	45	1643	San Gabriel		2	6	1	Yes	
PSMA0800	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Bromus diandrus*	5	NE	55	619	Los Angeles		2	47	1		
PSMA0801	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Ceanothus integerrimus*	12	NW	40	1111	Los Angeles	Yes	4	6	1		
PSMA0802	*Quercus chrysolepis* (tree)	*Quercus chrysolepis – Pseudotsuga macrocarpa*	4	NE	42	1383	Los Angeles		3	61	0	Yes	

Survey ID	Alliance	Association	PSMA Cover (%)	Aspect	Slope (°)	Elevation (m)	Watershed (HUC8)	Fire Evidence Present	No. of Fires	Year(s) Since Fire	Fire Severity	Reproduction	Mortality
PSMA0803	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Ceanothus integerrimus*	20	NE	35	1540	San Gabriel	Yes	1	6	2	Yes	
PSMA0804	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Cercocarpus montanus*	8	SW	40	1795	Antelope-Fremont Valleys		0		0		
PSMA0805	*Quercus chrysolepis* (tree)	*Quercus chrysolepis – Pseudotsuga macrocarpa*	1	SE	43	1639	Antelope-Fremont Valleys		0		0		
PSMA0806	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis*	6	NW	37	1715	Santa Ana	Yes	1	6	0	Yes	
PSMA0807	*Ceanothus integerrimus*	*Ceanothus integerrimus*	5	NE	38	985	San Gabriel	Yes	3	6	2		Yes
PSMA0900	*Quercus chrysolepis* (tree)	*Quercus chrysolepis – Pseudotsuga macrocarpa – Acer macrophyllum*	1	NW	40	774	Santa Clara	Yes	3	27	0	Yes	Yes
PSMA0901	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis*	16	NW	20	1047	Santa Clara	Yes	4	27	0	Yes	
PSMA0902	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Cercocarpus montanus*	7	NE	50	1092	Los Angeles	Yes	3	7	0		
PSMA0903	*Quercus chrysolepis* (tree)	*Quercus chrysolepis – Pseudotsuga macrocarpa*	3	NW	65	685	Los Angeles		2	47	1	Yes	
PSMA0905	*Quercus chrysolepis* (tree)	*Quercus chrysolepis – Pseudotsuga macrocarpa – Acer macrophyllum*	4	NE	70	639		Yes	1	96	0		Yes
PSMA0906	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Ceanothus integerrimus*	5	NW	35	812	Los Angeles	Yes	2	6	3		Yes
PSMA0907	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Ceanothus integerrimus*	5	NW	30	1135	Los Angeles	Yes	5	6	1		
PSMA0908	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis*	10	NE	30	1597	Los Angeles	Yes	0		1	Yes	
PSMA0909	*Cercocarpus montanus*	*Cercocarpus montanus – Eriogonum fasciculatum*	1	SE	45	1333	Los Angeles	Yes	3	22	0		Yes
PSMA0910	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Quercus wislizeni / Arctostaphylos glandulosa*	10	NE	25	1474	Los Angeles		3	61	0	Yes	
PSMA0911	*Quercus chrysolepis* (tree)	*Quercus chrysolepis – Pseudotsuga macrocarpa*	1	SE	50	2045	San Gabriel	Yes	0		0	Yes	
PSMA0915	*Quercus chrysolepis* (tree)	*Quercus chrysolepis – Pseudotsuga macrocarpa*	1	SW	15	1737	Antelope-Fremont Valleys		0		1		
PSMA0916	*Pinus coulteri*	*Pinus coulteri – Quercus chrysolepis*	1	SW	30	2041	Antelope-Fremont Valleys		0		1		

Survey ID	Alliance	Association	PSMA Cover (%)	Aspect	Slope (°)	Elevation (m)	Watershed (HUC8)	Fire Evidence Present	No. of Fires	Year(s) Since Fire	Fire Severity	Reproduction	Mortality
PSMA0917	*Pinus coulteri*	*Pinus coulteri – Quercus chrysolepis*	2	NW	40	1568	Antelope-Fremont Valleys	Yes	0		0	Yes	
PSMA0918	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Pinus monophylla / Fremontodendron californicum*	2	NE	15	1608	Antelope-Fremont Valleys		0		0	Yes	
PSMA0919	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Pinus coulteri*	5	NW	30	1670	Antelope-Fremont Valleys	Yes	0		0	Yes	Yes
PSMA0920	*Quercus chrysolepis* (tree)	*Quercus chrysolepis – Pseudotsuga macrocarpa*	1	NE	40	1853	Antelope-Fremont Valleys		0		0		
PSMA0921	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis – (Acer macrophyllum)*	19	SE	30	1475	San Gabriel	Yes	1	91	0	Yes	
PSMA0922	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Hesperoyucca whipplei*	10	SW	20	1506	San Gabriel	Yes	1	91	0	Yes	
PSMA0923	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus chrysolepis*	7	SE	25	1646	San Gabriel	Yes	0		0	Yes	
PSMA0924	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus kelloggii*	6	NE	10	1557	Antelope-Fremont Valleys		2	88	0	Yes	
PSMA0925	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus kelloggii*	15	NW	20	1520	Antelope-Fremont Valleys		2	88	0	Yes	
PSMA0926	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa – Quercus kelloggii*	21	NE	20	1598	Antelope-Fremont Valleys	Yes	1	91	0	Yes	
PSMA0927	*Quercus chrysolepis* (shrub)	*Quercus chrysolepis – Ceanothus integerrimus*	1	SW	8	1175	Antelope-Fremont Valleys	Yes	1	11	0		
PSMA0928	*Arctostaphylos pungens - Arctostaphylos pringlei - Ceanothus greggii*	*Arctostaphylos parryana*	0	SE	45	2230			0		0		
PSMA0929	*Arctostaphylos pungens - Arctostaphylos pringlei - Ceanothus greggii*	*Arctostaphylos parryana*	0	SW	30	2211		Yes	0		0		
PSMA0930	*Arctostaphylos pungens - Arctostaphylos pringlei - Ceanothus greggii*	*Arctostaphylos parryana*	0	SW	28	2135			0		1		
PSMA0931	*Pseudotsuga macrocarpa*	*Pseudotsuga macrocarpa* (alliance)	21	NW	30	1652		Yes	2	13	0	Yes	Yes

Survey ID	Alliance	Association	PSMA Cover (%)	Aspect	Slope (°)	Elevation (m)	Watershed (HUC8)	Fire Evidence Present	No. of Fires	Year(s) Since Fire	Fire Severity	Reproduction	Mortality
PSMA0932	*Arctostaphylos glauca*	*Arctostaphylos glauca*	0	SE	35	1843		Yes	0		0		
PSMA0933	*Arctostaphylos pungens - Arctostaphylos pringlei - Ceanothus greggii*	*Arctostaphylos parryana*	0	SE	36	1994			1	73	0		
PSMA0934	*Arctostaphylos pungens - Arctostaphylos pringlei - Ceanothus greggii*	*Arctostaphylos parryana*	0	SW	25	2181		Yes	0		0		
PSMA0935	*Arctostaphylos pungens - Arctostaphylos pringlei - Ceanothus greggii*	*Arctostaphylos parryana*	0	SW	29	2034			1	18	0		
PSMA0936	*Arctostaphylos pungens - Arctostaphylos pringlei - Ceanothus greggii*	*Arctostaphylos parryana*	0	SE	12	2247		Yes	2	21	0		

Appendix 2. Field Key for distinguishing vegetation types at the alliance and association level based on the classification.

Class A. Tree-Overstory Vegetation

Group I: Woodlands and forests characterized by needle or scale-leaved conifer trees, including, Doug-fir (*Pseudotsuga*), pine (*Pinus*), fir (*Abies*), incense cedar (*Calocedrus*), etc. The conifers may only occur intermittently in the overstory and may be associated with tree oaks or shrubs.

I.A. The overstory is dominated by pine (*Pinus* spp.) trees or in shared dominance with broadleaf evergreen trees and/or shrubs such as oaks (*Quercus*). If Bigcone Douglas-fir (*Pseudotsuga macrocarpa)* is co-dominant with pine(s), then see **I.B.** below.

IA.2. Jeffrey pine (*Pinus jeffreyi*) occurs as the dominant overstory conifer or co-dominant with sugar pine (*Pinus lambertiana*), and hardwood species may be present and similar in cover to the conifer species…

***Pinus jeffreyi* Alliance**

IA.3. Ponderosa pine (*Pinus ponderosa*) occurs as the dominant overstory conifer or is co-dominant with sugar pine (*Pinus lambertiana*), and hardwood species such as may be present and similar in cover to the conifer species…

***Pinus ponderosa* Alliance**

IA3.a. Stands occur in post-burn settings with relatively high cover of cheatgrass (*Bromus tectorum*) in the understory. Standing snags of trees are typically present…

***Pinus ponderosa – (Pinus lambertiana) / Bromus tectorum* Association**

IA.4. Coulter pine (*Pinus coulteri*) occurs as the dominant conifer tree or is co-dominant with sugar pine in an open to intermittent tree canopy, and there may be an abundant sub-canopy of oaks (*Quercus*), and an abundant understory of shrubs such as oaks, ceanothus (*Ceanothus*), and coffeeberry (*Frangula californica*) may be present…

***Pinus coulteri* Alliance**

IA4.a. Canyon live oak (*Quercus chrysolepis*) occurs as a hardwood tree in the overstory, and Coulter pine is usually co-dominant…

***Pinus coulteri – Quercus chrysolepis* Association**

IA.5. Singleleaf pinyon pine (*Pinus monophylla*) occurs as the dominant conifer tree in an open to intermittent tree canopy, and there may be an abundance of oaks (*Quercus*), and an abundant understory of shrubs may be present…

***Pinus monophylla* Alliance**

I.B. The overstory is dominated by one or more conifer species of fir (*Abies*), incense cedar (*Calocedrus*), Douglas-fir (*Pseudotsuga*), etc, and the conifers may have shared dominance with pines (*Pinus*) and broadleaf evergreen trees. Shrubs and herbs may be present, such as ceanothus, mountain mahogany (*Cercocarpus* spp.), and variable in cover.

IB.1. Bigcone Douglas-fir (*Pseudotsuga macrocarpa)* occurs as a dominant or co-dominant conifer in the overstory as a canopy tree, usually with at least 20% relative cover, and there may be an abundant (co-dominant or dominant) sub-canopy of oaks (*Quercus*)…

***Pseudotsuga macrocarpa* Alliance**

IB1.a. One or more conifer species is/are present in the overstory with bigcone Douglas-fir. Stands are often on north-facing slopes in both lower elevations (<1,7500 m elevation) and higher elevations (>1,7500 m elevation), but can be on south-facing slopes in the higher elevations. These associations are considered “mixed conifer” versions of this alliance, and can include *Abies concolor, Calocedrus decurrens, Pinus coulteri, P. lambertiana, P. monophylla, P. jeffreyi,* and *P. ponderosa…*

IB1a.i. One or more pine species is present such as *Pinus ponderosa, P. monophylla,* and/or *P. lambertiana* in the overstory and often co-dominant with bigcone Douglas-fir and canyon live oak. *Cercocarpus ledifolius* is characteristically present in the understory and other shrubs such as pineland manzanita (*Arctostaphylos parryana*) and big sagebrush (*Artemisia tridentata*) may be present…

***Pseudotsuga macrocarpa – Quercus chrysolepis* – mixed conifer / *Cercocarpus ledifolius* Association**

IB1a.ii. Coulter pine (*Pinus coulteri*) is characteristically present in the overstory and or understory with bigcone Douglas-fir and canyon live oak. Sugar pine is sometimes co-dominant with the other conifers. Understory includes various shrubs and cheat grass is characteristically present…

***Pseudotsuga macrocarpa* – *Quercus chrysolepis – Pinus coulteri* Association**

IB1a.iii. *Pinus monophylla* is characteristically present in the overstory as a sub-dominant or co-dominant with bigcone Douglas-fir and canyon live oak. If white fir (*Abies concolor*) is present, it is trace in cover (<1%). California flannel bush (*Fremontodendron californicum*) is characteristically present in the understory and other shrubs (e.g., *Cercocarpus montanus, Arctostaphylos glauca, Eriogonum* spp., *Frangula californica,* and *Rhamnus ilicifolia*), may also be present.

***Pseudotsuga macrocarpa – Quercus chrysolepis – Pinus monophylla / Fremontodendron californicum* Association**

IB1a.iv. One or more pine species is present such as *Pinus lambertiana*, *P. jeffreyi*, and/or *P. ponderosa*. White fir (*Abies concolor*) and/or incense cedar (*Calocedrus decurrens*) is characteristically present with at least 1% cover. Understory shrubs (e.g., *Artemisia tridentata*, *Ceanothus cordulatus, C. integerrimus, C. vestitus*, and *Cercocarpus montanus*) are variable in presence and cover.

***Pseudotsuga macrocarpa – Quercus chrysolepis – Abies concolor – Pinus* spp. (*lambertiana, jeffreyi, ponderosa*) Association**

IB1.b. Canyon live oak occurs as a dominant sub-canopy tree and sometimes as an understory shrub and is co-dominant or sub-dominant to bigcone Douglas-fir. If other hardwood trees are also present, see below, and if other conifers are present and co-dominant, see above…

IB1b.i. Big leaf maple, white alder, willow, California sycamore and or other riparian trees are characteristically present in the tree layer. Understory may be diverse in shrub and or herb species. Stands occur along streams or stream banks.

***Pseudotsuga macrocarpa – Quercus chrysolepis – (Acer macrophyllum)* Association**

IB1b.i. Interior live oak (*Querus wislizeni*) is characteristically present and sub-dominant to co-dominant in the tree canopy. Eastwood manzanita (*Arctostaphylos glandulosa*) is characteristically present in the shrub layer. Other shrubs (e.g., *Heteromeles arbutifolia, Toxicodendron diversilobum*) may also be present. Stands are often not in post-burn settings, though on lower elevation slopes (<1,600 m) that are rocky.

***Pseudotsuga macrocarpa – Quercus chrysolepis – Quercus wislizeni / Arctostaphylos glandulosa* Association**

IB1b.i. Birchleaf mountain-mahogany (*Cercocarpus montanus*) is characteristically present in the understory and often the highest cover shrub. Other shrubs (e.g., *Eriogonum fasciculatum, Hesperoyucca whipplei*) may be present. Stands are often not in post-burn settings, though on steep to abrupt slopes that are rocky.

***Pseudotsuga macrocarpa – Quercus chrysolepis / Cercocarpus montanus* Association**

IB1b.ii. Deerbrush (*Ceanothus integerrimus*) is characteristically present in the understory and dominant or co-dominant with other shrubs (e.g., *Ceanothus leucodermis, Eriogonum fasciculatum*). Herbaceous plants are variable, with cheatgrass often present. Stands are typically post-burn and/or have other disturbance…

***Pseudotsuga macrocarpa – Quercus chrysolepis / Ceanothus integerrimus* Association**

IB1b.ii. Chaparral yucca (*Hesperoyucca whipplei)* is characteristically present in the understory and dominant or co-dominant with other shrubs (e.g. *Erogonum fasciulatum).* The herbaceous layer is typically low in cover, but can contain plants such as bluegrass (*Poa*) …..

***Pseudotsuga macrocarpa – Quercus chrysolepis / Hesperoyucca whipplei* Association**

IB1b.iii. *Bromus diandrus* characteristically present and typically higher than other herbs in the understory; native herb cover is trace/low in cover and may include *Claytonia perfoliata*, and *Cirsium* sp. Stands are often post-burn and/or have other disturbance…

***Pseudotsuga macrocarpa – Quercus chrysolepis / Bromus diandrus* Association**

IB1b.iv. Understory plants are variable, though often with low cover and depauperate in shrub species and variable in cover and composition of herbs including bluegrass (*Poa*), bromes (*Bromus*), ferns (e.g., *Dryopteris arguta, Polystichum, Pteridium*) etc. Stands are either mature (>30 years since the last burn) or recently post-burn…

***Pseudotsuga macrocarpa – Quercus chrysolepis* Association**

IB1.c. Black oak occurs alone or with canyon live oak as a dominant canopy or sub-canopy tree, and is co-dominant with bigcone Douglas-fir (which may be regenerating as seedlings and saplings as well as trees). Understory is often high in herbaceous cover and varied in variable in composition (e.g., *Poa, Bromus tectorum*)…

***Pseudotsuga macrocarpa – Quercus kelloggii* Association**

IB1.e. Coast live oak occurs as a dominant sub-canopy tree and sometimes as an understory shrub and is co-dominant with bigcone Douglas-fir. Understory is variable in composition and often containing shrubs (e.g., *Heteromeles arbutifolia, Toxicodendron diversilobum*)…

***Pseudotsuga macrocarpa – Quercus agrifolia* Association**

IB1.f. Bigcone Douglas-fir occurs at sparse cover with or without oak species. Shrubs are also sparse in cover (<10% total cover), and herbs are usually sparse in cover, though sometimes open in cover with spikemoss (*Selaginella*), bluegrass, etc. Tree snags are also present, with stands typically in post-burn settings.

***Pinus jeffreyi / Arctostaphylos glauca - Ceanothus leucodermis* Sparse Shrubland Alliance (provisional)**

***Pseudotsuga macrocarpa* (sparse) Association**

IB.2. Incense cedar (*Calocedrus decurrens*) is the dominant overstory conifer, and oaks such as canyon live oak may be dominant in the sub-canopy tree layer.

***Calocedrus decurrens* Alliance**

IB2.a. White alder (*Alnus rhombifolia*) occurs in the tree layer as a sub-dominant along with other riparian trees (e.g., *Platanus racemosa*), and bigcone Douglas-fir, if present, is also sub-domiant…

***Calocedrus decurrens – Alnus rhombifolia* Association**

<u>Group II.</u> Woodlands and forests characterized mainly by broad-leaved evergreen and deciduous tree species such as oaks (*Quercus*), willows (*Salix*), etc. If conifers are present they are sub-dominant (<20% relative cover)

II.A. California sycamore (*Platanus racemosa*), Fremont cottonwood (*Populus fremontii*), willows (*Salix*), and other wetland trees are dominant or are co-dominant in the overstory in riparian habitats…

IIA.1. Bigleaf maple is solely dominant in the tree layer, often in riparian settings or on steep moist slopes with colluvial disturbance...

Acer macrophyllum* Alliance

IIA.2. White alder (*Alnus rhombifolia*) is the primary tree in the overstory, or it shares dominance with other trees…

Alnus rhombifolia* Alliance

IIA2.b. White alder is co-dominant with big-leaf maple…

Alnus rhombifolia – Acer macrophyllum* Association

IIA.3. Fremont cottonwood is provides an open to intermittent tree overstory canopy. Willows may occur in the sub-canopy as co-dominants (though sometimes they are higher in cover), or Fremont cottonwood occurs as the sole dominant tree…

Populus fremontii* Alliance

IIB. Woodlands and forests in upland and mesic habitats where one or more oak (*Quercus*) species occur as the dominant or co-dominant with other hardwoods (at >80% relative cover overall) in the canopy or sub-canopy tree layer …

IIB.1. Canyon live oak is the dominant species in the overstory. Conifers (such as Jeffrey pine or bigcone Douglas-fir) may be emergent and sub-dominant (<20% relative cover)…

***Quercus chrysolepis* (tree) Alliance (See Class B, Group IB1. for key to shrub associations)**

IIB1.a. Bigcone Douglas-fir occurs subdominant as either an emergent canopy tree or sub-canopy tree, and deerbrush is dominant or codominant with other shubs (e.g., *Keckiella* spp., *Sambucus nigra, Turricula parryi*), and stands are often in post-burn upland settings…

***Quercus chrysolepis / Ceanothus integerrimus* Association**

IIB1.b. Bigcone Douglas-fir occurs subdominant as either an emergent canopy tree or sub-canopy tree. Shrubs, if present, are typically low in cover, and composition is variable. Stands are often in post-burn upland settings.

***Quercus chrysolepis – Pseudotsuga macrocarpa* Association**

IIB1.c. Bigcone Douglas-fir occurs as a subdominant as either a canopy or sub-canopy tree; riparian trees such as bigleaf maple (*Acer macrophyllum*) and/or California sycamore (*Platanus racemosa*) are typically present. Shrubs, if present, are variable and often include birchleaf mountain mahogany, willow (*Salix),* mulefat (*Baccharis salicifolia*), and poison oak (*Toxicodendron diversilobum*). Stands occur within or at the edge of riparian corridors…

***Quercus chrysolepis – Pseudotsuga macrocarpa – Acer macrophyllum* Association**

IIB1.d. Bigcone Douglas-fir, if present, is trace (<1%) cover in the tree layer, and the tree layer is dominated by canyon live oak while interior live oak occurs as a sub-dominant in the tree (or shrub) layer, and other shrubs may be present and variable in cover…

***Quercus chrysolepis – Quercus wislizeni* Association**

IIB1.e. Bigcone Douglas-fir, if present, is trace (<1%) cover in the tree layer, and the tree layer is solely dominated by canyon live oak, and the shrub layer is typically trace or low in cover (<5%), and herbs are variable in cover…

***Quercus chrysolepis* (tree) Association**

IIB.2. Interior live oak occurs as a dominant or co-dominant with other species in the tree/shrub overstory. Scrub oak (*Quercus berberidifolia*) is absent, and canyon live oak, if present, can occur as a co-dominant…

***Quercus wislizeni* (tree) Alliance (See Class B, Group IB2. for key to shrub associations)**

IIB2.a. Interior live oak occurs as the dominant tree in the overstory. Shrubs, if present, are variable in composition and usually low in cover (<5%)

***Quercus wislizeni* (tree) Association**

IIB2.b. Interior live oak and canyon live oak typically occur as co-dominants. Coulter pine is present at lower cover, but usually at least 3% cover…

Quercus wislizeni – Quercus chrysolepis – Pinus coulteri* Association

IIB.3. Coast live oak is the dominant species in the overstory…

***Quercus agrifolia* Alliance**

IIB3.a. Engelmann oak (*Quercus engelmannii*) is present and usually subdominant in the tree layer with coast live oak dominant. The understory is usually shrubby and grassy, often with California buckwheat (*Eriogonum fasciculatum*) and bromes present…

***Quercus agrifolia – Quercus engelmannii* / *Eriogonum fasciculatum* Association**

IIB3.a. California bay (*Umbellularia californica*) is present and usually subdominant in the tree layer with coast live oak dominant. The understory is usually shrubby, often with poison oak present…

Quercus agrifolia – Umbellularia californica* Association

IIB.4. Black oak is the dominant species in the overstory, while conifers (such as Coulter pine) may be emergent and sub-dominant (<20% relative cover) …

Quercus kelloggii* Alliance

<u>Class B.</u> Shrub-Overstory Vegetation

<u>Group I</u>: Shrublands dominated by sclerophyllous temperate broad-leaved shrubs (with leaves hardened by a waxy cuticle). They are dominated by typical chaparral and evergreen montane chaparral shrub genera; including chamise (*Adenostoma fasciculatum*), manzanita (*Arctostaphylos*), *Ceanothus,* mountain mahogany (*Cercocarpus*), scrub oaks (*Quercus*), coffeeberry (*Rhamnus*), etc.

I.A. The overstory is dominated primarily by one species of shrub oak (*Quercus*) or has shared dominance with other chaparral shrub species such as ceanothus *(Ceanothus*)…

IA.1. Canyon live oak is dominant in the shrub layer, and interior live oak if present is sub-dominant

***Quercus chrysolepis* (shrub) Alliance**

IA1.a. Deerbrush (*Ceanothus integerrimus*) is typically present and co-dominant or sub-dominant in the shrub layer with canyon live oak and other shrubs. Sometime chaparral whitethorn (*Ceanothus leucodermis*) is present and co-dominant with canyon live oak with or without the deerbrush …

***Quercus chrysolepis – Ceanothus integerrimus* Association**

IA1.b. Canyon live oak dominant in the shrub layer. Other shrubs may be present and variable in cover and composition (e.g., *Adenostoma fasciculatum, Keckiella* spp.)…

***Quercus chrysolepis* (shrub) Association**

IA.2. The overstory is usually dominated by interior live oak alone or in shared dominance with other species (i.e., redshank, birchleaf mountain-mahogany, chaparral whitethorn, scrub oak, canyon live oak) in the shrub and/or tree layers…

IA2.a. Interior live oak occurs as a dominant or co-dominant in the shrub and/or tree layer(s) with shrubs such as birchleaf mountain mahogany and/or redshank. Canyon live oak occurs at variable cover and may be co-dominant…

***Quercus wislizeni* (shrub) Alliance**

IA2a.i. Canyon live oak is co-dominant with interior live oak in the shrub layer…

Quercus wislizeni – Quercus chrysolepis* (shrub) Association

IA2a.ii Interior live oak is dominant in the shrub layer…

***Quercus wislizeni* (shrub) Association**

I.G. The overstory is dominated by ceanothus (*Ceanothus*) alone or in shared dominance with other broad-leaf evergreen shrubs. If oak (shrubs/saplings) are present, they are subdominant. Trees may be present and emergent, but sparse in cover…

IG.2. Hairlyleaf ceanothus (*Ceanothus oliganthus*) occurs as a dominant or as a co-dominant with yerba santa, chamise, hoaryleaf Ceanothus, and/or eastwood manzanita …

***Ceanothus (oliganthus, tomentosus)* Alliance**

IG4.a. Hairleaf ceanothus is present as a dominant or co-dominant with other shrubs. Interior live oak, (shrubs/regenerating), hollyleaf redberry (*Rhamnus ilicifolia*), and others are usually often present at lower cover…

***Ceanothus oliganthus* Association**

IG.4. Deerbrush (*Ceanothus integerrimus*) is dominant or co-dominant in an intermittent to continuous shrub overstory…

***Ceanothus integerrimus* Alliance**

IG4.a. Deerbrush is present as a dominant or co-dominant with other shrubs. Interior live oak, (shrubs/regenerating), poodle bush (*Turricula parryi*), and others are usually often present at lower cover…

***Ceanothus integerrimus* Association**

IG.5. Chaparral whitethorn (*Ceanothus leucodermis*) is usually dominant in an open to continuous shrub overstory. If interior live oak (*Quercus wislizeni*) is present, it occurs at a lower cover value…

***Ceanothus leucodermis* Alliance**

IG5.a. Chaparral whitethorn is present as a co-dominant to dominant with other shrubs. Interior live oak, California buckwheat, and hollyleaf redberry are characteristically present at lower cover…

***Ceanothus leucodermis* Association**

I.H. The overstory is dominated by manzanita (*Arctostaphylos*) alone or in shared dominance with other broad-leaf evergreen shrubs. If trees (shrubs/saplings) are present, they are subdominant and sparse in cover…

IH.1. Bigberry manzanita (*Arctostaphylos glauca*) is usually dominant in the shrub overstory. If interior live oak (*Quercus wislizeni*) is present, it occurs at a lower cover value…

***Artcostaphylos glauca* Alliance**
***Arctostaphylos glauca* Association**

IH.2. Parry's manzanita (*Arctostaphylos parryana*) is usually dominant in the shrub overstory. Other shrubs such as California flannelbush (*Fremontodendron californicum*) and Mojave ceanothus (*Ceanothus greggii* var. *vestitus*) are often present as subdominants. Conifers (e.g., *Pinus jeffreyi*) are emergent and low in cover.

***Arctostaphylos pungens - Arctostaphylos pringlei - Ceanothus greggii* Alliance**
***Arctostaphylos parryana* Association**

I.I. The overstory is dominated by chamise (*Adenostoma fasciculatum*) alone or in shared dominance with other chaparral or coastal scrub species in an open to continuous shrub canopy…

II.3. Chamise usually occurs as a dominant, as a co-dominant with pink-bracted manzanita, California buckwheat, or laurel sumac, or at sparse cover with other shrubs. Mission manzanita is usually absent…

***Adenostoma fasciculatum* Alliance**

II4c.ii. Chamise and California buckwheat co-occur in an open to intermittent shrub overstory, and white sage is usually absent…

***Adenostoma fasciculatum – Eriogonum fasciculatum* Association**

<u>Class C.</u> Herbaceous and Sparse Vegetation

<u>Group II.</u> Vegetation dominated mainly by upland and mesic herbaceous species, including native and exotic grasses, forbs, cryptogrammic species; or vegetion is sparse in cover overall. If woody species are present, they cover <10% of the ground surface.

II.B. Vegetation dominated mainly by annual grasses and herbs of various assortments that are in upland habitats…

IIB.1. Cheatgrass (*Bromus tectorum*) is dominant with at least 20% relative cover…

***Bromus tectorum – Taeniatherum caput-medusae* Ruderal Alliance**
***Bromus tectorum* Association**

IIB.2. Various native and non-native herbs intermix in the understory such as alumroot (*Heuchera*), bluish spikemoss (*Selaginella asprella*), cheatgrass, and other herbs are conspicuous but usually sparse in cover (<10% cover). Bigcone Douglas-fir is present and sparse in cover; other trees such as canyon live oak that are often regenerating at sparse cover. Tree snags are also present, with stands typically in post-burn settings.

***Pinus jeffreyi / Arctostaphylos glauca - Ceanothus leucodermis* Sparse Shrubland Alliance (provisional)**
***Pseudotsuga macrocarpa* (sparse) Association**

Glossary of Terms Used in the Descriptions

- **Absolute cover** – Refers to the actual percentage of the ground (surface of the plot or stand) that is covered by a species or group of species. For example, *Pinus monophylla* covers between 5% and 10% of the stand. Absolute cover of all species or groups if added in a stand or plot may total greater or less than 100% because it is not a proportional number.
- **Average cover** – Average cover for a taxon in a vegetation type is calculated as the sum of its 'absolute' cover values divided by the total sample size.
- **Characteristically** – Present in >75% of the samples for that vegetation type, with no restriction on cover.
- **Co-dominant** – Must be in at least 75% of the samples, with at least 30% relative cover in all samples.
- **Cover** – The primary metric used to quantify the abundance of a particular species or a particular vegetation layer within a plot. It was measured by estimating the aerial extent of the living plants, or the "bird's-eye view" looking from above for each category.
- **Dense/Continuous cover** – Used to describe individual layers of vegetation (tree, shrub, herb, or subdivisions of them) where there is greater than 66 percent absolute cover.
- **Dominant** – Must be in at least 75% of the samples, with at least 50% relative cover in all samples.
- **Emergent** – A plant (or vegetation layer) is considered emergent if it includes plants that rises above a predominant vegetation layer, but that are sparse in cover. It is considered as a member of the next tallest layer, but typically has an absolute cover < 10%. (e.g., the emergent tree layer)
- **Herb** – Is any vascular plant species that has no main woody stem-development, and includes grasses, forbs, and perennial species that die-back seasonally.
- **Intermittent cover** – Used to describe individual layers of vegetation (tree, shrub, herb, or subdivisions of them) where there is 33-66 percent absolute cover.
- **Often** – Present in 50 to 75% of the samples, with no restriction on cover.
- **Open** – Used to describe individual layers of vegetation (tree, shrub, herb, or subdivisions of them) where the cover is less than 33 percent absolute cover.
- **Relative cover** – Refers to the amount of the surface of the plot or stand sampled that is covered by one species (or physiognomic group) as compared to (relative to) the amount of surface of the plot or stand covered by all species (in that group). Thus, 50% relative cover means that half of the total cover of all species or physiognomic groups is composed of the single species or group in question. Relative cover values are proportional numbers and, if added, total 100% for each stand (sample).
- **Shrub** – Is normally a multi-stemmed woody plant that generally has several erect, spreading, or prostrate stems and that is usually between 0.2 meters and 5 meters tall, giving it a bushy appearance. Definitions are blurred at the low and the high ends of the height scales. At the tall end, shrubs may approach trees based on disturbance frequencies (e.g., old-growth re-sprouting chaparral species such as *Quercus turbinella,* etc., may frequently attain "tree size"). At the low end, woody perennial herbs or sub-shrubs of various species are often difficult to categorize into a single life-form; usually sub-shrubs (per USDA-NRCS 2011) were categorized in the "shrub" category.
- **Sometimes** – Present in 25 to 50% of the samples with no restriction on cover.
- **Sparse** – Used to describe individual layers of vegetation (tree, shrub, herb, or subdivisions of them) where the *average* cover value is <10% absolute cover.
- **Stand** – The basic physical unit of vegetation in a landscape. It has no set size. Some vegetation stands are very small such as wetland seeps, and some may be several square kilometers in size such as desert or forest types. A stand is defined by two main unifying characteristics:
    - It has *compositional* integrity. Throughout the site, the combination of species is similar. The stand is differentiated from adjacent stands by a discernable boundary that may be abrupt or gradual.
    - It has *structural* integrity. It has a similar history or environmental setting, affording relatively similar horizontal and vertical spacing of plant species. For example, a hillside forest formerly dominated by the same species, but that has burned on the upper part of the slope and not the lower is divided into two stands. Likewise, a sparse woodland occupying a slope with shallow

rocky soils is considered a different stand from an adjacent slope of a denser woodland/forest with deep moister soil and the same species.

- **Tree** – Is a one-stemmed woody plant that normally grows to be greater than 5 meters tall. In some cases trees may be multiple-stemmed (ramifying) after fire or other disturbance, but size of mature plants is typically greater than 5 m and undisturbed individuals of these species are usually single stemmed.

Glossary of other characters

- ***** – Alliances or associations that were not represented in the surveys from the project, but they are related to the types that were classified and provide context to the overall classification.
- *– & /* – Within the vegetation classification names, species in the same stratum are separated with a dash (e.g., *Quercus chrysolepis – Pseudotsuga macrocarpa* association), while species in differing strata are separated with a "/" or slash, and species in the uppermost stratum are listed first (e.g., *Quercus chrysolepis* / *Ceanothus integerrimus* association).
- **( )** – When parentheses are used around a species name within a vegetation name, it indicates that the species is often present as an indicator species of that association or alliance, but it doesn't meet a threshold of 75% or more constancy. The parentheses may be used around the full scientific name or only around the species epithet. When the parentheses are around the entire name, that plant does not meet this threshhold constancy in that association; it is indicative but it will not always be there. An example is the *Pseudotsuga macrocarpa – Quercus chrysolepis – (Acer macrophyllum)* association. If parentheses are only around the species epithet, it means that the genus is consistently present but it could be another species within that genus that occurs.

Appendix 3. A summary of the suite of species that are regularly found as constant and abundant taxa in the alliances with the species on the left side and the alliance names across the top. The average percent cover of a species is given for the alliance it is regularly found in followed by its constancy in parentheses.

Forest and Woodland

Scientific Name	*Alnus rhombifolia*	*Calocedrus decurrens*	*Pinus coulteri*	*Pinus jeffreyi*	*Pinus monophylla*	*Pinus ponderosa*
Sample Size	1	1	9	3	1	4
Trees						
Abies concolor			0.15 (33)			
Abies concolor (sapling)				6.7 (33)		
Abies concolor (seedling)						
Acer macrophyllum	8 (100)					
Alnus rhombifolia	15 (100)	1 (100)				
Alnus rhombifolia (regen)	2 (100)	0.4 (100)				
Calocedrus decurrens		10 (100)				0.05 (25)
Calocedrus decurrens (sapling)		1 (100)				
Calocedrus decurrens (seedling)		2 (100)				
Pinus coulteri			7.4 (100)	6.7 (33)		0.05 (25)
Pinus coulteri (sapling)			0.2 (77)			0.05 (25)
Pinus coulteri (seedling)			0.13 (66)			0.05 (25)
Pinus jeffreyi				6 (100)		
Pinus jeffreyi (sapling)				0.67 (33)		
Pinus jeffreyi (seedling)				6.7 (33)		
Pinus lambertiana			1.5 (77)	3.7 (66)		2.8 (75)
Pinus lambertiana (sapling)			0.3 (44)			
Pinus lambertiana (seedling)			9 (44)			
Pinus monophylla					3 (100)	
Pinus monophylla (sapling)					0.2 (100)	
Pinus monophylla (seedling)					0.2 (100)	
Pinus ponderosa					1 (100)	7.75 (100)
Pinus ponderosa (sapling)						
Pinus ponderosa (seedling)						0.05 (25)
Platanus racemosa		3 (100)				
Platanus racemosa (regen)		1.2 (100)				
Pseudotsuga macrocarpa	5 (100)	3 (100)	1 (67)	1.4 (100)	1 (100)	0.25 (25)
Pseudotsuga macrocarpa (sapling)		0.2 (100)		6.7 (33)		
Pseudotsuga macrocarpa (seedling)				0.13 (67)		
Quercus agrifolia						
Quercus chrysolepis		8 (100)	9.24 (100)	5 (100)	2 (100)	0.35 (75)
Quercus chrysolepis (regen)		2 (100)	2.2 (100)	1.5 (67)	0.4 (100)	1.1 (100)
Quercus engelmannii						
Quercus wislizeni						
Quercus wislizeni (regen)						
Standing snag			1.5 (89)			3.1 (100)
Standing snag (regen)						0.05 (25)
Umbellularia californica	12 (100)					
Umbellularia californica (regen)	2 (100)					

Forest and Woodland

Scientific Name	*Alnus rhombifolia*	*Calocedrus decurrens*	*Pinus coulteri*	*Pinus jeffreyi*	*Pinus monophylla*	*Pinus ponderosa*
Sample Size	1	1	9	3	1	4
Shrubs						
Adenostoma fasciculatum						
Ageratina adenophora						
Arctostaphylos glandulosa						
Arctostaphylos glauca					0.2 (100)	
Arctostaphylos parryana					1 (100)	
Arctostaphylos patula						
Artemisia tridentata				2 (67)		
Brickellia						
Ceanothus cordulatus						
Ceanothus greggii var. vestitus						
Ceanothus integerrimus						0.1 (50)
Ceanothus leucodermis			0.13 (22)			0.25 (25)
Ceanothus oliganthus						
Cercocarpus ledifolius					1 (100)	
Cercocarpus montanus var. glaber				0.33 (33)		0.05 (25)
Dendromecon rigida						
Diplacus aurantiacus						
Ehrendorferia ochroleuca						
Ericameria nauseosa						
Ericameria parishii						
Eriodictyon crassifolium						
Eriodictyon trichocalyx						
Eriogonum fasciculatum			4.4 (22)			
Eriogonum umbellatum				6.7 (33)		
Eriophyllum confertiflorum			0.3 (44)	6.7 (33)		
Frangula californica	0.2 (100)		1 (22)			
Fremontodendron californicum				0.7 (33)	1 (100)	
Garrya						
Gutierrezia microcephala						
Hesperoyucca whipplei			0.13 (22)			0.05 (25)
Heteromeles arbutifolia						
Keckiella antirrhinoides						
Keckiella cordifolia						
Keckiella ternata						
Leptodactylon						
Malacothamnus marrubioides						0.05 (25)
Malosma laurina						
Phlox diffusa						
Phoradendron					1 (100)	
Quercus chrysolepis						
Quercus john-tuckeri						
Quercus wislizeni						
Rhamnus ilicifolia						

Forest and Woodland

Scientific Name	*Alnus rhombifolia*	*Calocedrus decurrens*	*Pinus coulteri*	*Pinus jeffreyi*	*Pinus monophylla*	*Pinus ponderosa*
Sample Size	1	1	9	3	1	4
Shrubs (cont.)						
Ribes						
Ribes californicum	0.2 (100)					
Ribes montigenum						
Rubus ursinus	3 (100)					
Standing snag						
Symphoricarpos mollis	0.2 (100)					
Tetradymia canescens						
Toxicodendron diversilobum	12 (100)					
Trichostema parishii						
Turricula parryi						0.3 (50)
Herbs						
Achnatherum parishii var. *parishii*						
Artemisia douglasiana	0.2 (100)					
Asclepias						0.05 (25)
Avena barbata						
Bromus diandrus						
Bromus madritensis						
Bromus tectorum			2.7 (67)	1 (33)		15 (100)
Calystegia occidentalis						
Castilleja applegatei						
Cordylanthus nevinii						
Cryptantha						
Dryopteris arguta	2 (100)					
Elymus elymoides						0.25 (25)
Epipactis gigantea						
Eragrostis						
Eriastrum densifolium						
Eriogonum nudum				6.7 (33)		
Eriogonum saxatile						
Eriogonum wrightii						
Erysimum capitatum						
Frasera neglecta						
Galium angustifolium				0.13 (67)		
Galium aparine	0.2 (100)					
Galium johnstonii						
Heuchera				6.7 (33)		
Juncus effusus var. *pacificus*						
Leptodactylon pungens						
Leymus condensatus						
Leymus triticoides	0.2 (100)					
Lilium	0.2 (100)					
Lupinus				6.7 (33)		0.05 (25)
Lupinus excubitus var. *austromontanus*						

Forest and Woodland

Scientific Name	*Alnus rhombifolia*	*Calocedrus decurrens*	*Pinus coulteri*	*Pinus jeffreyi*	*Pinus monophylla*	*Pinus ponderosa*
Sample Size	1	1	9	3	1	4
Herbs (cont.)						
Melica	0.2 (100)					
Nemophila						
Osmorhiza brachypoda	0.2 (100)					
Pellaea						
Penstemon grinnellii						
Penstemon speciosus						
Phacelia						0.1 (50)
Phacelia imbricata						
Poa		2 (100)		1.7 (33)		
Polypodium californicum						
Salvia columbariae						
Sedum						
Selaginella						
Senecio flaccidus						
Solanum xanti						
Solidago						
Sphaeralcea						
Stachys rigida	1 (100)					
Tauschia parishii						
Thalictrum fendleri	0.2 (100)					
Viola pinetorum						
Non-vascular						
Moss				6.7 (33)		

Forest and Woodland

Scientific Name	*Pseudotsuga macrocarpa*	*Quercus agrifolia*	*Quercus chrysolepis*	*Quercus wislizeni*
Sample Size	229	2	56	2
Trees				
Abies concolor				
Abies concolor (sapling)				
Abies concolor (seedling)				
Acer macrophyllum				
Alnus rhombifolia				
Alnus rhombifolia (regen)				
Calocedrus decurrens		0.1 (50)		
Calocedrus decurrens (sapling)				
Calocedrus decurrens (seedling)				
Pinus coulteri		1 (50)		5.6 (100)
Pinus coulteri (sapling)				
Pinus coulteri (seedling)				
Pinus jeffreyi				
Pinus jeffreyi (sapling)				
Pinus jeffreyi (seedling)				
Pinus lambertiana				
Pinus lambertiana (sapling)				
Pinus lambertiana (seedling)				
Pinus monophylla				
Pinus monophylla (sapling)				
Pinus monophylla (seedling)				
Pinus ponderosa				
Pinus ponderosa (sapling)				
Pinus ponderosa (seedling)				
Platanus racemosa		0.5 (50)		
Platanus racemosa (regen)				
Pseudotsuga macrocarpa	10.7 (100)	0.5 (50)	3 (96)	1.6 (100)
Pseudotsuga macrocarpa (sapling)	0.4 (51)		0.18 (29)	
Pseudotsuga macrocarpa (seedling)	0.2 (44)		9.3 (23)	
Quercus agrifolia		42 (100)		
Quercus chrysolepis	11.3 (98)	3 (50)	25.3 (100)	47.5 (100)
Quercus chrysolepis (regen)	3.7 (85)		3.4 (84)	12.5 (100)
Quercus engelmannii		10 (50)		
Quercus wislizeni				5.5 (100)
Quercus wislizeni (regen)				23.5 (100)
Standing snag	0.5 (55)		2 (70)	
Standing snag (regen)				
Umbellularia californica		14.5 (50)		
Umbellularia californica (regen)				

Forest and Woodland

Scientific Name	*Pseudotsuga macrocarpa*	*Quercus agrifolia*	*Quercus chrysolepis*	*Quercus wislizeni*
Sample Size	229	2	56	2
Shrubs				
Adenostoma fasciculatum				0.1 (50)
Ageratina adenophora				
Arctostaphylos glandulosa				0.1 (50)
Arctostaphylos glauca				
Arctostaphylos parryana				
Arctostaphylos patula				
Artemisia tridentata				
Brickellia				
Ceanothus cordulatus				
Ceanothus greggii var. *vestitus*				
Ceanothus integerrimus	2 (37)		0.7 (27)	
Ceanothus leucodermis				0.1 (50)
Ceanothus oliganthus				
Cercocarpus ledifolius				
Cercocarpus montanus var. *glaber*	0.7 (24)		0.5 (29)	
Dendromecon rigida				
Diplacus aurantiacus				1 (50)
Ehrendorferia ochroleuca				
Ericameria nauseosa				
Ericameria parishii				
Eriodictyon crassifolium				
Eriodictyon trichocalyx				
Eriogonum fasciculatum				1.5 (50)
Eriogonum umbellatum				
Eriophyllum confertiflorum	0.15 (21)			0.1 (50)
Frangula californica		0.1 (50)		1 (50)
Fremontodendron californicum				
Garrya				
Gutierrezia microcephala				
Hesperoyucca whipplei	0.4 (37)		0.3 (38)	
Heteromeles arbutifolia				
Keckiella antirrhinoides				
Keckiella cordifolia				0.5 (50)
Keckiella ternata				0.5 (50)
Leptodactylon				
Malacothamnus marrubioides				
Malosma laurina				
Phlox diffusa				
Phoradendron				
Quercus chrysolepis		0.5 (50)		

Forest and Woodland

Scientific Name	*Pseudotsuga macrocarpa*	*Quercus agrifolia*	*Quercus chrysolepis*	*Quercus wislizeni*
Sample Size	229	2	56	2
Shrubs (cont.)				
Quercus john-tuckeri		0.5 (50)		
Quercus wislizeni				
Rhamnus ilicifolia				
Ribes				
Ribes californicum				
Ribes montigenum				
Rubus ursinus				
Standing snag				
Symphoricarpos mollis				
Tetradymia canescens				
Toxicodendron diversilobum	0.4 (21)	4 (50)	0.6 (30)	
Trichostema parishii				
Turricula parryi				
Herbs				
Achnatherum parishii var. *parishii*				
Artemisia douglasiana				
Asclepias				
Avena barbata				
Bromus diandrus				
Bromus madritensis				
Bromus tectorum	2 (35)	7.5 (50)	1 (32)	
Calystegia occidentalis				
Castilleja applegatei				
Cordylanthus nevinii				
Cryptantha				
Dryopteris arguta		0.1 (50)		
Elymus elymoides				
Epipactis gigantea		0.1 (50)		
Eragrostis				
Eriastrum densifolium		0.1 (50)		
Eriogonum nudum				
Eriogonum saxatile				
Eriogonum wrightii				
Erysimum capitatum				
Frasera neglecta				
Galium angustifolium	0.2 (30)		0.3 (29)	
Galium aparine				
Galium johnstonii				
Heuchera				
Juncus effusus var. *pacificus*		0.1 (50)		

Forest and Woodland

Scientific Name	*Pseudotsuga macrocarpa*	*Quercus agrifolia*	*Quercus chrysolepis*	*Quercus wislizeni*
Sample Size	229	2	56	2
Herbs (cont.)				
Leptodactylon pungens				
Leymus condensatus		1 (50)		0.5 (50)
Leymus triticoides				
Lilium				
Lupinus				
Lupinus excubitus var. *austromontanus*				
Melica				
Nemophila				
Osmorhiza brachypoda				
Pellaea				
Penstemon grinnellii				
Penstemon speciosus				
Phacelia				
Phacelia imbricata				
Poa	1.5 (36)		0.4 (23)	
Polypodium californicum				
Salvia columbariae				
Sedum				
Selaginella				
Senecio flaccidus				
Solanum xanti				
Solidago				
Sphaeralcea				
Stachys rigida				
Tauschia parishii				
Thalictrum fendleri				
Viola pinetorum		0.1 (50)		
Non-vascular				
Moss				

Shrublands

Scientific Name	*Adenostoma fasciculatum*	*Arctostaphylos glauca*	*Arctostaphylos pungens - Arctostaphylos pringlei - Ceanothus greggii*	*Ceanothus integerrimus*	*Ceanothus leucodermis*	*Ceanothus oliganthus*
Sample Size	1	1	7	20	1	1
Trees						
Abies concolor			5.7 (29)			
Abies concolor (sapling)						
Abies concolor (seedling)						
Acer macrophyllum						
Alnus rhombifolia						
Alnus rhombifolia (regen)						
Calocedrus decurrens						
Calocedrus decurrens (sapling)						
Calocedrus decurrens (seedling)						
Pinus coulteri						
Pinus coulteri (sapling)						
Pinus coulteri (seedling)						
Pinus jeffreyi			2.17 (100)			
Pinus jeffreyi (sapling)			0.7 (86)			
Pinus jeffreyi (seedling)			0.11 (57)			
Pinus lambertiana						
Pinus lambertiana (sapling)						
Pinus lambertiana (seedling)						
Pinus monophylla		0.2 (100)	0.5 (57)			
Pinus monophylla (sapling)		0.2 (100)	8.6 (43)			
Pinus monophylla (seedling)						
Pinus ponderosa						
Pinus ponderosa (sapling)						
Pinus ponderosa (seedling)						
Platanus racemosa						
Platanus racemosa (regen)						
Pseudotsuga macrocarpa				1 (60)		3 (100)
Pseudotsuga macrocarpa (sapling)						0.2 (100)
Pseudotsuga macrocarpa (seedling)						
Quercus agrifolia						
Quercus chrysolepis			1.3 (100)	0.77 (45)	0.2 (100)	2 (100)
Quercus chrysolepis (regen)			1 (71)	7.06 (100)	12.2 (100)	3.2 (100)
Quercus engelmannii						
Quercus wislizeni						
Quercus wislizeni (regen)						
Standing snag			0.2 (43)	3.85 (100)	1.2 (100)	1 (100)
Standing snag (regen)					0.2 (100)	
Umbellularia californica						
Umbellularia californica (regen)						

Shrublands

Scientific Name	*Adenostoma fasciculatum*	*Arctostaphylos glauca*	*Arctostaphylos pungens - Arctostaphylos pringlei - Ceanothus greggii*	*Ceanothus integerrimus*	*Ceanothus leucodermis*	*Ceanothus oliganthus*
Sample Size	1	1	7	20	1	1
Shrubs						
Adenostoma fasciculatum	40 (100)				2 (100)	
Ageratina adenophora						
Arctostaphylos glandulosa						
Arctostaphylos glauca		22 (100)			0.2 (100)	
Arctostaphylos parryana			22 (100)			
Arctostaphylos patula						
Artemisia tridentata			0.2 (29)			
Brickellia						
Ceanothus cordulatus						
Ceanothus greggii var. *vestitus*		0.2 (100)	1.6 (71)			
Ceanothus integerrimus				29.3 (100)		
Ceanothus leucodermis	0.2 (100)			2.06 (50)	12 (100)	0.2 (100)
Ceanothus oliganthus						7 (100)
Cercocarpus ledifolius			0.3 (29)			
Cercocarpus montanus var. *glaber*		0.2 (100)			0.2 (100)	
Dendromecon rigida						
Diplacus aurantiacus						
Ehrendorferia ochroleuca						
Ericameria nauseosa			0.3 (43)			
Ericameria parishii						
Eriodictyon crassifolium						
Eriodictyon trichocalyx					1 (100)	
Eriogonum fasciculatum	3 (100)	2 (100)			0.2 (100)	10 (100)
Eriogonum umbellatum						
Eriophyllum confertiflorum		0.2 (100)	0.5 (71)	0.15 (35)	0.2 (100)	3 (100)
Frangula californica						
Fremontodendron californicum		1 (100)	3.6 (86)			
Garrya					2 (100)	3 (100)
Gutierrezia microcephala			0.17 (29)			
Hesperoyucca whipplei	0.2 (100)	2 (100)	0.5 (43)		0.2 (100)	
Heteromeles arbutifolia						
Keckiella antirrhinoides						
Keckiella cordifolia						
Keckiella ternata				1 (40)		0.2 (100)
Leptodactylon					0.2 (100)	
Malacothamnus marrubioides						
Malosma laurina						
Phlox diffusa						
Phoradendron						
Quercus chrysolepis						

Shrublands

Scientific Name	*Adenostoma fasciculatum*	*Arctostaphylos glauca*	*Arctostaphylos pungens - Arctostaphylos pringlei - Ceanothus greggii*	*Ceanothus integerrimus*	*Ceanothus leucodermis*	*Ceanothus oliganthus*
Sample Size	1	1	7	20	1	1
Shrubs (cont.)						
Quercus john-tuckeri						
Quercus wislizeni						
Rhamnus ilicifolia						3 (100)
Ribes						
Ribes californicum						
Ribes montigenum						
Rubus ursinus						
Standing snag		1 (100)	0.6 (29)			
Symphoricarpos mollis						
Tetradymia canescens			0.7 (43)			
Toxicodendron diversilobum				0.16 (20)		
Trichostema parishii						
Turricula parryi				2.39 (70)		
Herbs						
Achnatherum parishii var. *parishii*		0.2 (100)	8.6 (43)			
Artemisia douglasiana						
Asclepias						
Avena barbata						
Bromus diandrus						
Bromus madritensis						5 (100)
Bromus tectorum			1.6 (57)	3.48 (75)		5 (100)
Calystegia occidentalis			0.11 (57)			
Castilleja applegatei			8.6 (43)			
Cordylanthus nevinii			8.6 (43)			
Cryptantha	0.2 (100)	0.2 (100)				
Dryopteris arguta						
Elymus elymoides			0.3 (71)			
Epipactis gigantea						
Eragrostis						1 (100)
Eriastrum densifolium			8.6 (43)			
Eriogonum nudum						
Eriogonum saxatile			0.11 (57)			
Eriogonum wrightii			1 (29)			
Erysimum capitatum						
Frasera neglecta			0.2 (57)			
Galium angustifolium				0.94 (35)		2 (100)
Galium aparine						
Galium johnstonii			5.7 (29)			
Heuchera						
Juncus effusus var. *pacificus*						

Shrublands

Scientific Name	*Adenostoma fasciculatum*	*Arctostaphylos glauca*	*Arctostaphylos pungens - Arctostaphylos pringlei - Ceanothus greggii*	*Ceanothus integerrimus*	*Ceanothus leucodermis*	*Ceanothus oliganthus*
Sample Size	1	1	7	20	1	1
Herbs (cont.)						
Leptodactylon pungens			5.7 (29)			
Leymus condensatus						
Leymus triticoides						
Lilium						
Lupinus	0.2 (100)					
Lupinus excubitus var. *austromontanus*			0.6 (29)			
Melica						
Nemophila						0.2 (100)
Osmorhiza brachypoda						
Pellaea		0.2 (100)				
Penstemon grinnellii			5.7 (29)	0.14 (30)		
Penstemon speciosus			5.7 (29)			
Phacelia						
Phacelia imbricata			8.6 (43)			
Poa					0.2 (100)	
Polypodium californicum						
Salvia columbariae						
Sedum						
Selaginella						
Senecio flaccidus						
Solanum xanti				0.27 (50)		
Solidago						
Sphaeralcea						
Stachys rigida						
Tauschia parishii			8.6 (43)			
Thalictrum fendleri						
Viola pinetorum						
Non-vascular						
Moss						

Shrublands, Herbaceous and Sparse

Scientific Name	*Cercocarpus montanus*	*Quercus chrysolepis* (shrub)	*Quercus wislizeni* (shrub)	*Bromus tectorum* - *Taeniatherum caput-medusae* Ruderal	*Pinus jeffreyi* / *Arctostaphylos glauca* - *Ceanothus leucodermis* Sparse
Sample Size	3	36	4	4	5
Trees					
Abies concolor					
Abies concolor (sapling)					
Abies concolor (seedling)					0.04 (20)
Acer macrophyllum					
Alnus rhombifolia					
Alnus rhombifolia (regen)					
Calocedrus decurrens				0.05 (25)	
Calocedrus decurrens (sapling)				0.05 (25)	
Calocedrus decurrens (seedling)					
Pinus coulteri			0.1 (50)		
Pinus coulteri (sapling)				0.05 (25)	
Pinus coulteri (seedling)				0.05 (25)	
Pinus jeffreyi					
Pinus jeffreyi (sapling)					
Pinus jeffreyi (seedling)					
Pinus lambertiana					0.04 (20)
Pinus lambertiana (sapling)					
Pinus lambertiana (seedling)					
Pinus monophylla					
Pinus monophylla (sapling)					
Pinus monophylla (seedling)					0.04 (20)
Pinus ponderosa				0.75 (25)	0.08 (40)
Pinus ponderosa (sapling)			0.05 (25)		
Pinus ponderosa (seedling)				0.05 (25)	
Platanus racemosa					
Platanus racemosa (regen)					
Pseudotsuga macrocarpa	0.7 (67)	1.14 (72)	0.05 (25)	1 (50)	2.6 (100)
Pseudotsuga macrocarpa (sapling)					0.24 (40)
Pseudotsuga macrocarpa (seedling)					0.04 (20)
Quercus agrifolia					0.04 (20)
Quercus chrysolepis	2.7 (100)	1.9 (56)	1.5 (25)	0.85 (75)	2 (80)
Quercus chrysolepis (regen)	0.8 (67)	12.17 (97)		1.3 (100)	1.44 (80)
Quercus engelmannii					
Quercus wislizeni			0.75 (25)		
Quercus wislizeni (regen)			13 (25)		
Standing snag		4.9 (100)		6.65 (100)	1.04 (80)
Standing snag (regen)				0.05 (25)	
Umbellularia californica					0.2 (20)
Umbellularia californica (regen)	6.7 (33)				

Shrublands, Herbaceous and Sparse

Scientific Name	*Cercocarpus montanus*	*Quercus chrysolepis* (shrub)	*Quercus wislizeni* (shrub)	*Bromus tectorum* - *Taeniatherum caput-medusae* Ruderal	*Pinus jeffreyi* / *Arctostaphylos glauca* - *Ceanothus leucodermis* Sparse
Sample Size	3	36	4	4	5
Shrubs					
Adenostoma fasciculatum	0.7 (33)		0.75 (25)		
Ageratina adenophora	2.3 (33)				
Arctostaphylos glandulosa			2.25 (25)		
Arctostaphylos glauca			0.5 (25)		
Arctostaphylos parryana					
Arctostaphylos patula	0.3 (33)				
Artemisia tridentata					
Brickellia	6.7 (33)				
Ceanothus cordulatus					0.2 (20)
Ceanothus greggii var. *vestitus*					
Ceanothus integerrimus		5 (81)		0.55 (50)	
Ceanothus leucodermis	0.7 (33)	2.5 (56)	0.9 (100)	0.3 (50)	
Ceanothus oliganthus					
Cercocarpus ledifolius					
Cercocarpus montanus var. *glaber*	12 (100)		0.3 (50)	0.1 (50)	0.84 (60)
Dendromecon rigida	6.7 (33		0.05 (25)		
Diplacus aurantiacus	0.7 (100)				
Ehrendorferia ochroleuca	0.33 (33)				
Ericameria nauseosa					
Ericameria parishii			0.75 (25)		
Eriodictyon crassifolium	0.7 (33)				
Eriodictyon trichocalyx					
Eriogonum fasciculatum	4.7 (100)		1.8 (75)		0.2 (20)
Eriogonum umbellatum					
Eriophyllum confertiflorum	0.4 (67)	0.1 (28)	0.15 (75)		
Frangula californica	0.33 (33)				
Fremontodendron californicum					
Garrya					
Gutierrezia microcephala					
Hesperoyucca whipplei	0.4 (67)	9 (33)	0.3 (50)	0.05 (25)	0.2 (20)
Heteromeles arbutifolia					0.2 (20)
Keckiella antirrhinoides			0.05 (25)		
Keckiella cordifolia					
Keckiella ternata		0.5 (31)	0.05 (25)		
Leptodactylon					
Malacothamnus marrubioides					
Malosma laurina					0.04 (20)
Phlox diffusa			0.05 (25)		
Phoradendron					
Quercus chrysolepis			0.5 (25)		

Shrublands, Herbaceous and Sparse

Scientific Name	*Cercocarpus montanus*	*Quercus chrysolepis* (shrub)	*Quercus wislizeni* (shrub)	*Bromus tectorum - Taeniatherum caput-medusae* Ruderal	*Pinus jeffreyi / Arctostaphylos glauca - Ceanothus leucodermis* Sparse
Sample Size	3	36	4	4	5
Quercus john-tuckeri					
Shrubs (cont.)					
Quercus wislizeni			30 (75)		
Rhamnus ilicifolia					
Ribes					0.24 (40)
Ribes californicum					
Ribes montigenum				0.05 (25)	
Rubus ursinus					
Standing snag					
Symphoricarpos mollis					
Tetradymia canescens					
Toxicodendron diversilobum	0.33 (33)				
Trichostema parishii			0.25 (25)		
Turricula parryi		0.5 (44)		1.05 (75)	
Herbs					
Achnatherum parishii var. *parishii*					
Artemisia douglasiana					
Asclepias					
Avena barbata	1.7 (33)				
Bromus diandrus	4 (67)		0.5 (25)	2.5 (25)	
Bromus madritensis					
Bromus tectorum		7.6 (78)	0.55 (50)	31.25 (100)	0.64 (40)
Calystegia occidentalis					
Castilleja applegatei					
Cordylanthus nevinii					
Cryptantha			0.05 (25)		
Dryopteris arguta					
Elymus elymoides					
Epipactis gigantea					
Eragrostis					
Eriastrum densifolium					
Eriogonum nudum					
Eriogonum saxatile					
Eriogonum wrightii					
Erysimum capitatum				0.1 (50)	
Frasera neglecta					
Galium angustifolium	0.33 (33)	0.8 (47)	0.1 (50)	0.15 (75)	0.04 (20)
Galium aparine					
Galium johnstonii					
Heuchera					0.04 (20)
Juncus effusus var. *pacificus*					

Shrublands, Herbaceous and Sparse

Scientific Name	*Cercocarpus montanus*	*Quercus chrysolepis* (shrub)	*Quercus wislizeni* (shrub)	*Bromus tectorum* - *Taeniatherum caput-medusae* Ruderal	*Pinus jeffreyi* / *Arctostaphylos glauca* - *Ceanothus leucodermis* Sparse
Sample Size	3	36	4	4	5
Leptodactylon pungens					
Herbs (cont.)					
Leymus condensatus					
Leymus triticoides	6.7 (33)				
Lilium					
Lupinus					
Lupinus excubitus var. *austromontanus*					
Melica	6.7 (33)				
Nemophila					
Osmorhiza brachypoda					
Pellaea					
Penstemon grinnellii					0.04 (20)
Penstemon speciosus					
Phacelia			0.05 (25)		
Phacelia imbricata					
Poa		0.9 (25)			
Polypodium californicum					0.04 (20)
Salvia columbariae			0.05 (25)		
Sedum	6.7 (33)				
Selaginella	6.7 (33)				2 (20)
Senecio flaccidus				0.05 (25)	
Solanum xanti		7.8 (28)			
Solidago				2 (25)	
Sphaeralcea				0.05 (25)	
Stachys rigida					
Tauschia parishii					
Thalictrum fendleri					
Viola pinetorum					
Non-vascular					
Moss					

Appendix 4. A summary of the environmental variables for the alliances classified in this project including the average followed by the range in parentheses.

Forest and Woodland

Scientific Name	*Alnus rhombifolia*	*Calocedrus decurrens*	*Pinus coulteri*	*Pinus jeffreyi*	*Pinus monophylla*	*Pinus ponderosa*	*Pseudotsuga macrocarpa*	*Quercus agrifolia*	*Quercus chrysolepis (tree)*	*Quercus wislizeni (tree)*
SampleSize	1	1	9	3	1	4	229	2	56	2
%Fire		100	67	33	100	100	68	50	66	50
Avg. Time Since Fire (years)			6	62		6	24	6	21	
Elevation (m)	917	1399	1823	1835	1608	1864	1447	1312	1453	1360
	(917-917)	(1399-1399)	(1434-2041)	(1644-2012)	(1608-1608)	(1794-1936)	(523-3009)	(949-1675)	(527-3982)	(1355-1366)
Slope (degrees)	6	4	29	25	35	29	34	18	34	38
	(6-6)	(4-4)	(14-40)	(10-33)	(35-35)	(18-40)	(3-70)	(18-18)	(4-70)	(32-45)
Conifer Cover (%)		13.0	10.0	11.0	5.0	11.0	12.0	0.0	4.0	7.0
		(13-13)	(4-27)	(9-12)	(5-5)	(10-12)	(2-63)	(0-1)	(0-15)	(0.2-13)
Hardwood Cover (%)		12.0	9.0	5.0	2.0	0.0	13.0	70.0	25.0	56.0
		(12-12)	(0.2-18)	(4-6)	(2-2)	(0-1)	(0.2-65)	(60-80)	(1-80)	(55-56)
Regen. Cover (%)	4.0	2.0	3.0	2.0	0.0	1.0	5.0	5.0	4.0	
	(4-4)	(2-2)	(1-8)	(0.2-5)	(0.2-0.2)	(0.2-3)	(0-45)	(5-5)	(0-20)	
Shrub Cover (%)	15.0	0.0	3.0	3.0	4.0	1.0	7.0	4.0	6.0	40.0
	(15-15)	(0-0)	(0.2-14)	(0-5)	(4-4)	(0.2-2)	(0-62)	(0.2-8)	(0-40)	(35-45)
Herb Cover (%)	4.0	2.0	4.0	4.0	0.0	17.0	9.0	9.0	8.0	2.0
	(4-4)	(2-2)	(0-20)	(0.2-9)	(0.2-0.2)	(10-30)	(0-51)	(3-15)	(0-85)	(0-3)

Shrublands, Herbaceous and Sparse

Scientific Name	*Adenostoma fasciculatum*	*Arctostaphylos glauca*	*Arctostaphylos pungens - Arctostaphylos pringlei - Ceanothus greggii*	*Ceanothus integerrimus*	*Ceanothus leucodermis*	*Ceanothus oliganthus*	*Cercocarpus montanus*	*Quercus chrysolepis (shrub)*	*Quercus wislizeni (shrub)*	*Bromus tectorum - Taeniatherum caput-medusae Ruderal*	*Pinus jeffreyi / Arctostaphylos glauca - Ceanothus leucodermis Sparse*
SampleSize	1	1	7	20	1	1	3	36	4	4	5
%Fire	100	100	43	100	100	100	100	100	100	100	80
Avg. Time Since Fire (years)	6		37	6	13	13	11	7	8	6	10
Elevation (m)	1495	1843	2147	1488	1570	1355	1242	1462	1986	1638	1388
	(1495-1495)	(1843-1843)	(1994-2247)	(985-1750)	(1570-1570)	(1355-1355)	(869-1525)	(881-1908)	(1544-3199)	(1407-1913)	(1045-1737)
Slope (degrees)	18	35	29	27	35	38	41	33	36	29	41
	(18-18)	(35-35)	(12-45)	(2-41)	(35-35)	(38-38)	(34-45)	(8-55)	(28-49)	(16-38)	(35-48)
Conifer Cover (%)	0.0	0.0	3.0	1.0	0.0	3.0	1.0	1.0	0.0	2.0	3.0
	(0-0)	(0.2-0.2)	(1-7)	(0-8)	(0-0)	(3-3)	(0-1)	(0-8)	(0-0.2)	(0.2-3)	(1.5-5)
Hardwood Cover (%)	0.0	3.0	2.0	1.0	0.0	2.0	2.0	1.0	2.0	1.0	2.0
	(0-0)	(3-3)	(0.02-4)	(0-7)	(0.2-0.2)	(2-2)	(1-5)	(0-7)	(0-9)	(0-5)	(1-3)
Regen. Cover (%)	0.0	2.0	2.0	7.0	12.0	3.0	1.0	13.0	17.0	1.0	2.0
	(0-0)	(2-2)	(1-4)	(0.2-20)	(12-12)	(3-3)	(1-1)	(3-55)	(0-50)	(0.2-3)	(0-4)
Shrub Cover (%)	45.0	27.0	30.0	36.0	18.0	24.0	22.0	12.0	38.0	2.0	2.0
	(45-45)	(27-27)	(15-45)	(10-85)	(18-18)	(24-24)	(20-25)	(0.2-60)	(2-67)	(0.2-5)	(0.2-5)
Herb Cover (%)	0.0	1.0	5.0	10.0	0.0	17.0	12.0	14.0	2.0	34.0	4.0
	(0.2-0.2)	(1-1)	(1-15)	(0.2-35)	(0.2-0.2)	(17-17)	(5-20)	(0.2-40)	(1-4)	(30-40)	(0.2-15)

Appendix 5. A summary of the suite of species that are regularly found as constant and abundant taxa in the associations with the species on the left side and the association names across the top. The average percent cover of a species is given for the association it is regularly found in followed by its constancy in parentheses.

Forest and Woodland

Scientific Name	*Alnus rhombifolia – Acer macrophyllum*	*Calocedrus decurrens – Alnus rhombifolia*	*Pinus coulteri – Quercus chrysolepis*	*Pinus ponderosa – (Pinus lambertiana) / Bromus tectorum*	*Pseudotsuga macrocarpa – Quercus agrifolia*	*Pseudotsuga macrocarpa – Quercus chrysolepis*
Sample Size	1	1	9	4	3	54
Trees						
Abies concolor			0.2 (33)			
Abies concolor (sapling)						
Abies concolor (seedling)						
Acer macrophyllum	8 (100)				0.7 (33)	
Acer macrophyllum (regen)						
Alnus rhombifolia	15 (100)	1 (100)				
Alnus rhombifolia (regen)	2 (100)	0.4 (100)				
Calocedrus decurrens		10 (100)		0.1 (25)		
Calocedrus decurrens (sapling)		1 (100)				
Calocedrus decurrens (seedling)		2 (100)				
Fraxinus dipetala (regen)					0.7 (33)	
Pinus coulteri			7.4 (100)	0.1 (25)		
Pinus coulteri (sapling)			0.2 (78)	0.1 (25)		
Pinus coulteri (seedling)			0.1 (67)	0.1 (25)		
Pinus jeffreyi						
Pinus jeffreyi (sapling)						
Pinus jeffreyi (seedling)						
Pinus lambertiana			1.5 (78)	2.8 (75)		
Pinus lambertiana (sapling)			0.3 (44)			
Pinus lambertiana (seedling)			8.8 (44)			
Pinus monophylla						
Pinus monophylla (sapling)						
Pinus monophylla (seedling)						
Pinus ponderosa				7.8 (100)		
Pinus ponderosa (seedling)				0.1 (25)		
Pinus sabiniana						
Pinus sabiniana (sapling)						
Pinus sabiniana (seedling)						
Platanus racemosa		3 (100)			1.3 (33)	
Platanus racemosa (regen)		1.2 (100)				
Pseudotsuga macrocarpa	5 (100)	3 (100)	1 (67)	0.3 (25)	17 (100)	16 (100)
Pseudotsuga macrocarpa (sapling)		0.2 (100)				0.5 (59)
Pseudotsuga macrocarpa (seedling)						0.2 (59)
Quercus agrifolia					30.6 (100)	

Forest and Woodland

Scientific Name	*Alnus rhombifolia – Acer macrophyllum*	*Calocedrus decurrens – Alnus rhombifolia*	*Pinus coulteri – Quercus chrysolepis*	*Pinus ponderosa – (Pinus lambertiana) / Bromus tectorum*	*Pseudotsuga macrocarpa – Quercus agrifolia*	*Pseudotsuga macrocarpa – Quercus chrysolepis*
Sample Size	1	1	9	4	3	54
Trees (cont.)						
Quercus chrysolepis		8 (100)	9.3 (100)	0.4 (75)	1.7 (33)	19 (100)
Quercus chrysolepis (regen)		2 (100)	2.2 (100)	1.1 (100)	1.7 (33)	65 (94)
Quercus engelmannii						
Quercus kelloggii						
Quercus kelloggii (regen)						
Quercus wislizeni						
Quercus wislizeni (regen)						
Salix laevigata						
Standing snag			1.5 (89)	3.1 (100)	0.1 (67)	0.5 (52)
Standing snag (regen)				0.1 (25)		
Umbellularia californica	12 (100)					
Umbellularia californica (regen)	2 (100)					
Shrubs						
Adenostoma fasciculatum						
Adenostoma sparsifolium						
Arctostaphylos glandulosa						
Arctostaphylos glauca						
Arctostaphylos parryana						
Artemisia tridentata						
Ceanothus cordulatus						
Ceanothus cuneatus				0.1 (50)		
Ceanothus integerrimus				0.3 (25)		0.7 (41)
Ceanothus leucodermis			0.1 (22)			
Cercocarpus ledifolius				0.1 (25)		
Cercocarpus montanus var. *glaber*					1 (33)	9 (22)
Clematis						
Diplacus aurantiacus						
Eriogonum fasciculatum			4.4 (22)			
Eriogonum umbellatum						
Eriophyllum confertiflorum			0.3 (44)			
Frangula californica	0.2 (100)		1 (22)			
Fremontodendron californicum						
Garrya				0.1 (25)		
Hesperoyucca whipplei			0.1 (22)			0.2 (28)
Heteromeles arbutifolia					1.3 (67)	
Keckiella cordifolia					1 (67)	
Keckiella ternata					6.7 (33)	
Lonicera				0.1 (25)	0.3 (33)	
Malacothamnus marrubioides						
Malosma laurina						

Forest and Woodland

Scientific Name	*Alnus rhombifolia – Acer macrophyllum*	*Calocedrus decurrens – Alnus rhombifolia*	*Pinus coulteri – Quercus chrysolepis*	*Pinus ponderosa – (Pinus lambertiana) / Bromus tectorum*	*Pseudotsuga macrocarpa – Quercus agrifolia*	*Pseudotsuga macrocarpa – Quercus chrysolepis*
Sample Size	1	1	9	4	3	54
Shrubs (cont.)						
Phoradendron						
Prunus ilicifolia					0.7 (33)	
Quercus berberidifolia						
Quercus chrysolepis						
Quercus john-tuckeri						
Rhamnus ilicifolia					1.3 (33)	
Ribes						
Ribes californicum	0.2 (100)					
Ribes montigenum						
Ribes roezlii						
Rubus ursinus	3 (100)					
Salix						
Sambucus nigra					0.3 (33)	
Symphoricarpos mollis	0.2 (100)					
Toxicodendron diversilobum	12 (100)			0.3 (50)	4 (67)	0.5 (30)
Turricula parryi						
Herbs						
Achnatherum						
Artemisia douglasiana	0.2 (100)			0.1 (25)		
Asclepias						
Athyrium filix-femina						
Bromus catharticus						
Bromus diandrus						
Bromus madritensis				15 (100)		
Bromus tectorum			2.7 (67)			0.4 (26)
Carex						
Claytonia perfoliata						
Dryopteris arguta	2 (100)			0.3 (25)	6.7 (33)	
Elymus elymoides						
Epipactis gigantea						
Eriastrum densifolium						
Eriogonum nudum						
Eriogonum wrightii						
Festuca					6.7 (33)	
Galium angustifolium					6.7 (33)	0.1 (24)
Galium aparine	0.2 (100)					
Heuchera						
Juncus effusus var. pacificus						
Leymus condensatus						
Leymus triticoides	0.2 (100)					

Forest and Woodland

Scientific Name	*Alnus rhombifolia – Acer macrophyllum*	*Calocedrus decurrens – Alnus rhombifolia*	*Pinus coulteri – Quercus chrysolepis*	*Pinus ponderosa – (Pinus lambertiana) / Bromus tectorum*	*Pseudotsuga macrocarpa – Quercus agrifolia*	*Pseudotsuga macrocarpa – Quercus chrysolepis*
Sample Size	1	1	9	4	3	54
Herbs (cont.)						
Lilium	0.2 (100)			0.1 (25)		
Lupinus						
Marah						
Melica	0.2 (100)					
Osmorhiza brachypoda	0.2 (100)			0.1 (50)		
Phacelia						
Poa		2 (100)				1 (31)
Polypodium californicum						
Polystichum imbricans						0.7 (31)
Solanum xanti						
Stachys rigida	1 (100)					
Thalictrum fendleri	0.2 (100)					
Viola pinetorum						
Non-vascular						
Lichen						
Moss						

Forest and Woodland

Scientific Name	*Pseudotsuga macrocarpa – Quercus chrysolepis – (Acer macrophyllum)*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Abies concolor – Pinus spp. (lambertiana, jeffreyi, ponderosa)*	*Pseudotsuga macrocarpa – Quercus chrysolepis – mixed conifer / Cercocarpus ledifolius*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Pinus coulteri*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Pinus monophylla / Fremontodendron californicum*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Quercus wislizeni / Arctostaphylos glandulosa*
Sample Size	14	17	4	25	14	6
Trees						
Abies concolor		1.6 (76)				
Abies concolor (sapling)		7 (35)	0.1 (25)			
Abies concolor (seedling)		0.3 (35)	0.1 (25)			
Acer macrophyllum	1.6 (71)		1.3 (25)			
Acer macrophyllum (regen)	0.7 (29)					
Alnus rhombifolia						
Alnus rhombifolia (regen)						
Calocedrus decurrens		0.6 (47)	1.1 (75)	0.3 (24)		
Calocedrus decurrens (sapling)						
Calocedrus decurrens (seedling)						
Fraxinus dipetala (regen)						
Pinus coulteri			0.8 (25)	2.7 (92)		0.7 (33)
Pinus coulteri (sapling)			0.3 (25)			
Pinus coulteri (seedling)			0.3 (25)	0.1 (36)		
Pinus jeffreyi		0.6 (24)	0.1 (25)			
Pinus jeffreyi (sapling)						
Pinus jeffreyi (seedling)						
Pinus lambertiana		1.3 (59)	0.5 (50)	0.5 (24)		
Pinus lambertiana (sapling)		0.2 (41)	0.4 (75)			
Pinus lambertiana (seedling)		0.2 (41)	0.3 (50)			
Pinus monophylla			0.3 (25)		1 (57)	
Pinus monophylla (sapling)			0.3 (50)		0.5 (71)	
Pinus monophylla (seedling)			0.1 (25)		0.3 (71)	
Pinus ponderosa		1.5 (41)	2 (75)			
Pinus ponderosa (seedling)						
Pinus sabiniana						
Pinus sabiniana (sapling)						
Pinus sabiniana (seedling)						
Platanus racemosa	0.2 (21)					
Platanus racemosa (regen)	1 (21)					
Pseudotsuga macrocarpa	8 (100)	7 (100)	3.5 (100)	9 (100)	4.6 (100)	16 (100)
Pseudotsuga macrocarpa (sapling)	0.5 (43)	0.3 (65)	0.4 (75)	0.2 (40)	0.4 (64)	0.9 (67)
Pseudotsuga macrocarpa (seedling)	0.5 (50)	0.1 (65)	0.1 (25)	0.1 (48)	0.1 (43)	0.1 (50)
Quercus agrifolia						
Quercus chrysolepis	9 (93)	5.7 (100)	6 (100)	9.6 (100)	5.6 (100)	21 (100)
Quercus chrysolepis (regen)	2 (79)	1.3 (82)	1.8 (75)	2.6 (92)	1.4 (100)	4.7 (83)

Scientific Name	*Pseudotsuga macrocarpa – Quercus chrysolepis – (Acer macrophyllum)*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Abies concolor – Pinus spp. (lambertiana, jeffreyi, ponderosa)*	*Pseudotsuga macrocarpa – Quercus chrysolepis – mixed conifer / Cercocarpus ledifolius*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Pinus coulteri*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Pinus monophylla / Fremontodendron californicum*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Quercus wislizeni / Arctostaphylos glandulosa*
Sample Size	14	17	4	25	14	6
Trees (cont.)						
Quercus engelmannii						
Quercus kelloggii						
Quercus kelloggii (regen)						
Quercus wislizeni						1.5 (33)
Quercus wislizeni (regen)						4.6 (67)
Salix laevigata						
Standing snag	4.3 (21)			1.3 (100)		
Standing snag (regen)				0.1 (24)		
Umbellularia californica	0.4 (21)					
Umbellularia californica (regen)	0.5 (21)					
Shrubs						
Adenostoma fasciculatum						0.4 (50)
Adenostoma sparsifolium						
Arctostaphylos glandulosa						3 (83)
Arctostaphylos glauca					0.6 (21)	
Arctostaphylos parryana			1 (25)			
Artemisia tridentata		0.3 (24)	1 (25)			
Ceanothus cordulatus		0.8 (24)				
Ceanothus cuneatus						
Ceanothus integerrimus	0.2 (29)			0.3 (36)		
Ceanothus leucodermis						0.4 (33)
Cercocarpus ledifolius			1.8 (100)			
Cercocarpus montanus var. *glaber*	0.2 (36)	0.3 (29)			1 (36)	
Clematis						
Diplacus aurantiacus						
Eriogonum fasciculatum						
Eriogonum umbellatum						
Eriophyllum confertiflorum				0.3 (24)		
Frangula californica	0.3 (36)		0.5 (25)			
Fremontodendron californicum			1 (25)		1 (93)	
Garrya						
Hesperoyucca whipplei	0.7 (50)	0.2 (29)	0.6 (50)	0.3 (36)		
Heteromeles arbutifolia						
Keckiella cordifolia						
Keckiella ternata						
Lonicera	0.2 (21)					

Scientific Name	Pseudotsuga macrocarpa – Quercus chrysolepis – (Acer macrophyllum)	Pseudotsuga macrocarpa – Quercus chrysolepis – Abies concolor – Pinus spp. (lambertiana, jeffreyi, ponderosa)	Pseudotsuga macrocarpa – Quercus chrysolepis – mixed conifer / Cercocarpus ledifolius	Pseudotsuga macrocarpa – Quercus chrysolepis – Pinus coulteri	Pseudotsuga macrocarpa – Quercus chrysolepis – Pinus monophylla / Fremontodendron californicum	Pseudotsuga macrocarpa – Quercus chrysolepis – Quercus wislizeni / Arctostaphylos glandulosa
Sample Size	14	17	4	25	14	6
Shrubs (cont.)						
Malacothamnus marrubioides						
Malosma laurina						
Phoradendron			0.1 (25)			
Prunus ilicifolia						
Quercus berberidifolia						
Quercus chrysolepis						
Quercus john-tuckeri						
Rhamnus ilicifolia	0.6 (29)					
Ribes	0.2 (21)					
Ribes californicum						
Ribes montigenum	4.3 (21)					
Ribes roezlii						
Rubus ursinus						
Salix						
Sambucus nigra						
Symphoricarpos mollis						
Toxicodendron diversilobum	1 (50)					0.5 (33)
Turricula parryi				0.1 (24)		
Herbs						
Achnatherum						
Artemisia douglasiana						
Asclepias						
Athyrium filix-femina						
Bromus catharticus						
Bromus diandrus						
Bromus madritensis						
Bromus tectorum		1 (24)	0.1 (25)	5 (84)		
Carex						
Claytonia perfoliata						
Dryopteris arguta						
Elymus elymoides						
Epipactis gigantea						
Eriastrum densifolium						
Eriogonum nudum					0.1 (29)	
Eriogonum wrightii						
Festuca						6.6 (33)

Forest and Woodland

Scientific Name	*Pseudotsuga macrocarpa – Quercus chrysolepis – (Acer macrophyllum)*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Abies concolor – Pinus spp. (lambertiana, jeffreyi, ponderosa)*	*Pseudotsuga macrocarpa – Quercus chrysolepis – mixed conifer / Cercocarpus ledifolius*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Pinus coulteri*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Pinus monophylla / Fremontodendron californicum*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Quercus wislizeni / Arctostaphylos glandulosa*
Sample Size	14	17	4	25	14	6
Herbs (cont.)						
Galium angustifolium		0.2 (29)		0.2 (68)		6.6 (33)
Galium aparine						
Heuchera						
Juncus effusus var. pacificus						
Leymus condensatus						
Leymus triticoides						
Lilium						
Lupinus						
Marah						
Melica						
Osmorhiza brachypoda						
Phacelia						
Poa	3 (36)	0.3 (24)		0.8 (40)	3 (71)	6.6 (33)
Polypodium californicum	1 (21)					
Polystichum imbricans	4.3 (21)					
Solanum xanti						
Stachys rigida						
Thalictrum fendleri						
Viola pinetorum						
Non-vascular						
Lichen						
Moss					0.8 (29)	

Forest and Woodland

Scientific Name	*Pseudotsuga macrocarpa – Quercus chrysolepis / Bromus diandrus*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Ceanothus integerrimus*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Cercocarpus montanus*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Hesperoyucca whipplei*	*Pseudotsuga macrocarpa – Quercus kelloggii*	*Quercus agrifolia – Quercus engelmannii / Eriogonum fasciculatum*
Sample Size	14	35	17	14	5	1
Trees						
Abies concolor						
Abies concolor (sapling)						
Abies concolor (seedling)						
Acer macrophyllum						
Acer macrophyllum (regen)						
Alnus rhombifolia						
Alnus rhombifolia (regen)						
Calocedrus decurrens						
Calocedrus decurrens (sapling)						
Calocedrus decurrens (seedling)						
Fraxinus dipetala (regen)						
Pinus coulteri						
Pinus coulteri (sapling)						
Pinus coulteri (seedling)						
Pinus jeffreyi						
Pinus jeffreyi (sapling)						
Pinus jeffreyi (seedling)						
Pinus lambertiana						
Pinus lambertiana (sapling)						
Pinus lambertiana (seedling)						
Pinus monophylla						
Pinus monophylla (sapling)						
Pinus monophylla (seedling)						
Pinus ponderosa						
Pinus ponderosa (seedling)						
Pinus sabiniana					0.8 (40)	
Pinus sabiniana (sapling)					0.4 (40)	
Pinus sabiniana (seedling)					0.2 (40)	
Platanus racemosa						
Platanus racemosa (regen)						
Pseudotsuga macrocarpa	6 (100)	11.2 (100)	9.6 (100)	8.3 (100)	8.4 (100)	
Pseudotsuga macrocarpa (sapling)	5.7 (29)	5.7 (29)	0.3 (65)	1 (57)	2.4 (100)	
Pseudotsuga macrocarpa (seedling)		4.6 (23)	0.2 (53)	0.8 (43)	1.3 (100)	
Quercus agrifolia						40 (100)
Quercus chrysolepis	7.8 (100)	11.6 (100)	9.2 (100)	8.9 (100)	2.6 (80)	
Quercus chrysolepis (regen)	2.6 (86)	5.4 (86)	1 (65)	3.8 (86)	0.2 (40)	

Forest and Woodland

Scientific Name	*Pseudotsuga macrocarpa – Quercus chrysolepis / Bromus diandrus*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Ceanothus integerrimus*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Cercocarpus montanus*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Hesperoyucca whipplei*	*Pseudotsuga macrocarpa – Quercus kelloggii*	*Quercus agrifolia – Quercus engelmannii / Eriogonum fasciculatum*
Sample Size	14	35	17	14	5	1
Trees (cont.)						
Quercus engelmannii						20 (100)
Quercus kelloggii					6 (100)	
Quercus kelloggii (regen)					0.7 (60)	
Quercus wislizeni						
Quercus wislizeni (regen)						
Salix laevigata						
Standing snag	1 (93)	1 (100)	0.2 (53)	4.3 (100)		
Standing snag (regen)						
Umbellularia californica						
Umbellularia californica (regen)						
Shrubs						
Adenostoma fasciculatum						
Adenostoma sparsifolium						
Arctostaphylos glandulosa						
Arctostaphylos glauca						
Arctostaphylos parryana						
Artemisia tridentata						
Ceanothus cordulatus				0.4 (21)		
Ceanothus cuneatus						
Ceanothus integerrimus	0.6 (50)	10.7 (100)			0.8 (40)	
Ceanothus leucodermis						
Cercocarpus ledifolius				4.3 (21)		
Cercocarpus montanus var. *glaber*	4.3 (21)		6 (100)			
Clematis				4.3 (21)		
Diplacus aurantiacus						
Eriogonum fasciculatum			1 (47)	0.3 (50)		
Eriogonum umbellatum						
Eriophyllum confertiflorum	0.1 (57)	0.4 (31)	0.3 (35)			
Frangula californica						0.2 (100)
Fremontodendron californicum						
Garrya						
Hesperoyucca whipplei	0.2 (50)	0.3 (29)	1.4 (82)	1 (100)		
Heteromeles arbutifolia						
Keckiella cordifolia			0.3 (24)			
Keckiella ternata	0.4 (29)	0.8 (26)				
Lonicera						

Scientific Name	Pseudotsuga macrocarpa – Quercus chrysolepis / Bromus diandrus	Pseudotsuga macrocarpa – Quercus chrysolepis / Ceanothus integerrimus	Pseudotsuga macrocarpa – Quercus chrysolepis / Cercocarpus montanus	Pseudotsuga macrocarpa – Quercus chrysolepis / Hesperoyucca whipplei	Pseudotsuga macrocarpa – Quercus kelloggii	Quercus agrifolia – Quercus engelmannii / Eriogonum fasciculatum
Sample Size	14	35	17	14	5	1
Shrubs (cont.)						
Malacothamnus marrubioides						
Malosma laurina						
Phoradendron						
Prunus ilicifolia						
Quercus berberidifolia						
Quercus chrysolepis						1 (100)
Quercus john-tuckeri						1 (100)
Rhamnus ilicifolia			0.2 (24)	0.3 (21)		
Ribes					0.4 (60)	
Ribes californicum						
Ribes montigenum						
Ribes roezlii						
Rubus ursinus						
Salix						
Sambucus nigra	0.2 (21)				0.6 (40)	
Symphoricarpos mollis						
Toxicodendron diversilobum	1 (50)	0.6 (23)		0.3 (29)		
Turricula parryi						
Herbs						
Achnatherum						
Artemisia douglasiana						
Asclepias						
Athyrium filix-femina						
Bromus catharticus						
Bromus diandrus	16 (100)	1.7 (26)				
Bromus madritensis						
Bromus tectorum	1.6 (29)	6.3 (51)	0.6 (47)		14 (40)	15 (100)
Carex						
Claytonia perfoliata	0.5 (21)					
Dryopteris arguta						
Elymus elymoides						
Epipactis gigantea						
Eriastrum densifolium						0.2 (100)
Eriogonum nudum						
Eriogonum wrightii						
Festuca						

Forest and Woodland

Scientific Name	*Pseudotsuga macrocarpa – Quercus chrysolepis / Bromus diandrus*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Ceanothus integerrimus*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Cercocarpus montanus*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Hesperoyucca whipplei*	*Pseudotsuga macrocarpa – Quercus kelloggii*	*Quercus agrifolia – Quercus engelmannii / Eriogonum fasciculatum*
Sample Size	14	35	17	14	5	1
Herbs (cont.)						
Galium angustifolium	0.6 (43)	0.3 (31)	0.5 (35)			
Galium aparine	0.1 (21)					
Heuchera						
Juncus effusus var. pacificus						
Leymus condensatus						
Leymus triticoides						
Lilium						
Lupinus						
Marah						
Melica						
Osmorhiza brachypoda						
Phacelia	0.1 (29)					
Poa	5.7 (29)	1.8 (34)	0.4 (41)	0.8 (21)	12.4 (60)	
Polypodium californicum			0.4 (24)			
Polystichum imbricans						
Solanum xanti	7 (36)	9.7 (23)				
Stachys rigida						
Thalictrum fendleri						
Viola pinetorum						0.2 (100)
Non-vascular						
Lichen						
Moss						

Forest and Woodland

Scientific Name	*Quercus agrifolia – Umbellularia californica*	*Quercus chrysolepis – Pseudotsuga macrocarpa*	*Quercus chrysolepis – Pseudotsuga macrocarpa – Acer macrophyllum*	*Quercus chrysolepis – Quercus wislizeni*	*Quercus chrysolepis (tree)*	*Quercus chrysolepis / Ceanothus integerrimus*
Sample Size	1	37	7	1	4	6
Trees						
Abies concolor						
Abies concolor (sapling)						
Abies concolor (seedling)						
Acer macrophyllum			7.7 (86)			
Acer macrophyllum (regen)						
Alnus rhombifolia			1 (29)			
Alnus rhombifolia (regen)						
Calocedrus decurrens	0.2 (100)					0.5 (33)
Calocedrus decurrens (sapling)						
Calocedrus decurrens (seedling)						6.7 (33)
Fraxinus dipetala (regen)						
Pinus coulteri	2 (100)			0.2 (100)		0.7 (50)
Pinus coulteri (sapling)						
Pinus coulteri (seedling)						
Pinus jeffreyi						
Pinus jeffreyi (sapling)						
Pinus jeffreyi (seedling)						
Pinus lambertiana						
Pinus lambertiana (sapling)						
Pinus lambertiana (seedling)						
Pinus monophylla						
Pinus monophylla (sapling)						
Pinus monophylla (seedling)					0.1 (25)	
Pinus ponderosa						
Pinus ponderosa (seedling)						
Pinus sabiniana						
Pinus sabiniana (sapling)						
Pinus sabiniana (seedling)						
Platanus racemosa	1 (100)		3 (71)			
Platanus racemosa (regen)						
Pseudotsuga macrocarpa	1 (100)	3 (97)	3 (100)	0.2 (100)	0.2 (75)	4.2 (100)
Pseudotsuga macrocarpa (sapling)		0.2 (30)			0.2 (75)	6.7 (33)
Pseudotsuga macrocarpa (seedling)		0.1 (24)				0.1 (66)
Quercus agrifolia	44 (100)					
Quercus chrysolepis	6 (100)	22 (100)	2 (100)	58 (100)	51.3 (100)	20 (100)
Quercus chrysolepis (regen)		3.4 (89)	2 (57)		0.6 (100)	8 (100)

Forest and Woodland

Scientific Name	*Quercus agrifolia – Umbellularia californica*	*Quercus chrysolepis – Pseudotsuga macrocarpa*	*Quercus chrysolepis – Pseudotsuga macrocarpa – Acer macrophyllum*	*Quercus chrysolepis – Quercus wislizeni*	*Quercus chrysolepis (tree)*	*Quercus chrysolepis / Ceanothus integerrimus*
Sample Size	1	37	7	1	4	6
Trees (cont.)						
Quercus engelmannii						
Quercus kelloggii						
Quercus kelloggii (regen)						
Quercus wislizeni			0.6 (29)			
Quercus wislizeni (regen)				25 (100)		
Salix laevigata			5.7 (29)			
Standing snag		1.6 (78)	0.2 (29)		0.1 (25)	7 (100)
Standing snag (regen)						6.7 (33)
Umbellularia californica	29 (100)					
Umbellularia californica (regen)						
Shrubs						
Adenostoma fasciculatum						
Adenostoma sparsifolium						
Arctostaphylos glandulosa						
Arctostaphylos glauca				0.2 (100)		
Arctostaphylos parryana						
Artemisia tridentata						
Ceanothus cordulatus						
Ceanothus cuneatus					0.5 (25)	
Ceanothus integerrimus		0.2 (24)				5.8 (100)
Ceanothus leucodermis						
Cercocarpus ledifolius						
Cercocarpus montanus var. *glaber*		0.6 (30)	0.6 (43)		0.1 (25)	
Clematis						
Diplacus aurantiacus						
Eriogonum fasciculatum		0.2 (27)				
Eriogonum umbellatum					0.1 (25)	
Eriophyllum confertiflorum		6 (30)				
Frangula californica			0.4 (29)			
Fremontodendron californicum					0.1 (25)	
Garrya					0.8 (25)	
Hesperoyucca whipplei		0.4 (46)			0.3 (25)	6.7 (33)
Heteromeles arbutifolia				1 (100)		
Keckiella cordifolia				5 (100)		
Keckiella ternata						
Lonicera				1 (100)		

Scientific Name	Quercus agrifolia – Umbellularia californica	Quercus chrysolepis – Pseudotsuga macrocarpa	Quercus chrysolepis – Pseudotsuga macrocarpa – Acer macrophyllum	Quercus chrysolepis – Quercus wislizeni	Quercus chrysolepis (tree)	Quercus chrysolepis / Ceanothus integerrimus
Sample Size	1	37	7	1	4	6
Shrubs (cont.)						
Malacothamnus marrubioides						
Malosma laurina				0.2 (100)		
Phoradendron					0.1 (50)	
Prunus ilicifolia						
Quercus berberidifolia				1 (100)		
Quercus chrysolepis						
Quercus john-tuckeri						
Rhamnus ilicifolia				7 (100)	0.1 (25)	
Ribes			5.7 (29)		0.1 (25)	
Ribes californicum						
Ribes montigenum					0.1 (25)	
Ribes roezlii				1 (100)		
Rubus ursinus						
Salix			0.4 (29)			
Sambucus nigra						6.7 (33)
Symphoricarpos mollis						
Toxicodendron diversilobum	8 (100)	0.6 (35)	1.6 (43)		0.1 (25)	
Turricula parryi						0.7 (33)
Herbs						
Achnatherum					1 (25)	
Artemisia douglasiana			0.5 (29)			
Asclepias						
Athyrium filix-femina						0.2 (33)
Bromus catharticus					0.3 (25)	
Bromus diandrus		2 (30)				
Bromus madritensis				0.2 (100)		
Bromus tectorum		1.4 (38)			0.1 (25)	1.7 (50)
Carex						6.7 (33)
Claytonia perfoliata					0.1 (25)	
Dryopteris arguta	0.2 (100)		0.3 (57)		0.1 (25)	
Elymus elymoides						
Epipactis gigantea	0.2 (100)					
Eriastrum densifolium						
Eriogonum nudum					0.1 (25)	
Eriogonum wrightii						
Festuca						

Forest and Woodland

Scientific Name	*Quercus agrifolia – Umbellularia californica*	*Quercus chrysolepis – Pseudotsuga macrocarpa*	*Quercus chrysolepis – Pseudotsuga macrocarpa – Acer macrophyllum*	*Quercus chrysolepis – Quercus wislizeni*	*Quercus chrysolepis (tree)*	*Quercus chrysolepis / Ceanothus integerrimus*
Sample Size	1	37	7	1	4	6
Herbs (cont.)						
Galium angustifolium		0.4 (35)			0.1 (25)	0.2 (33)
Galium aparine						
Heuchera						
Juncus effusus var. pacificus	0.2 (100)					
Leymus condensatus	2 (100)					
Leymus triticoides						
Lilium						
Lupinus					0.1 (25)	
Marah					0.1 (25)	
Melica						
Osmorhiza brachypoda						
Phacelia						
Poa		0.4 (24)			0.1 (50)	1.8 (33)
Polypodium californicum			2 (29)			
Polystichum imbricans			0.3 (29)		0.1 (25)	0.2 (50)
Solanum xanti						0.4 (33)
Stachys rigida						
Thalictrum fendleri						
Viola pinetorum						
Non-vascular						
Lichen						
Moss					0.1 (25)	

Forest and Woodland

Scientific Name	*Quercus wislizeni* – *Quercus chrysolepis*	*Quercus wislizeni* – *Quercus chrysolepis* – *Pinus coulteri*
Sample Size	1	1
Trees		
Abies concolor		
Abies concolor (sapling)		
Abies concolor (seedling)		
Acer macrophyllum		
Acer macrophyllum (regen)		
Alnus rhombifolia		
Alnus rhombifolia (regen)		
Calocedrus decurrens		
Calocedrus decurrens (sapling)		
Calocedrus decurrens (seedling)		
Fraxinus dipetala (regen)		
Pinus coulteri	0.2 (100)	11 (100)
Pinus coulteri (sapling)		
Pinus coulteri (seedling)		
Pinus jeffreyi		
Pinus jeffreyi (sapling)		
Pinus jeffreyi (seedling)		
Pinus lambertiana		
Pinus lambertiana (sapling)		
Pinus lambertiana (seedling)		
Pinus monophylla		
Pinus monophylla (sapling)		
Pinus monophylla (seedling)		
Pinus ponderosa		
Pinus ponderosa (seedling)		
Pinus sabiniana		
Pinus sabiniana (sapling)		
Pinus sabiniana (seedling)		
Platanus racemosa		
Platanus racemosa (regen)		
Pseudotsuga macrocarpa	0.2 (100)	3 (100)
Pseudotsuga macrocarpa (sapling)		
Pseudotsuga macrocarpa (seedling)		
Quercus agrifolia		
Quercus chrysolepis	50 (100)	45 (100)
Quercus chrysolepis (regen)	15 (100)	10 (100)

Forest and Woodland

Scientific Name	*Quercus wislizeni – Quercus chrysolepis*	*Quercus wislizeni – Quercus chrysolepis – Pinus coulteri*
Sample Size	1	1
Trees (cont.)		
Quercus engelmannii		
Quercus kelloggii		
Quercus kelloggii (regen)		
Quercus wislizeni	5 (100)	6 (100)
Quercus wislizeni (regen)	20 (100)	27 (100)
Salix laevigata		
Standing snag		
Standing snag (regen)		
Umbellularia californica		
Umbellularia californica (regen)		
Shrubs		
Adenostoma fasciculatum	0.2 (100)	
Adenostoma sparsifolium		
Arctostaphylos glandulosa	0.2 (100)	
Arctostaphylos glauca		
Arctostaphylos parryana		
Artemisia tridentata		
Ceanothus cordulatus		
Ceanothus cuneatus		
Ceanothus integerrimus		
Ceanothus leucodermis	0.2 (100)	
Cercocarpus ledifolius		
Cercocarpus montanus var. *glaber*		
Clematis		
Diplacus aurantiacus		2 (100)
Eriogonum fasciculatum		3 (100)
Eriogonum umbellatum		
Eriophyllum confertiflorum		0.2 (100)
Frangula californica		2 (100)
Fremontodendron californicum		
Garrya		
Hesperoyucca whipplei		
Heteromeles arbutifolia		
Keckiella cordifolia		1 (100)
Keckiella ternata		1 (100)
Lonicera		

Forest and Woodland

Scientific Name	*Quercus wislizeni – Quercus chrysolepis*	*Quercus wislizeni – Quercus chrysolepis – Pinus coulteri*
Sample Size	1	1
Shrubs (cont.)		
Malacothamnus marrubioides		
Malosma laurina		
Phoradendron		
Prunus ilicifolia		
Quercus berberidifolia		
Quercus chrysolepis		
Quercus john-tuckeri		
Rhamnus ilicifolia		
Ribes		
Ribes californicum		
Ribes montigenum		
Ribes roezlii		
Rubus ursinus		
Salix		
Sambucus nigra		
Symphoricarpos mollis		
Toxicodendron diversilobum		
Turricula parryi		
Herbs		
Achnatherum		
Artemisia douglasiana		
Asclepias		
Athyrium filix-femina		
Bromus catharticus		
Bromus diandrus		
Bromus madritensis		
Bromus tectorum		
Carex		
Claytonia perfoliata		
Dryopteris arguta		
Elymus elymoides		
Epipactis gigantea		
Eriastrum densifolium		
Eriogonum nudum		
Eriogonum wrightii		
Festuca		

Forest and Woodland

Scientific Name	*Quercus wislizeni – Quercus chrysolepis*	*Quercus wislizeni – Quercus chrysolepis – Pinus coulteri*
Sample Size	1	1
Herbs (cont.)		
Galium angustifolium		
Galium aparine		
Heuchera		
Juncus effusus var. pacificus		
Leymus condensatus		1 (100)
Leymus triticoides		
Lilium		
Lupinus		
Marah		
Melica		
Osmorhiza brachypoda		
Phacelia		
Poa		
Polypodium californicum		
Polystichum imbricans		
Solanum xanti		
Stachys rigida		
Thalictrum fendleri		
Viola pinetorum		
Non-vascular		
Lichen		
Moss		

Shrubland

Scientific Name	*Adenostoma fasciculatum – Eriogonum fasciculatum*	*Arctostaphylos glauca*	*Arctostaphylos parryana*	*Ceanothus integerrimus*	*Ceanothus leucodermis*	*Ceanothus oliganthus*
Sample Size	1	1	7	20	1	1
Trees						
Abies concolor			0.1 (29)			
Calocedrus decurrens (tree)						
Calocedrus decurrens (sapling)						
Pinus coulteri						
Pinus jeffreyi (tree)			2.2 (100)			
Pinus jeffreyi (sapling)			0.7 (86)			
Pinus jeffreyi (seedling)			0.1 (57)			
Pinus monophylla (tree)		0.2 (100)	0.5 (57)			
Pinus monophylla (sapling)		0.2 (100)	0.1 (42)			
Pinus ponderosa (sapling)						
Platanus racemosa						
Pseudotsuga macrocarpa (tree)				1 (60)		3 (100)
Pseudotsuga macrocarpa (sapling)						0.2 (100)
Quercus chrysolepis (tree)			1.3 (100)	0.8 (45)	0.2 (100)	2 (100)
Quercus chrysolepis (regen/shrub)			1 (71)	7 (95)	12 (100)	3 (100)
Quercus wislizeni (tree)						
Quercus wislizeni (regen/shrub)						
Standing snag		1 (100)	0.2 (43)	3.9 (100)	1.4 (100)	1 (100)
Umbellularia californica (regen)						
Shrubs						
Adenostoma fasciculatum	40 (100)				2 (100)	
Ageratina adenophora						
Arctostaphylos glandulosa						
Arctostaphylos glauca		22 (100)			0.2 (100)	
Arctostaphylos parryana			22.3 (100)			
Arctostaphylos patula						
Artemisia tridentata			0.2 (29)			
Brickellia						
Ceanothus crassifolius						
Ceanothus greggii var. *vestitus*		0.2 (100)	1.6 (71)			
Ceanothus integerrimus				29.3 (100)		
Ceanothus leucodermis	0.2 (100)			2.1 (50)	12 (100)	0.2 (100)
Ceanothus oliganthus						7 (100)
Cercocarpus ledifolius			0.3 (29)			
Cercocarpus montanus var. *glaber*		0.2 (100)			0.2 (100)	
Chrysothamnus viscidiflorus						
Dendromecon rigida						

Shrubland

Scientific Name	*Adenostoma fasciculatum – Eriogonum fasciculatum*	*Arctostaphylos glauca*	*Arctostaphylos parryana*	*Ceanothus integerrimus*	*Ceanothus leucodermis*	*Ceanothus oliganthus*
Sample Size	1	1	7	20	1	1
Shrubs (cont.)						
Diplacus aurantiacus						
Ehrendorferia ochroleuca						
Ericameria nauseosa			0.3 (43)			
Ericameria parishii						
Eriodictyon crassifolium						
Eriodictyon trichocalyx					1 (100)	
Eriogonum fasciculatum	3 (100)	2 (100)			0.2 (100)	10 (100)
Eriogonum wrightii			1.1 (29)			
Eriophyllum confertiflorum		0.2 (100)	0.5 (71)	0.2 (35)	0.2 (100)	3 (100)
Frangula californica						
Fremontodendron californicum		1 (100)	3.6 (86)			
Garrya					2 (100)	3 (100)
Gutierrezia microcephala			0.2 (29)			
Hesperoyucca whipplei	0.2 (100)	2 (100)	0.5 (43)		0.2 (100)	
Keckiella antirrhinoides						
Keckiella ternata				1 (40)		0.2 (100)
Lonicera						
Phlox diffusa						
Rhamnus ilicifolia						3 (100)
Standing snag (shrub)		1 (100)	0.6 (29)			
Tetradymia canescens			0.7 (43)			
Toxicodendron diversilobum						
Trichostema parishii						
Turricula parryi				2.4 (70)		
Herbs						
Achnatherum parishii var. *parishii*		0.2 (100)	0.1 (43)			
Avena barbata						
Bromus diandrus						
Bromus madritensis						5 (100)
Bromus tectorum			1.6 (57)	3.5 (75)		5 (100)
Calystegia occidentalis			0.1 (57)			
Castilleja applegatei			0.1 (43)			
Cordylanthus nevinii			0.1 (43)			
Cryptantha	0.2 (100)	0.2 (100)				
Elymus elymoides			0.3 (71)			
Eragrostis						1 (100)
Eriastrum densifolium			0.1 (43)			

Shrubland

Scientific Name	*Adenostoma fasciculatum – Eriogonum fasciculatum*	*Arctostaphylos glauca*	*Arctostaphylos parryana*	*Ceanothus integerrimus*	*Ceanothus leucodermis*	*Ceanothus oliganthus*
Sample Size	1	1	7	20	1	1
Herbs (cont.)						
Eriogonum saxatile			0.1 (57)			
Frasera neglecta			0.2 (57)			
Galium angustifolium				0.9 (35)		2 (100)
Galium johnstonii			0.1 (29)			
Leptodactylon					0.2 (100)	
Leptodactylon pungens			0.1 (29)			
Leymus triticoides						
Lupinus	0.2 (100)					
Lupinus excubitus var. *austromontanus*			0.6 (29)			
Melica						
Nemophila						0.2 (100)
Pellaea		0.2 (100)				
Penstemon grinnellii			0.1 (29)	0.1 (30)		
Penstemon speciosus			0.1 (29)			
Phacelia imbricata			0.1 (43)			
Poa					0.2 (100)	
Salvia columbariae						
Sedum						
Selaginella						
Solanum xanti				0.3 (50)		
Tauschia parishii			0.1 (43)			

Shrubland, Herbaceous, and Sparse

Scientific Name	*Cercocarpus montanus – Eriogonum fasciculatum*	*Quercus chrysolepis – Ceanothus integerrimus*	*Quercus chrysolepis (shrub)*	*Quercus wislizeni – Quercus chrysolepis (shrub)*	*Quercus wislizeni (shrub)*	*Bromus tectorum*	*Pseudotsuga macrocarpa (sparse)*
Sample Size	3	27	5	1	3	4	5
Trees							
Abies concolor							
Calocedrus decurrens (tree)						0.1 (25)	
Calocedrus decurrens (sapling)						0.1 (25)	
Pinus coulteri				0.2 (100)	0.1 (33)	0.1 (25)	
Pinus jeffreyi (tree)							
Pinus jeffreyi (sapling)							
Pinus jeffreyi (seedling)							
Pinus monophylla (tree)							
Pinus monophylla (sapling)						0.8 (25)	0.9 (40)
Pinus ponderosa (sapling)					0.1 (33)	0.1 (25)	
Platanus racemosa						1 (50)	2.6 (100)
Pseudotsuga macrocarpa (tree)	0.7 (67)	1.1 (67)	1.5 (100)	0.2 (100)			0.2 (40)
Pseudotsuga macrocarpa (sapling)						0.9 (75)	2 (80)
Quercus chrysolepis (tree)	2.7 (100)	0.9 (53.3)	6.8 (67)	6 (100)		1.3 (100)	1.4 (80)
Quercus chrysolepis (regen/shrub)	0.7 (67)	13 (80)	7.7 (100)		0.7 (33)		
Quercus wislizeni (tree)				3 (100)			
Quercus wislizeni (regen/shrub)				52 (100)	40 (100)	6.7 (275)	1.0 (80)
Standing snag		5.1 (100)	3.7 (100)			0.1 (25)	
Umbellularia californica (regen)	0.1 (33)						
Shrubs							
Adenostoma fasciculatum	0.7 (33)			3 (100)			
Ageratina adenophora	2 (33)						
Arctostaphylos glandulosa				9 (100)			
Arctostaphylos glauca					0.7 (33)		
Arctostaphylos parryana							
Arctostaphylos patula	0.3 (33)						
Artemisia tridentata							
Brickellia	0.1 (33)						
Ceanothus crassifolius							
Ceanothus greggii var. *vestitus*						0.6 (50)	
Ceanothus integerrimus		6.1 (90)	0.2 (40)			0.3 (50)	
Ceanothus leucodermis	0.7 (33)	2.9 (57)	0.3 (60)	0.2 (100)	1.1 (100)		
Ceanothus oliganthus							
Cercocarpus ledifolius						0.1 (50)	0.8 (60)
Cercocarpus montanus var. *glaber*	12 (100)				0.4 (67)		
Chrysothamnus viscidiflorus							
Dendromecon rigida	0.1 (33)			0.2 (100)			
Diplacus aurantiacus	0.7 (100)						
Ehrendorferia ochroleuca	0.3 (33)						

Shrubland, Herbaceous, and Sparse

Scientific Name	*Cercocarpus montanus – Eriogonum fasciculatum*	*Quercus chrysolepis – Ceanothus integerrimus*	*Quercus chrysolepis (shrub)*	*Quercus wislizeni – Quercus chrysolepis (shrub)*	*Quercus wislizeni (shrub)*	*Bromus tectorum*	*Pseudotsuga macrocarpa (sparse)*
Sample Size	3	27	5	1	3	4	5
Shrubs (cont.)							
Ericameria nauseosa							
Ericameria parishii					1 (33)		
Eriodictyon crassifolium	0.7 (33)						
Eriodictyon trichocalyx							
Eriogonum fasciculatum	4.7 (100)			2 (100)	1.7 (67)		
Eriogonum wrightii							
Eriophyllum confertiflorum	0.4 (67)	0.1 (27)	0.6 (40)		0.2 (100)		
Frangula californica	0.3 (33)						
Fremontodendron californicum						0.1 (25)	
Garrya							
Gutierrezia microcephala							
Hesperoyucca whipplei	0.4 (67)	0.1 (27)	0.1 (60)		0.4 (67)		
Keckiella antirrhinoides				0.2 (100)			
Keckiella ternata		0.5 (27)	1 (60)		0.1 (33)		
Lonicera			0.4 (40)				0.2 (40)
Phlox diffusa					0.1 (33)	0.1 (25)	
Rhamnus ilicifolia							
Standing snag (shrub)							
Tetradymia canescens							
Toxicodendron diversilobum	0.3 (33)						
Trichostema parishii					0.3 (33)	1.1 (75)	
Turricula parryi		0.5 (47)	0.1 (40)				
Herbs							
Achnatherum parishii var. *parishii*							
Avena barbata	1.7 (33)					2.5 (25)	
Bromus diandrus	4 (67)			2 (100)			
Bromus madritensis			0.6 (40)			31.3 (100)	0.6 (40)
Bromus tectorum		7.8 (77)	7.4 (100)		0.7 (67)		
Calystegia occidentalis							
Castilleja applegatei							
Cordylanthus nevinii							
Cryptantha					0.1 (33)		
Elymus elymoides							
Eragrostis							
Eriastrum densifolium						0.1 (50)	
Eriogonum saxatile							
Frasera neglecta	0.3 (33)	1 (53)			0.1 (67)	0.2 (75)	
Galium angustifolium							
Galium johnstonii							

Shrubland, Herbaceous, and Sparse

Scientific Name	*Cercocarpus montanus – Eriogonum fasciculatum*	*Quercus chrysolepis – Ceanothus integerrimus*	*Quercus chrysolepis (shrub)*	*Quercus wislizeni – Quercus chrysolepis (shrub)*	*Quercus wislizeni (shrub)*	*Bromus tectorum*	*Pseudotsuga macrocarpa (sparse)*
Sample Size	3	27	5	1	3	4	5
Herbs (cont.)							
Leptodactylon							
Leptodactylon pungens	0.1 (33)						
Leymus triticoides							
Lupinus							
Lupinus excubitus var. *austromontanus*	0.1 (33)						
Melica							
Nemophila							
Pellaea							
Penstemon grinnellii							
Penstemon speciosus					0.1 (33)		
Phacelia imbricata		1.1 (27)					
Poa					0.1 (33)		
Salvia columbariae	0.1 (33)					0.1 (25)	
Sedum	0.1 (33)						
Selaginella						2 (25)	
Solanum xanti		0.1 (33)				0.1 (25)	
Tauschia parishii							

Appendix 6. A summary of the environmental variables for the associations classified in this project including the average followed by the range in parentheses.

Forest and Woodland

Scientific Name	*Alnus rhombifolia – Acer macrophyllum*	*Calocedrus decurrens – Alnus rhombifolia*	*Pinus coulteri – Quercus chrysolepis*	*Pinus ponderosa – (Pinus lambertiana) / Bromus tectorum*	*Pseudotsuga macrocarpa – Quercus agrifolia*	*Pseudotsuga macrocarpa – Quercus chrysolepis*	*Pseudotsuga macrocarpa – Quercus chrysolepis – (Acer macrophyllum)*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Abies concolor – Pinus spp. (lambertiana, jeffreyi, ponderosa)*	*Pseudotsuga macrocarpa – Quercus chrysolepis – mixed conifer / Cercocarpus ledifolius*
SampleSize	1	1	9	4	3	54	14	17	4
%Fire	0	100	67	100	33	69	64	65	25
Avg. Time Since Fire (years)	N/A	Unknown	6	6	6	25	42	23	98
Elevation (m)	917	1399	1823	1864	907	1408	1118	1817	1883
	(917-917)	(1399-1399)	(1434-2041)	(1794-1936)	(643-1060)	(523-3009)	(585-1551)	(1559-2001)	(1795-1942)
Slope (degrees)	6	4	29	29	31	36	28	32	43
	(6-6)	(4-4)	(14-40)	(18-40)	(4-50)	(7-54)	(5-50)	(3-70)	(30-55)
Conifer Cover (%)	0.0	13.0	10.3	10.8	15.0	16.4	9.1	13.6	12.5
	(0-0)	(13-13)	(4-27)	(10-12)	(12-18)	(5-60)	(2-16)	(3-40)	(6-30)
Hardwood Cover (%)	0.0	12.0	9.2	0.4	46.0	21.2	11.2	7.1	12.3
	(0-0)	(12-12)	(0.2-18)	(0-1)	(40-52)	(1-65)	(2-28)	(3-20)	(1-40)
Regen. Cover (%)	4.0	2.0	3.4	1.1	15.0	6.8	4.8	2.7	5.8
	(4-4)	(2-2)	(1-8)	(0.2-3)	(8-22)	(0.2-45)	(1-12)	(0-6)	(2-10)
Shrub Cover (%)	15.0	0.0	2.9	0.9	10.3	4.1	7.5	5.7	5.3
	(15-15)	(0-0)	(0.2-14)	(0.2-2)	(0-23)	(0-22)	(3-27)	(0-26)	(1-10)
Herb Cover (%)	4.0	2.0	4.3	16.8	3.0	6.4	6.0	4.0	3.0
	(4-4)	(2-2)	(0-20)	(10-30)	(0-6)	(0-25)	(0.2-20)	(0.2-20)	(0-10)

Forest and Woodland

Scientific Name	*Pseudotsuga macrocarpa – Quercus chrysolepis – Pinus coulteri*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Pinus monophylla / Fremontodendron californicum*	*Pseudotsuga macrocarpa – Quercus chrysolepis – Quercus wislizeni / Arctostaphylos glandulosa*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Bromus diandrus*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Ceanothus integerrimus*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Cercocarpus montanus*	*Pseudotsuga macrocarpa – Quercus chrysolepis / Hesperoyucca whipplei*	*Pseudotsuga macrocarpa – Quercus kelloggii*	*Quercus agrifolia – Quercus engelmannii / Eriogonum fasciculatum*
SampleSize	25	14	6	14	35	17	14	5	1
%Fire	76	50	0	79	94	35	86	40	100
Avg. Time Since Fire (years)	12	Unknown	46	16	9	25	31	85	6
Elevation (m)	1691	1692	1317	1130	1318	1274	1575	1549	1675
	(1338-1906)	(1452-1916)	(1166-1547)	(619-1339)	(812-1796)	(923-1795)	(962-1978)	(1460-1611)	(1675-1675)
Slope (degrees)	34	31	36	37	35	41	29	20	18
	(12-55)	(15-50)	(14-56)	(22-55)	(25-50)	(20-60)	(4-44)	(10-30)	(18-18)
Conifer Cover (%)	12.6	6.4	16.7	5.6	12.0	10.2	8.6	9.4	0.0
	(4-63)	(3-14)	(8-38)	(3-15)	(2-37)	(2-40)	(3-30)	(3-15)	(0-0)
Hardwood Cover (%)	9.9	5.4	23.3	8.2	12.2	11.0	8.4	8.6	60.0
	(1-25)	(1-12)	(12-46)	(3-18)	(0.2-45)	(2-30)	(0.2-16)	(3-12)	(60-60)
Regen. Cover (%)	3.1	1.7	8.1	2.7	5.5	2.0	4.6	5.2	5.0
	(0.2-10)	(0.2-5)	(0.2-20)	(0.2-7)	(0-20)	(0.2-7)	(0-17)	(1-7)	(5-5)
Shrub Cover (%)	1.4	3.3	13.2	2.8	17.1	11.2	5.7	3.4	0.2
	(0-17)	(0.2-7)	(0.2-30)	(0-10)	(2-62)	(3-22)	(0.2-28)	(0.2-8)	(0.2-0.2)
Herb Cover (%)	7.4	4.0	4.6	22.2	14.8	6.0	4.2	27.4	15.0
	(0.2-26)	(0.2-14)	(0-22)	(4-51)	(1-40)	(1-15)	(0.2-20)	(7-40)	(15-15)

Forest and Woodland

Scientific Name	*Quercus agrifolia – Umbellularia californica*	*Quercus chrysolepis – Pseudotsuga macrocarpa*	*Quercus chrysolepis – Pseudotsuga macrocarpa – Acer macrophyllum*	*Quercus chrysolepis – Quercus wislizeni*	*Quercus chrysolepis (tree)*	*Quercus chrysolepis / Ceanothus integerrimus*	*Quercus wislizeni – Quercus chrysolepis*	*Quercus wislizeni – Quercus chrysolepis – Pinus coulteri*
SampleSize	1	37	7	1	4	6	1	1
%Fire	0	70	43	100	25	100	100	0
Avg. Time Since Fire (years)	N/A	20	43	25	25	9	N/A	N/A
Elevation (m)	949	1368	1478	3202	1561	1466	1366	1355
	(949-949)	(527-2045)	(639-3982)	(3202-3202)	(1299-1928)	(1031-1641)	(1366-1366)	(1355-1355)
Slope (degrees)	18	35	30	39	33	34	45	32
	(18-18)	(5-65)	(4-70)	(39-39)	(20-40)	(22-48)	(45-45)	(32-32)
Conifer Cover (%)	1.0	3.7	5.6	0.0	0.2	5.3	0.2	13.0
	(1-1)	(1-14)	(1-15)	(0-0)	(0-0.2)	(3-11)	(0.2-0.2)	(13-13)
Hardwood Cover (%)	80.0	21.7	26.2	58.0	50.0	21.0	55.0	56.0
	(80-80)	(1-70)	(8-65)	(58-58)	(15-80)	(10-30)	(55-55)	(56-56)
Regen. Cover (%)		3.7	2.6		5.6	8.0		
	(-)	(0-12)	(0-6)	(-)	(0.2-20)	(3-15)	(-)	(-)
Shrub Cover (%)	8.0	5.4	5.5	40.0	1.9	7.7	35.0	45.0
	(8-8)	(0-32)	(5-6)	(40-40)	(0.2-7)	(3-12)	(35-35)	(45-45)
Herb Cover (%)	3.0	8.7	9.3	4.0	2.6	10.5	0.0	3.0
	(3-3)	(0-85)	(1-25)	(4-4)	(0.2-5)	(2-35)	(0-0)	(3-3)

Shrubland

Scientific Name	*Adenostoma fasciculatum – Eriogonum fasciculatum*	*Arctostaphylos glauca*	*Arctostaphylos parryana*	*Ceanothus integerrimus*	*Ceanothus leucodermis*	*Ceanothus oliganthus*	*Cercocarpus montanus – Eriogonum fasciculatum*	*Quercus chrysolepis – Ceanothus integerrimus*	*Quercus chrysolepis (shrub)*
SampleSize	1	1	7	20	1	1	3	30	6
%Fire	100	100	43	100	100	100	100	100	100
Avg. Time Since Fire (years)	6	Unknown	37	6	13	13	11	7	7
Elevation (m)	1495	1843	2147	1488	1570	1355	1242	1480	1373
	(1495-1495)	(1843-1843)	(1994-2247)	(985-1750)	(1570-1570)	(1355-1355)	(869-1525)	(1066-1908)	(881-1841)
Slope (degrees)	18	35	29	27	35	38	41	32	36
	(18-18)	(35-35)	(12-45)	(2-41)	(35-35)	(38-38)	(34-45)	(8-42)	(15-55)
Conifer Cover (%)	0.0	0.2	2.7	1.2	0.0	3.0	0.7	1.4	1.5
	(0-0)	(0.2-0.2)	(1-7)	(0-8)	(0-0)	(3-3)	(0-1)	(0-8)	(0-3)
Hardwood Cover (%)	0.0	3.0	1.8	1.0	0.2	2.0	2.3	1.0	1.0
	(0-0)	(3-3)	(0.02-4)	(0-7)	(0.2-0.2)	(2-2)	(1-5)	(0-7)	(0-2)
Regen. Cover (%)	0.0	2.0	2.0	7.1	12.0	3.0	1.0	13.0	13.2
	(0-0)	(2-2)	(1-4)	(0.2-20)	(12-12)	(3-3)	(1-1)	(3-55)	(7-35)
Shrub Cover (%)	45.0	27.0	29.9	36.0	18.0	24.0	22.0	13.1	7.0
	(45-45)	(27-27)	(15-45)	(10-85)	(18-18)	(24-24)	(20-25)	(0.2-60)	(0.2-14)
Herb Cover (%)	0.2	1.0	5.1	9.8	0.2	17.0	11.7	15.1	9.0
	(0.2-0.2)	(1-1)	(1-15)	(0.2-35)	(0.2-0.2)	(17-17)	(5-20)	(0.2-40)	(3-17)

Shrubland, Herbaceous, and Sparse

Scientific Name	*Quercus wislizeni – Quercus chrysolepis (shrub)*	*Quercus wislizeni (shrub)*	*Bromus tectorum*	*Pseudotsuga macrocarpa (sparse)*
SampleSize	1	3	4	5
%Fire	100	100	100	80
Avg. Time Since Fire (years)	8	8	6	10.5
Elevation (m)	3199	1582	1638	1388
	(3199-3199)	(1544-1644)	(1407-1913)	(1045-1737)
Slope (degrees)	49	31	29	41
	(49-49)	(28-36)	(16-38)	(35-48)
Conifer Cover (%)	0.2	0.1	1.8	2.7
	(0.2-0.2)	(0-0.2)	(0.2-3)	(1.5-5)
Hardwood Cover (%)	9.0	0.0	1.4	2.3
	(9-9)	(0-0)	(0-5)	(1-3)
Regen. Cover (%)		16.7	1.3	1.8
	(-)	(0-50)	(0.2-3)	(0-4)
Shrub Cover (%)	67.0	28.3	2.3	2.3
	(67-67)	(2-50)	(0.2-5)	(0.2-5)
Herb Cover (%)	4.0	1.3	34.3	4.4
	(4-4)	(1-2)	(30-40)	(0.2-15)

CALIFORNIA NATIVE PLANT SOCIETY / DEPARTMENT OF FISH AND GAME
PROTOCOL FOR COMBINED VEGETATION RAPID ASSESSMENT
AND RELEVÉ SAMPLING FIELD FORM
(September 15, 2015)

Introduction

This protocol describes the methodology for both the relevé and rapid assessment vegetation sampling techniques as recorded in the combined relevé and rapid assessment field survey form of the same date as this protocol. The same environmental data are collected for both techniques. However, the relevé sample is plot-based, with each species in the plot and its cover being recorded. The rapid assessment sample is based not on a plot but on the entire stand, with 12-20 of the dominant or characteristic species and their cover values recorded. For more background on the relevé and rapid assessment sampling methods, see the relevé and rapid assessment protocols at www.cnps.org.

Selecting stands to sample:

To start either the relevé or rapid assessment method, a stand of vegetation needs to be defined.
A stand is the basic physical unit of vegetation in a landscape. It has no set size. Some vegetation stands are very small, such as alpine meadow or tundra types, and some may be several square kilometers in size, such as desert or forest types. A stand is defined by two main unifying characteristics:

1) It has compositional integrity. Throughout the site, the combination of species is similar. The stand is differentiated from adjacent stands by a discernable boundary that may be abrupt or indistinct.
2) It has structural integrity. It has a similar history or environmental setting that affords relatively similar horizontal and vertical spacing of plant species. For example, a hillside forest originally dominated by the same species that burned on the upper part of the slopes, but not the lower, would be divided into two stands. Likewise, sparse woodland occupying a slope with very shallow rocky soils would be considered a different stand from an adjacent slope with deeper, moister soil and a denser woodland or forest of the same species.

The structural and compositional features of a stand are often combined into a term called homogeneity. For an area of vegetated ground to meet the requirements of a stand, it must be homogeneous (uniform in structure and composition throughout).

Stands to be sampled may be selected by evaluation prior to a site visit (*e.g.,* delineated from aerial photos or satellite images), or they may be selected on site during reconnaissance (to determine extent and boundaries, location of other similar stands, etc.).

Depending on the project goals, you may want to select just one or a few representative stands of each homogeneous vegetation type for sampling (*e.g.,* for developing a classification for a vegetation mapping project), or you may want to sample all of them (*e.g.,* to define a rare vegetation type and/or compare site quality between the few remaining stands).

For the rapid assessment method, you will collect data based on the entire stand.

Selecting a plot to sample within in a stand (for relevés only):
Because many stands are large, it may be difficult to summarize the species composition, cover, and structure of an entire stand. We are also usually trying to capture the most information as efficiently as possible. Thus, we are typically forced to select a representative portion to sample.

When sampling a vegetation stand, the main point to remember is to select a sample that, in as many ways possible, is representative of that stand. This means that you are not randomly selecting a plot; on the contrary, you are actively using your own best judgment to find a representative example of the stand.

Selecting a plot requires that you see enough of the stand you are sampling to feel comfortable in choosing a representative plot location. Take a brief walk through the stand and look for variations in species composition and in stand structure. In many cases in hilly or mountainous terrain look for a vantage point from which you can get a representative view of the whole stand. Variations in vegetation that are repeated throughout the stand should be included in your plot. Once you assess the variation within the stand, attempt to find an area that captures the stand's common species composition and structural condition to sample.

Plot Size
All relevés of the same type of vegetation to be analyzed in a study need to be the same size. Plot shape and size are somewhat dependent on the type of vegetation under study. Therefore, general guidelines for plot sizes of tree-, shrub-, and herbaceous communities have been established. Sufficient work has been done in temperate vegetation to be confident the following conventions will capture species richness:

Herbaceous communities: 100 sq. m plot
Special herbaceous communities, such as vernal pools, fens: 10 sq m plot
Shrublands and Riparian forest/woodlands: 400 sq. m plot
Open desert and other shrublands with widely dispersed but regularly occurring woody species: 1000 sq. m plot
Upland Forest and woodland communities: 1000 sq. m plot

Plot Shape
A relevé has no fixed shape, though plot shape should reflect the character of the stand. If the stand is about the same size as a relevé, the plot boundaries may be similar to that of the entire stand. If we are sampling streamside riparian or other linear communities, our plot dimensions should not go beyond the community's natural ecological boundaries. Thus, a relatively long, narrow plot capturing the vegetation within the stand, but not

outside it would be appropriate. Species present along the edges of the plot that are clearly part of the adjacent stand should be excluded.

If we are sampling broad homogeneous stands, we would most likely choose a shape such as a circle (which has the advantage of the edges being equidistant to the center point) or a square (which can be quickly laid out using perpendicular tapes).

Definitions of fields in the protocol

I. LOCATIONAL/ENVIRONMENTAL DESCRIPTION

Polygon/Stand #: Number assigned either in the field or in the office prior to sampling. It is usually denoted with a four-letter abbreviation of the sampling location and then a four-number sequential number of that locale (*e.g.* PSMA0001 for Bigcone Douglas-fir sample #1). The maximum number of letters/numbers is eight.

Date: Date of the sampling.

Name of recorder: The full name of the recorder should be provided for the first field form for the day. On successive forms, initials can be recorded.

Other Surveyors: The full names of each person assisting should be provided for the first field form for the day. On successive forms, initials of each person assisting can be recorded.

GPS name: The name/number assigned to each GPS unit. This can be the serial number if another number is not assigned.

Datum: (NAD 83) The standard GPS datum used is NAD 83. If you are using a different datum, note it here.

Bearing°, left axis at SW point of Long or Short side: Fill this in for relevés only. For square or rectangular plots: from the SW corner (= the GPS point location), looking towards the plot, record the bearing of the axis to your left. If the plot is a rectangle, indicate whether the left side of the plot is the long or short side of the rectangle by circling "long" or "short" side (no need to circle anything for circular or square plots). If there are no stand constraints, you would choose a circular or square plot and straight-sided plots should be set up with boundaries running in the cardinal directions. If you choose a rectangular plot that is not constrained by the stand dimensions, the short side should run from east to west, while the long side should run from north to south.

Coordinates: Easting (UTME) and northing (UTMN) location coordinates using the Universal Transverse Mercator (UTM) grid. If using the ArcGIS Collector App, record the Latitude and Longitude in the space provided. Record in writing the information from a GPS unit. These coordinates are always the base point of the survey. Soil samples and photos are taken from this point, and exposure, steepness, topography, etc. are measured

here. If the GPS is not within the stand (ie: the point is projected), these are the UTMs of the base point.

For relevé plots, take the waypoint in the southwest corner of the plot whenever possible or in the center of a circular plot.

UTM zone: Universal Transverse Mercator zone. Zone 10 is for California west of the 120th longitude, zone 11 is for California east of 120th longitude, which is the same as the straight portion of California's eastern boundary.

Error: ± The accuracy of the GPS location, when taking the UTM field reading. Please record the error units by circling feet (ft), meters (m), or positional dilution of precision (pdop). If your GPS does not determine error, insert N/A in this field.

Is GPS within stand? Yes / No Circle"Yes" to denote that the GPS waypoint was taken directly within or at the edge of the stand being assessed for a rapid assessment, or circle "No" if the waypoint was taken at a distance from the stand (such as with a binocular view of the stand). If the point is taken at the edge of the stand, note the direction to the stand.

If No, cite from GPS to stand: distance (in meters), bearing (in degrees), inclination (in degrees): From the base GPS point, measure the distance to the projected point using a range finder. Record the compass bearing from the base point to the projected point; record the inclination if the base and projected points are not at the same elevation. **and record projected UTMs:** These are the coordinates of the projected point, or the point being surveyed. They are generated in the field if the GPS units have the ability to calculate projected points. If the GPS unit does not have this capability, make a note to that effect and leave these fields blank.

Elevation: Recorded from the GPS unit or USGS topographic map. Please circle feet (ft) or meters (m). If using Ipad Collector App, leave this field blank.

Camera Name/Photograph #s: Write the name of the camera or the initials of the camera owner, JPG/frame number, and direction of photos. *Take four photos in the main cardinal directions (N, E, S, W) clockwise from the north, from the GPS location.* If additional photos are taken in other directions, please note this information on the form. If this is a distance survey to a projected point, take the four cardinal photos at the base point and at least one photo of the stand.

Stand Size: Estimate the size of the entire stand in which the sample is taken. As a measure, one acre is about 4000 square meters (approximately 64 x 64 m), or 208 feet by 208 feet. One acre is similar in size to a football field.

Plot Size: If this is a relevé, circle the size of the plot.

Plot Shape: Record the length and width of the plot and circle measurement units (i.e., ft or m).

RA Radius: Enter radius of visually estimated sample area for rapid assessments (should be a 20 meter radius minimum).

Exposure: (Enter actual º and circle general category): With your back to the general uphill direction of the slope (i.e., by facing downhill of the slope), read degrees of the compass for the aspect or the direction you are standing, using degrees from north, adjusted for declination. Average the reading over the entire stand, even if you are sampling a relevé plot, since your plot is representative of the stand. If estimating the exposure, write "N/A" for the actual degrees, and circle the general category chosen. "Variable" may be selected if the same, homogenous stand of vegetation occurs across a varied range of slope exposures. Select "all" if stand is on top of a knoll that slopes in all directions or if the same, homogenous stand of vegetation occurs across all ranges of slope.

Steepness: (Enter actual º and circle general category): Read degree slope from a compass or clinometer. If estimating, write "N/A" for the actual degrees, and circle the general category chosen. Make sure to average the reading across the entire stand even if you are sampling in a relevé plot.

Topography: First assess the broad (**Macro**) topographic feature or general position of the stand in the surrounding watershed, that is, the stand is at the top, upper (1/3 of slope), middle (1/3 of slope), lower (1/3 of slope), or bottom. **Circle *all* of the positions that apply for macrotopography.**
Then assess the local (**Micro**) topographic features or the lay of the area (*e.g.,* surface is flat or concave). **Circle only *one* of the microtopographic descriptors**.

Geology: Geological parent material of site. If exact type is unknown, use a more general category (*e.g.,* igneous, metamorphic, sedimentary). *See code list for types.*

Soil Texture: Record soil texture that is characteristic of the site (*e.g.,* coarse loamy sand, sandy clay loam). *See soil texture key and code list for types.*

Upland or Wetland/Riparian (circle one): Indicate if the stand is in an upland or a wetland. There are only two options. Wetland and riparian are one category. Note that a site need not be officially delineated as a wetland to qualify as such in this context (*e.g.,* seasonally wet meadow).

% Surface cover (abiotic substrates). It is helpful to imagine "mowing off" all of the live vegetation at the base of the plants and removing it – you will be estimating what is left covering the surface. **The total should sum to 100%.** Note that non-vascular cover (lichens, mosses, cryptobiotic crusts) is not estimated in this section.

% Water: Estimate the percent surface cover of running or standing water, ignoring the substrate below the water.

% BA Stems: Percent surface cover of the plant basal area, *i.e.*, the basal area of stems at the ground surface. Note that for most vegetation types BA is 1-3% cover.

% Litter: Percent surface cover of litter, duff, or wood on the ground.

% Bedrock: Percent surface cover of bedrock.
% Boulders: Percent surface cover of rocks > 60 cm in diameter.
% Stone: Percent surface cover of rocks 25-60 cm in diameter.
% Cobble: Percent surface cover of rocks 7.5 to 25 cm in diameter.
% Gravel: Percent surface cover of rocks 2 mm to 7.5 cm in diameter.
% Fines: Percent surface cover of bare ground and fine sediment (e.g. dirt) < 2 mm in diameter.

% Current year bioturbation: Estimate the percent of the sample or stand exhibiting soil disturbance by fossorial organisms (any organism that lives underground). Do not include disturbance by ungulates. Note that this is a separate estimation from surface cover.

Past bioturbation present? Circle Yes if there is evidence of bioturbation from previous years.

% Hoof punch: Note the percent of the sample or stand surface that has been punched down by hooves (cattle or native grazers) in wet soil.

Fire Evidence: Circle Yes if there is visible evidence of fire, and note the type of evidence in the "Site history, stand age and comments section," for example, "charred dead stems of *Quercus berberidifolia* extending 2 feet above resprouting shrubs." If you are certain of the year of the fire, put this in the Site history section.

Site history, stand age, and comments: Briefly describe the stand age/seral stage, disturbance history, nature and extent of land use, and other site environmental and vegetation factors. Examples of disturbance history: fire, landslides, avalanching, drought, flood, animal burrowing, or pest outbreak. Also, try to estimate year or frequency of disturbance. Examples of land use: grazing, timber harvest, or mining. Examples of other site factors: exposed rocks, soil with fine-textured sediments, high litter/duff build-up, multi-storied vegetation structure, or other stand dynamics.

Disturbance code / Intensity (L,M,H): List codes for potential or existing impacts on the stability of the plant community. Characterize each impact as **L** (=Light), **M** (=Moderate), or **H** (=Heavy). For invasive exotics, divide the total exotic cover (e.g. 25% Bromus diandrus + 8% Bromus madritensis + 5% Centaurea melitensis = 38% total exotics) by the total % cover of all the layers when added up (e.g. 15% tree + 25% shrub + 40% herbs = 80% total) and multiply by 100 to get the % relative cover of exotics (e.g. 38% total exotics/80% total cover = 48% relative exotic cover). L = 0-33% *relative* cover of exotics; M =34-66% relative cover, and H = > 66% relative cover. *See code list for impacts.*

II. HABITAT AND VEGETATION DESCRIPTION

California Wildlife-Habitat Relationships (CWHR)
For CWHR, identify the size/height class of the stand using the following tree, shrub, and/or herbaceous categories. These categories are based on functional life forms.

Tree DBH: Circle one of the tree size classes provided when the tree canopy closure exceeds 10 percent of the total cover, or if young tree density indicates imminent tree dominance. Size class is based on the average diameter at breast height (dbh) of each trunk (standard breast height is 4.5ft or 137cm). When marking the main size class, make sure to estimate the mean diameter of all trees over the entire stand, and weight the mean if there are some larger tree dbh's. The "**T6 multi-layered**" dbh size class contains a multi-layered tree canopy (with a size class T3 and/or T4 layer growing under a T5 layer and a distinct height separation between the classes) exceeding 60% total cover. Stands in the T6 class need also to contain at least 10% cover of size class 5 (>24" dbh) trees growing over a distinct layer with at least 10% combined cover of trees in size classes 3 or 4 (>11-24" dbh).

Shrub: Circle one of the shrub size classes provided when shrub canopy closure exceeds 10 percent (except in desert types, where MCV rules allow lower shrub cover) by recording which class is predominant in the survey. Shrub size class is based on the average amount of crown decadence (dead standing vegetation on live shrubs when looking across the crowns of the shrubs).

Herb: Circle one of the herb height classes when herbaceous cover exceeds 2 percent by recording the predominant class in the survey. Note: *This height class is based on the average plant height at maturity, not necessarily at the time of observation.*

Overall Cover of Vegetation

Provide an estimate of cover for the following categories below (based on functional life forms). Record a specific number for the total aerial cover or "bird's-eye view" looking from above for each category, estimating cover for the living plants only. Litter/duff should not be included in these estimates. The porosity of the vegetation should be taken into consideration when estimating percent cover (how much of the sky can you see when you are standing under the canopy of a tree, or how much light passes through the canopy of the shrub layer?).

To come up with a specific number estimate for percent cover, first use generalized cover classes as reference aids such as the CWHR cover classes (<2%, 2-9%, 10-24%, 25-39%, 40-59%, 60-100%) or the modified Braun-Blanquet cover-abundance scale (<1%, 1-5%, >5-15%, >15-25%, >25-50%, >50-75%, >75%). While keeping these intervals in mind, you can then refine your estimate to a specific percentage for each category below.

% NonVasc cover: The total cover of all lichens, bryophytes (mosses, liverworts, hornworts), and cryptogamic crust on substrate surfaces including downed logs, rocks and soil, but not on standing or inclined trees or vertical rock surfaces.

% Vasc Veg cover: The total cover of all vascular vegetation taking into consideration the porosity, or the holes, in the vegetation, and disregarding overlap[1] of the various tree, shrub, and/or herbaceous layers and species.

[1] Porosity reduces the total cover of the canopy. Overlapping strata should not be included in the total cover percent; for instance, if a shrub is growing under a tree, only the cover of the tree will be added into the total;

% Cover by Layer

% Conifer Tree /Hardwood Tree: The total foliar cover (considering porosity) of all live tree species, disregarding overlap[1] of individual trees. Estimate conifer and hardwood covers separately.

Please note: These cover values should not include the coverage of regenerating tree species (i.e., tree seedlings and saplings).

% Regenerating Tree: The total foliar cover of seedlings and saplings, disregarding overlap[1] of individual recruits. See seedling and sapling definitions below.

%Shrub: The total foliar cover (considering porosity) of all live shrub species disregarding overlap[1] of individual shrubs.

%Herbaceous: The total cover (considering porosity) of all herbaceous species, disregarding overlap[1] of individual herbs.

Height Class by Layer

Modal height for conifer tree /hardwood tree, shrub, and herbaceous categories: Record an average height value per each category by estimating the mean height for each group. Please use the following height intervals to record a height class: 01 = <1/2 m, 02 = 1/2-1 m, 03 = 1-2 m, 04 = 2-5 m, 05 = 5-10 m, 06 = 10-15 m, 07 = 15-20 m, 08 = 20-35 m, 09 = 35-50 m, 10 => 50 m. Note: *For the herbaceous layer height, this height class is based on the average plant height at the time of observation, as opposed to how this is recorded in the CWHR section (at maturity).*

Species List and Coverage

For rapid assessments, list the 10-20 species that are dominant or that are characteristically consistent throughout the stand. These species may or may not be abundant, but they should be constant representatives in the survey. When different layers of vegetation occur in the stand, make sure to list species from each stratum. As a general guide, make sure to list at least 1-2 of the most abundant species per stratum.

For relevés, list all species present in the plot, using the second species list page if necessary.

For both sample types, provide the stratum:

T = Tree. A woody perennial plant that has a single trunk.

S = Shrub. A perennial, woody plant, that is multi-branched and doesn't die back to the ground every year.

H = Herb. An annual or perennial that dies down to ground level every year.

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the cover of the shrub will be disregarded, except for the amount by which it fills in the porosity of the tree canopy.

E = SEedling. A tree species clearly of a very young age that is < 1” dbh or has not reached breast height. Applies only to trees propagating from seed; resprouts are not recorded here even if they meet the size requirements.
A = SApling. 1" - <6" dbh and young in age, OR small trees that are <1” dbh, are clearly of appreciable age, and are kept short by repeated browsing, burning, or other disturbance. Includes trees that are re-sprouting from roots or stumps following fire, logging or other disturbance. These re-sprouts may exhibit a shrubby form, with multiple small trunks, but are species that are generally considered trees. If a majority of the trunks are >6” dbh, then the re-sprouts would be recorded under the “Tree” stratum.
N = Non-vascular. Includes moss, lichen, liverworts, hornworts, cryptogammic crust, and algae.

Be consistent and don’t break up a single species into two separate strata. The only time it would be appropriate to do so is when one or more tree species are regenerating, in which case the Seedling and/or Sapling strata should be recorded for that species. These may be noted on the same line, e.g.:

Strata	Species	%Cover	C
T/E/A	Quercus douglasii	40/<1/<1	

If a species collection is made, it should be indicated in the collection column with a “C” (for collected). If the species is later keyed out, cross out the species name or description and write the keyed species name in pen on the data sheet. Do not erase what was written in the field, because this information can be used if specimens get mixed up later. If the specimen is then thrown out, the “C” in the collection column should crossed out. If the specimen is kept but is still not confidently identified, add a “U” to the “C” in the collection column (CU = collected and unconfirmed). In this case the unconfirmed species epithet should be put in parentheses [e.g *Hordeum (murinum)*]. If the specimen is kept and is confidently identified, add a “C” to the existing “C” in the collection column (CC = Collected and confirmed).

Use Jepson Manual nomenclature. Write out the genus and species of the plant. Do not abbreviate. When uncertain of an identification (which you intend to confirm later) use parentheses to indicate what part of the determination needs to be confirmed. For example, you could write out *Brassica* (*nigra*) if you are sure it is a *Brassica* but you need further clarification on the specific epithet.

Provide the % absolute aerial cover for each species listed. When estimating, it is often helpful to think of coverage in terms of the following cover intervals at first:

<1%, 1-5%, >5-15%, >15-25%, >25-50%, >50-75%, >75%.

Keeping these classes in mind, then refine your estimate to a specific percentage. All species percent covers may total over 100% because of overlap.

Include the percent cover of snags (standing dead) of trees and shrubs. Note their species, if known, in the “Stand history, stand age and comments” section.

For rapid assessments, make sure that the major non-native species occurring in the stand also are listed in the space provided in the species list with their strata and % cover. For relevés, all non-native species should be included in the species list.

Also for relevés, you can record the <1% cover in two categories: r = trace (i.e., rare in plot, or solitary individuals) and + = <1% (few individuals at < 1% cover, but common in the plot).

Unusual species: List species that are locally or regionally rare, endangered, or atypical (*e.g.,* range extension or range limit) within the stand. This field will be useful to the Program for obtaining data on regionally or locally significant populations of plants.

INTERPRETATION OF STAND

Field-assessed vegetation alliance name: Name of alliance or habitat following the most recent CNPS classification system or the Manual of California Vegetation (Sawyer J.O., Keeler-Wolf T., and Evens, J. 2009). Please use scientific nomenclature, *e.g., Quercus agrifolia* forest. An alliance is based on the dominant or diagnostic species of the stand, and is usually of the uppermost and/or dominant height stratum. A dominant species covers the greatest area. A diagnostic species is consistently found in some vegetation types but not others.

Please note: The field-assessed alliance name may not exist in the present classification, in which case you can provide a new alliance name in this field. If this is the case, also make sure to state that it is not in the MCV under the explanation for "Confidence in alliance identification."

Field-assessed association name (optional): Name of the species in the alliance and additional dominant/diagnostic species from any strata, as according to CNPS classification. In following naming conventions, species in differing strata are separated with a slash, and species in the uppermost stratum are listed first (*e.g., Quercus douglasii/Toxicodendron diversilobum*). Species in the same stratum are separated with a dash (*e.g., Quercus lobata-Quercus douglasii)*.

Please note: The field-assessed association name may not exist in the present classification, in which you can provide a new association name in this field.

Adjacent Alliances/direction: Identify other vegetation types that are directly adjacent to the stand being assessed by noting the dominant species (or known type). Also note the distance away in meters from the GPS waypoint and the direction in degrees aspect that the adjacent alliance is found
(e.g., *Amsinckia tessellata* / 50m, 360° N *Eriogonum fasciculatum* /100m, 110°).

Confidence in Identification: (L, M, H) With respect to the "field-assessed alliance name", note whether you have L (=Low), M (=Moderate), or H (=High) confidence in the interpretation of this alliance name.

Explain: Please elaborate if your "Confidence in Identification" is low or moderate. Low confidence can occur from such things as a poor view of the stand, an unusual mix of

species that does not meet the criteria of any described alliance, or a low confidence in your ability to identify species that are significant members of the stand.

Phenology: Indicate early (E), peak (P) or late (L) phenology for each of the strata.

Other identification problems or mapping issues: Discuss any further problems with the identification of the assessment or issues that may be of interest to mappers. Note if this sample represents a type that is likely too small to map. If it does, how much of the likely mapping unit would be comprised of this type. For example: “this sample represents the top of kangaroo rat precincts in this general area, which are surrounded by vegetation represented by CARR000x; this type makes up 10% of the mapping unit.”

Note: Field forms are generally filled out in pencil, so that changes may be made easily while working in the plot or stand. Once out of the stand, however, entries on the field form should not be erased, but should be crossed out and corrected in a different-colored ink.

Additions for Bigcone Douglas-fir:
Regeneration:
Count the number of seedlings and saplings in the regeneration plot.

Use 4.37m radius regen plot in very dense seedling/sapling regenerating areas, otherwise, use 11.35 m radius regen plot in areas with very few seedling/sapling regeneration.

Number of seedlings (“a tree species clearly of a very young age that is < 1” dbh.”) per unit area.

Number of saplings (“1" - <6" dbh and young in age, OR small trees that are < 1”diameter at breast height, are clearly of appreciable age, and kept short by repeated browsing, burning, or other disturbance”) per unit area.

You may use the tally space at the bottom of the page to tally the seedlings and saplings. Record the final number in the blanks provided.

Fecundity of PSMA: Should equal 100%.
Record the percentage of PSMA trees in stand in the following categories:

- no cones
- 1 to 10 cones
- 11 to 100 cones
- greater than 100 cones

You may use the tally space at the bottom of the form to tally number of trees in each category. Record the percentage of all PSMA trees in each category by dividing the number of trees in a category by the total number of trees and multiplying by 100.

% PSMA mortality:
These are *relative* percentages for mortality of trees from Fir Borer and other causes (totals 100%). This may be determined by ocular estimate.

Overall site/occurrence quality/viability (site + population) (CNDDB):
Is the likely persistence of the occurrence into the future Excellent, Good, Fair, or Poor? This is an assessment of the overall viability of this occurrence. Both the quality & condition of the site and of the occurrence must be considered when scoring. Take into account population size, demography, viability over time, site condition, and any disturbances. And also see additional characteristics at:
http://www.natureserve.org/explorer/eorankguide.htm

Fuels model:
Select a fuels model that best fits the stand and write its number in the blank.

Code	Detailed Description – Andersons 13 fuel models
1	Contains fine, very porous, and continuous herbaceous fuels that have cured or are nearly cured. Generally less than one-third of the area contains shrubs or timber. Grasslands and savanna are represented along with stubble, grass-tundra, and grass-shrub combinations. Annual and perennial grasses are included in this fuel model
2	Herbaceous material with litter and dead-down stem wood from the open shrub or timber overstory Open shrub lands and pine stands or scrub oak stands that cover one-third to two-thirds of the area Stand may include clumps and may include pinyon-juniper
3	Stands are tall, averaging about three feet, but considerable variation may occur. Approximately one-third or more of the stand is considered dead and cured. May include cultivated grains that have not been harvested, tall prairie, and marshland grasses
4	Stands of mature shrubs, 6 feet or more tall such as California mixed chaparral, the high pocosin along the east coast, the pine barrens of New Jersey, or the closed jack pine stands of the north-central states. Besides flammable foliage, stand may contain dead woody material. May contain a deep litter layer.
5	Shrubs are young with little dead material, and the foliage contains little volatile material. Usually shrubs are short and almost totally cover the area. Young, green stands with no dead wood qualify: laurel, vine maple, alder, or even chaparral, manzanita, or chamise.
6	The shrubs are older, but not as tall as model 4, nor do they contain as much fuel as model 4. This model covers a broad range of shrub conditions: intermediate stands of chamise, chaparral, oak brush, low pocosin, Alaskan spruce taiga, and shrub tundra. May include hardwood slash that has cured. Pinyon-juniper shrub lands may be represented.
7	Stands of shrubs are generally between 2 and 6 feet high. Palmetto-galliberry understory, with a pine overstory, are typical. Low pocosin may be represented. Black spruce shrub combinations in Alaska may also be represented.
8	Contains closed canopy stands of short needle conifers or hardwoods that have leafed out. The compact litter layer is mainly needles, leaves, and occasionally twigs because little undergrowth is present. Representative conifer types are white pine, lodgepole pine, spruce, fir, and larch.
9	Both long-needle conifer stands and hardwood stands, especially the oak-hickory types, are typical. Closed stands of long-needled pine like ponderosa, Jeffrey, red pines, or southern pine plantations are grouped in this model. May contain concentrations of dead-down woody material.
10	Dead-down fuels include quantities of 3-inch or larger limb wood resulting from over maturity or natural events that create a large load of dead material on the forest floor. Any forest type may be considered if heavy down material is present; examples are insect- or disease-ridden stands, wind thrown stands, overmature situations with deadfall, and aged light thinning or partial cut slash.
11	Contains slash and herbaceous material intermixed with slash. Light partial cuts or thinning operations in mixed conifer stands, hardwood stands, and southern pine harvests are considered. Clearcuts generally produce more slash than represented here. The less than 3-inch material load is less than 12 tons per acre. The greater than 3 inch is represented by not more than 10 pieces, 4 inches in diameter, along a 50 foot transect
12	The visual impression is dominated by slash and much of it is less than 3 inches in diameter. The fuels are well distributed. Heavily thinned conifer stands; clearcuts, and medium or heavy partial cuts are represented. The material larger than 3 inches is represented by encountering 11 pieces, 6 inches in diameter along a 50 foot transect
13	There is a continuous layer of slash. Large quantities of material larger than 3 inches are present. Clearcuts and heavy partial cuts in mature and over mature stands are depicted where the slash load is dominated by the greater than 3 inch diameter material. Fuels less than 3 inches are generally only 10 percent of the total load. May include situations where the slash still has “red” needles attached.

Basal Area in Square Feet:
Basal area will be recorded by species in the basal area and crown height table. Live and dead individuals of a species should be recorded separately.

Select one basal area factor (in ft^2/ac) that should give you between 8-12 hits for all species cumulatively. The basal area factor should be the same for all species.

Record the number of hits and the Basal Area Factor in the respective columns.

The following is from: Hovind, H. J., & Rieck, C. E. (1970). *Basal area and point-sampling: Interpretation and application*. Madison, Wis: Dept. of Natural Resources.

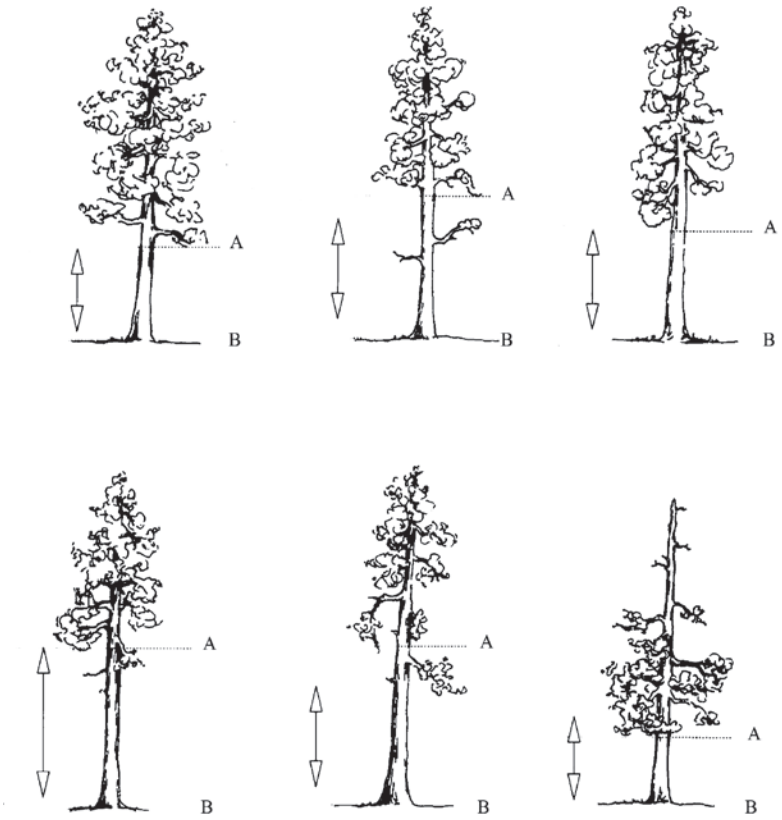
Begin with the first tree to the right of true north. “With the eye as the point center, the cruiser counts all trees whose diameters at breast height appear larger than the crossarm. Where the trees appear the same size as the crossarm one can count every other tree… With trees that lean to the right or left of the line of sight, turn the angle-gauge until the crossarm is at right angles to the stem. Trees that lean toward or away from the observer can generally be handled like normal trees. Trees that are forked above breast height should be counted as one tree for basal area. Trees forked below breast height should be counted as two trees. Be sure to maintain the eye as the point center when making the tree count…”

“One must be certain of tallying all trees and especially those larger trees that may be hidden at some distance from the center. Since the cruiser counts trees from a fixed spot, he must make sure not to count dead ones or miss any that may be hidden by other trees. Care must be exercised to maintain the same distance from a hidden tree to point center when necessary to move off point center to view the hidden tree. Where only merchantable trees are to be tallied, one can select a small sapling as a pivot point to be certain of maintaining the point center. However, where the total basal area is to be tallied, selecting a small sapling as plot center should be avoided as this tree will automatically give 10 square feet (BAF 10) whereas under ordinary circumstances few trees this size may actually be counted.”

“In hilly terrain allowances must be made for slopes that exceed 15 percent (Table 6). Although slope correction tables are available, actually a separate correction factor would have to be applied to almost every tree on the "plot”. The only cases where constant slope correction factors for all trees can be applied would be at the bottom of a perfect bowl or the top of a perfect knob (cone). Therefore, in hilly country the Spiegel-Relaskop would appear to be the best instrument to use since it automatically corrects for slope.”

Average Crown Base Height Measure Crown Base Height of all trees that were “hits” in the Basal Area measurement. Record the values in the space next to the tree species name in the Basal Area and Crown Height Table. For standing dead trees, do not record a Crown Base Height measurement.
Crown base height should be measured using laser rangefinder.
The crown base is defined as in the CSE protocol and reproduced below:

“Record crown height, in feet, on the uphill side of the tree, from the ground line to the base of the live crown (the lowest branch whorl with live branches in at least two quadrants exclusive of epicormic branches and whorls not continuous with the main crown).”



“Measure the height from the base of the tree on the uphill side (B) to the base (A) of the live crown. Base of the live crown is the lowest branch whorl with live branches in at least two quadrants exclusive of epicormic branching and of whorls not continuous with the main crown.”

Round the measurements with examples below:

1		0.1 - 1.4 feet. This includes crowns that touch the ground.
23		22.5 - 23.4 feet
151		150.5 - 151.4 feet

Tally Space: This is a scratch place for use when tallying regeneration and cone production. These spaces should not be used to record data.

CNPS and CDFW Combined Vegetation Rapid Assessment Form for PSMA

(Revised September 14, 2015)

For Office Use
Final database #:

Final vegetation type: **Alliance**_____
Association

I. LOCATIONAL/ENVIRONMENTAL DESCRIPTION

Stand ID: | **Date:** | **Name of recorder:**

Other surveyors:

GPS name: _____ **Datum: NAD83 or** _____ For Relevé: **Bearing°,** left axis at SW point_____ of **Long / Short** side

UTME ___ ___ ___ ___ ___ ___ **UTMN** ___ ___ ___ ___ ___ ___ ___ **Zone: 10 / 11** (circle one) **Error: ±_____ ft / m / pdop**

Or LAT ___ ___ .___ ___ ___ ___ ___ ___ **LONG -** ___ ___ ___. ___ ___ ___ ___ ___ ___

GPS within stand? Yes / No If No, cite from GPS to stand: distance (m) _____ bearing ° _____ inclination ° _____
and record projected UTMs: UTME ___ ___ ___ ___ ___ ___ UTMN ___ ___ ___ ___ ___ ___

Elevation: ft / m **Camera Name/Photograph #'s**:

Stand Size (acres): **<1, 1-5, >5 | Plot Size** (m^2)**: 10 / 100 / 400 / 1000 | Plot Shape** ___ **x** ___ ft / m **or RA Radius**____ft / m

Exposure, Actual °: _____ **NE NW SE SW Flat Variable | Steepness, Actual °:** _____ **0° 1-5° 5-25° > 25**

Topography: Macro: top upper mid lower bottom | Micro: convex flat concave undulating

Geology code: _____ **Soil Texture code:** _____ | **Upland** or **Wetland/Riparian** (circle one)

% Surface cover: (Incl. outcrops) (>60cm diam) (25-60cm) (7.5-25cm) (2mm-7.5cm) (Incl sand, mud)

H20: BA Stems: Litter: Bedrock: Boulder: Stone: Cobble: Gravel: Fines: =100%

% Current year bioturbation _____ **Past bioturbation present? Yes / No | % Hoof punch** _____

Fire evidence: Yes / No (circle one) If yes, describe in Site history section, including date of fire, if known.

Site history, stand age, comments:

Disturbance code / Intensity (L,M,H): ____/___ ____/___ ____/___ ____/___ ____/___ **"Other"** _____/___

II. HABITAT AND VEGETATION DESCRIPTION

Tree DBH : T1 (<1" dbh), **T2** (1-6" dbh), **T3** (6-11" dbh), **T4** (11-24" dbh), **T5** (>24" dbh), **T6** multi-layered (T3 or T4 layer under T5, >60% cover)

Shrub: S1 seedling (<3 yr. old), **S2** young (<1% dead), **S3** mature (1-25% dead), **S4** decadent (>25% dead)

Herb: H1 (<12" plant ht.), **H2** (>12" ht.) **% NonVasc cover:____ % Vasc Veg cover:_____**

% Cover: Conifer tree / Hardwood tree: _____/_____ **Regenerating Tree:** _____ **Shrub:** _____ **Herbaceous:** _____

Height Class: Conifer tree / Hardwood tree: _____/_____ **Regenerating Tree:** _____ **Shrub:** _____ **Herbaceous:** _____

Height classes: 01=<1/2m 02=1/2-1m 03=1-2m 04=2-5m 05=5-10m 06=10-15m 07=15-20m 08=20-35m 09=35-50m 10=>50m

Species, Stratum, and % cover. Stratum categories: T=Tree, S = Shrub, H= Herb, E = SEedling, A = SApling, N= Non-vascular.
% cover intervals for reference: <1%, 1-5%, >5-15%, >15-25%, >25-50%, >50-75%, 75%.

Strata	Species	% cover	C	Strata	Species	% cover	C

Unusual species: _____

III. INTERPRETATION OF STAND

Field-assessed vegetation alliance name: _____

Field-assessed association name (optional): _____

Adjacent alliances/direction: _____/_____, _____/_____

Confidence in alliance identification: L M H Explain: _____

Phenology (E,P,L)**: Herb Shrub Tree Other identification or mapping information:**

CNPS and CDFW Combined Vegetation Rapid Assessment Form for PSMA

(Revised September 14, 2015)

PSMA# _____

IV. BIGCONE DOUGLAS-FIR DATA	
Regeneration: _____ PSMA seedlings	_____PSMA saplings **Plot radius: 4.37 m 11.35m**
Fecundity (% of PSMA trees in each category): No cones_____% 1-10 cones_____% 11-100_____% >100 _____% = 100%	
Causes and percent of stand mortality: Fir Borer _____% Other:_____ _____% Other:_____ _____%	
Overall site/occurrence quality/viability (site + population) (CNDDB): ☐ **Excellent** ☐ **Good** ☐ **Poor** ☐ **Fair** Take into account population size, demography, viability over time, site condition, and any disturbances.	
Fuels Model : _____	

V. BASAL AREA AND CROWN BASE HEIGHT

Tree Species	L/D	# of "Hits"	BAF	Crown Base Height of Trees in ft			

TALLY SPACE

0 Cones	1-10 Cones	11-100 Cones	>100 Cones	Seedlings	Saplings

CNPS and CDFW Combined Vegetation Rapid Assessment Form for PSMA

(Revised September 14, 2015)

For Office Use
Final database #:

Final vegetation type: Alliance _____
Association

I. LOCATIONAL/ENVIRONMENTAL DESCRIPTION

Stand ID: PMSA0390 **Date:** 11/19 **Name of recorder:** KAUFFMANN **Other surveyors:**

GPS name: Bross **Datum: NAD83 or** _____ For Relevé: **Bearing°**, left axis at SW point_____ of **Long / Short** side

UTME 5 _____ **UTMN** _____ **Zone: 10 / 11** (circle one) **Error: ±**_____ **ft / m / pdop**

Or LAT 34.699039 **LONG -** 118.515423

GPS within stand? (Yes) / No If No, cite from GPS to stand: distance (m) _____ bearing ° _____ inclination ° _____
and record projected UTMs: UTME _____ UTMN _____

Elevation: _____ ft / m **Camera Name/Photograph #'s:** NIC 1938-1941

Stand Size (acres): <1, (1-5), >5 | **Plot Size** (m^2): 10 / 100 / (400) / 1000 | **Plot Shape** ___ x ___ ft / m **or RA Radius** 20 ft / m

Exposure, Actual °: 20 (NE) NW SE SW Flat Variable | **Steepness, Actual °:** 30 0° 1-5° (5-25°) > 25

Topography: Macro: top upper mid (lower) bottom | **Micro:** convex (flat) concave undulating

Geology code: Gm **Soil Texture code:** _____ | **Upland or Wetland/Riparian** (circle one)

% Surface cover: (Incl. outcrops) (>60cm diam) (25-60cm) (7.5-25cm) (2mm-7.5cm) (Incl sand, mud)

H20: **BA Stems:** 3 **Litter:** 77 **Bedrock:** / **Boulder:** / **Stone:** 5 **Cobble:** 5 **Gravel:** 5 **Fines:** 5 **=100%**

% Current year bioturbation — **Past bioturbation present?** Yes / No | **% Hoof punch** _____

Fire evidence: Yes / No (circle one) If yes, describe in Site history section, including date of fire, if known.

Site history, stand age, comments: Slope above Arroyo on north-facing slope w/ large Sabiniana, PSM & recreation of Both. disturbed hillsides w/ Mger seeding PSM - possibly old mine

Disturbance code / Intensity (L,M,H): ___/___ ___/___ ___/___ ___/___ ___/___ **"Other"** _____/___

II. HABITAT AND VEGETATION DESCRIPTION

Tree DBH : T1 (<1" dbh), **T2** (1-6" dbh), **T3** (6-11" dbh), **T4** (11-24" dbh), **T5** (>24" dbh), **T6** multi-layered (T3 or T4 layer under T5, >60% cover)

Shrub: S1 seedling (<3 yr. old), **S2** young (<1% dead), **S3** mature (1-25% dead), **S4** decadent (>25% dead)

Herb: H1 (<12" plant ht.), **H2** (>12" ht.) **% NonVasc cover:**____ **% Vasc Veg cover:** 23%

% Cover: **Conifer tree / Hardwood tree:** 8 / 7 **Regenerating Tree:** 2+ **Shrub:** 4 **Herbaceous:** 2

Height Class: **Conifer tree / Hardwood tree:** 06 / 05 **Regenerating Tree:** 04 **Shrub:** 04 **Herbaceous:** 01

Height classes: 01=<1/2m 02=1/2-1m 03=1-2m 04=2-5m 05=5-10m 06=10-15m 07=15-20m 08=20-35m 09=35-50m 10=>50m

Species, Stratum, and % cover. Stratum categories: T=Tree, S = Shrub, H= Herb, E = SEedling, A = SApling, N= Non-vascular.
% cover intervals for reference: <1%, 1-5%, >5-15%, >15-25%, >25-50%, >50-75%, 75%.

Strata	Species	% cover	C	Strata	Species	% cover	C
TSHE	QUCH	12+		S	Ceanothus californica	+	
	PSMA	5++		S	Yucca whipplei	+	
	PISabiniana	3++		S	Cercocarpus montanus	+	
	Acer negundo	+/-		S	Salix sp.	2	
				S	Lonicera sp.	1	
				S	Ribes sp.	+	
				S	Ceanothus integerrimus	+	

Unusual species: _____

III. INTERPRETATION OF STAND

Field-assessed vegetation alliance name: QUCH

Field-assessed association name (optional): PSMA

Adjacent alliances/direction: _____/_____, _____/_____

Confidence in alliance identification: L M (H) **Explain:** _____

Phenology (E,P,L): **Herb** L **Shrub** L **Tree** L **Other identification or mapping information:** _____

CNPS and CDFW Combined Vegetation Rapid Assessment Form for PSMA

(Revised September 14, 2015)

PSMA# 9999

IV. BIGCONE DOUGLAS-FIR DATA

Regeneration: 5 PSMA seedlings 3 PSMA saplings | **Plot radius:** 4.37 m 11.35m

Fecundity (% of PSMA trees in each category): No cones 20 % 1-10 cones 12 % 11-100 52 % >100 16 % = 100%

Causes and percent of stand mortality: Fir Borer 0 % Other: Fire 20 % Other: _____ _____ %

Overall site/occurrence quality/viability (site + population) (CNDDB): ☐Excellent ☒Good ☐Fair ☐Poor

Take into account population size, demography, viability over time, site condition, and any disturbances.

Fuels Model : 10

V. BASAL AREA AND CROWN BASE HEIGHT

Tree Species	L/D	# of "Hits"	BAF	Crown Base Height of Trees in ft			
Pinus coulteri	L	2	10	20	6		
Pinus coulteri	D	1	10	—	—	—	—
Pseudotsuga macrocarpa	L	3	10	15	10	1	
Pseudotsuga macrocarpa	D	2	10	—	—	—	—
Pinus lambertiana	L	1	10	17			

TALLY SPACE

0 Cones	1-10 Cones	11-100 Cones	>100 Cones	Seedlings	Saplings
𝍸	𝍸	𝍸 𝍸	𝍸	𝍸	𝍸
5	3	13	4		

RECON FIELD FORM (May 17, 2011)

Date: **Surveyors (circle recorder):**

Waypoint ID: **GPSname:** **Projected? Yes / No / Base** If yes, enter base Waypoint ID:
Bearing: _____(degrees) **Distance: _____(meters)**

UID: Base UTMs / projected UTMs (circle one)

UTME __ __ __ __ __ __ __ __ UTMN __ __ __ __ __ __ __ __ PDOP: +/- Elev.(m)

Size of stand (acres): <1 1-10 >10 Camera/Photos:

Field alliance name:

Comments:

% Cover - Conifer Tree: Hardwood tree: Joshua Tree: Tree: Shrub: Herb:

Strata	Species	% cover		Strata	Species	% cover		Strata	Species	% cover

Date: **Surveyors (circle recorder):**

Waypoint ID: **GPSname:** **Projected? Yes / No / Base** If yes, enter base Waypoint ID:
Bearing: _____(degrees) **Distance: _____(meters)**

UID: Base UTMs / projected UTMs (circle one)

UTME __ __ __ __ __ __ __ __ UTMN __ __ __ __ __ __ __ __ PDOP: +/- Elev.(m)

Size of stand (acres): <1 1-10 >10 Camera/Photos:

Field alliance name:

Comments:

% Cover - Conifer Tree: Hardwood tree: Joshua Tree: Tree: Shrub: Herb:

Strata	Species	% cover		Strata	Species	% cover		Strata	Species	% cover

Date: **Surveyors (circle recorder):**

Waypoint ID: **GPSname:** **Projected? Yes / No / Base** If yes, enter base Waypoint ID:
Bearing: _____(degrees) **Distance: _____(meters)**

UID: Base UTMs / projected UTMs (circle one)

UTME __ __ __ __ __ __ __ __ UTMN __ __ __ __ __ __ __ __ PDOP: +/- Elev.(m)

Size of stand (acres): <1 1-10 >10 Camera/Photos:

Field alliance name:

Comments:

% Cover - Conifer Tree: Hardwood tree: Joshua Tree: Tree: Shrub: Herb:

Strata	Species	% cover		Strata	Species	% cover		Strata	Species	% cover

Table 4: AICc results of logistic regression models to predict reproduction as a function of elevation, slope, aspect, and prior evidence of fire for big-cone Douglas fir stand in the Angeles National Forest. The number of fitted parameters in the model is given by df (degrees of freedom), a colon in the model description indicates a statistical interaction.

Model	df	log(Likelihood)	AICc	ΔAICc	Model weight	Cumulative weight
Elevation + StationFire + Elevation :StationFire	4	-199.1	406.33	0.00	0.28	0.28
Elevation + Aspect + StationFire	6	-197.5	407.32	0.99	0.17	0.46
Aspect + StationFire	5	-199.1	408.40	2.07	0.10	0.56
Elevation + Slope + Aspect + StationFire	7	-197.1	408.59	2.26	0.09	0.65
Elevation + StationFire	3	-201.4	408.92	2.59	0.08	0.73
StationFire	2	-202.6	409.19	2.86	0.07	0.80
Elevation + Slope + StationFire	4	-200.6	409.28	2.95	0.07	0.86
Slope + Aspect + StationFire	6	-198.9	409.98	3.65	0.05	0.91
Slope + StationFire	3	-202.0	410.10	3.77	0.04	0.95
Elevation + Slope + Aspect + StationFire + Elevation:Slope	8	-197.1	410.67	4.34	0.03	0.98
Elevation + Slope + Aspect + StationFire + Elevation:Aspect	10	-196.2	413.14	6.81	0.01	0.99
Slope + FireNum	3	-205.0	416.02	9.69	0.00	0.99
Elevation + Slope + FireYrs	4	-204.0	416.07	9.74	0.00	1.00
Elevation + FireYrs	3	-205.7	417.38	11.05	0.00	1.00
Elevation + Slope + FireNum	4	-204.7	417.49	11.16	0.00	1.00
FireNum	2	-207.4	418.76	12.43	0.00	1.00
Elevation + FireNum	3	-207.1	420.36	14.03	0.00	1.00
Slope + Aspect + FireNum	6	-204.1	420.38	14.05	0.00	1.00
Elevation + Slope + Aspect + FireYrs	7	-203.0	420.38	14.05	0.00	1.00
Elevation + Aspect + FireYrs	6	-204.4	421.05	14.72	0.00	1.00
Elevation + Slope + Aspect + FireNum	7	-203.6	421.65	15.32	0.00	1.00
Aspect + FireNum	5	-206.0	422.22	15.89	0.00	1.00
Elevation + Slope + Aspect + FireYrs + Elevation:Slope	8	-202.9	422.22	15.89	0.00	1.00
Elevation + Slope + Aspect + FireNum + Elevation :Slope	8	-203.5	423.40	17.07	0.00	1.00
Elevation + Aspect + FireNum	6	-205.6	423.56	17.23	0.00	1.00
Elevation + Slope + Aspect + FireNum + Elevation:Aspect	10	-201.9	424.62	18.29	0.00	1.00
Elevation + Slope + Aspect + FireYrs + Elevation:Aspect	10	-202.0	424.67	18.34	0.00	1.00

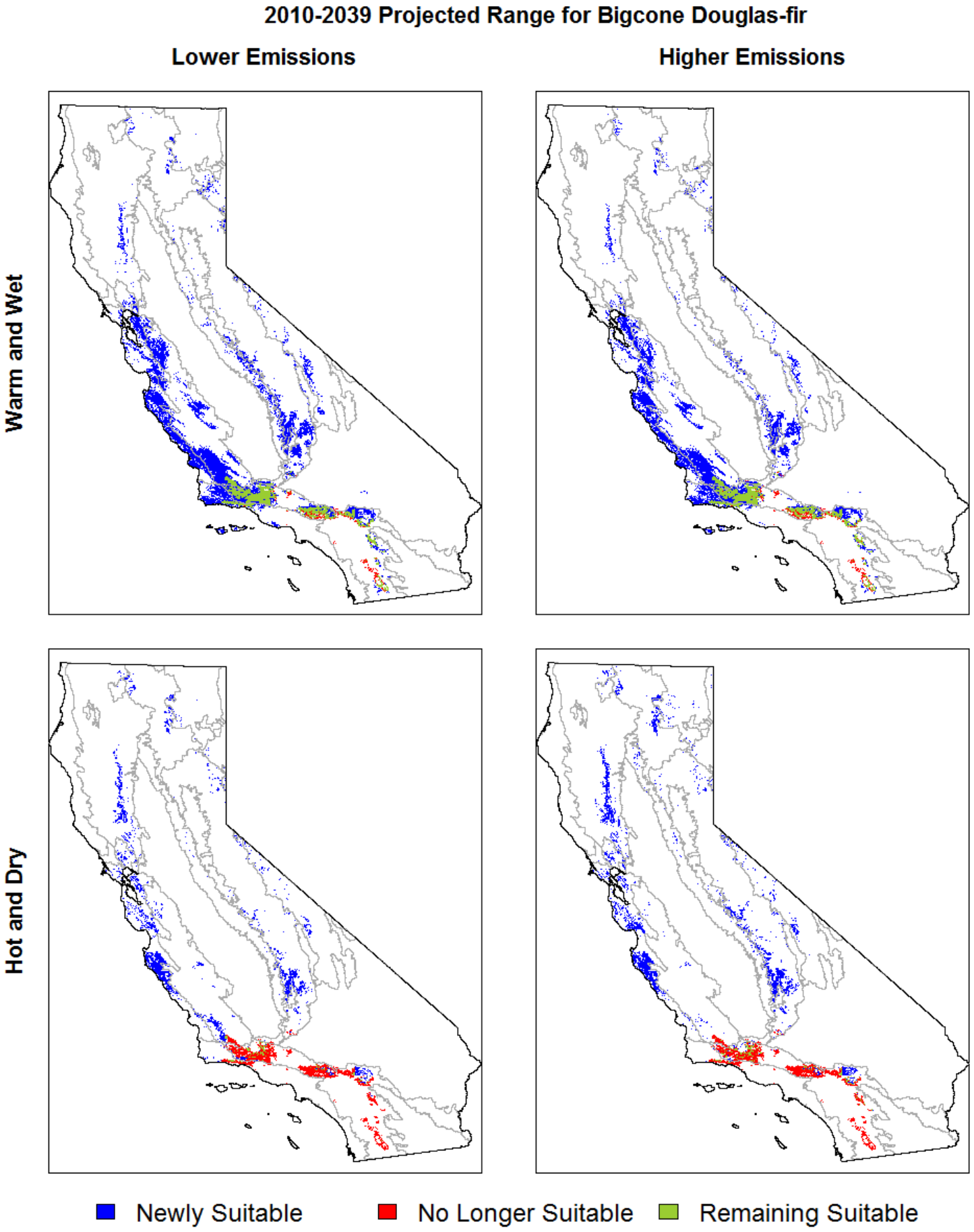
Model	df	log(Likelihood)	AICc	ΔAICc	Model weight	Cumulative weight
FireYrs	2	-210.6	425.29	18.96	0.00	1.00
Slope + FireYrs	3	-209.8	425.64	19.31	0.00	1.00
Elevation + Slope	3	-211.5	429.02	22.69	0.00	1.00
Elevation	2	-212.7	429.36	23.03	0.00	1.00
Elevation + Slope + FireY/N	4	-210.8	429.66	23.33	0.00	1.00
Elevation + FireY/N	3	-211.9	429.95	23.62	0.00	1.00
Aspect + FireYrs	5	-210.0	430.21	23.88	0.00	1.00
Slope + Aspect + FireYrs	6	-209.2	430.77	24.44	0.00	1.00
Elevation + Slope + Elevation:Slope	4	-211.4	430.96	24.63	0.00	1.00
null	1	-215.6	433.12	26.79	0.00	1.00
FireY/N	2	-214.6	433.19	26.86	0.00	1.00
Elevation + Aspect	5	-211.6	433.43	27.10	0.00	1.00
Elevation + Slope + Aspect	6	-210.6	433.57	27.24	0.00	1.00
Elevation + Aspect + FireY/N	6	-210.7	433.73	27.40	0.00	1.00
Slope	2	-214.9	433.76	27.43	0.00	1.00
Elevation + Slope + Aspect + Elevation:Slope	6	-210.8	433.83	27.50	0.00	1.00
Slope + FireY/N	3	-213.9	433.83	27.50	0.00	1.00
Elevation + Slope + Aspect + FireY/N	7	-209.8	433.98	27.65	0.00	1.00
Elevation + Slope + Aspect + FireY/N + Elevation:Slope	8	-209.8	436.04	29.71	0.00	1.00
Elevation + Aspect + Elevation:Aspect	8	-210.1	436.67	30.34	0.00	1.00
Elevation + Slope + Aspect + Elevation:Aspect	8	-210.1	436.67	30.34	0.00	1.00
Aspect + FireY/N	5	-213.8	437.76	31.43	0.00	1.00
Aspect	4	-214.9	437.96	31.63	0.00	1.00
Elevation + Slope + Aspect + FireY/N + Elevation:Aspect	10	-208.6	438.02	31.69	0.00	1.00
Slope + Aspect + FireY/N	6	-213.2	438.68	32.35	0.00	1.00
Slope + Aspect	5	-214.3	438.79	32.46	0.00	1.00

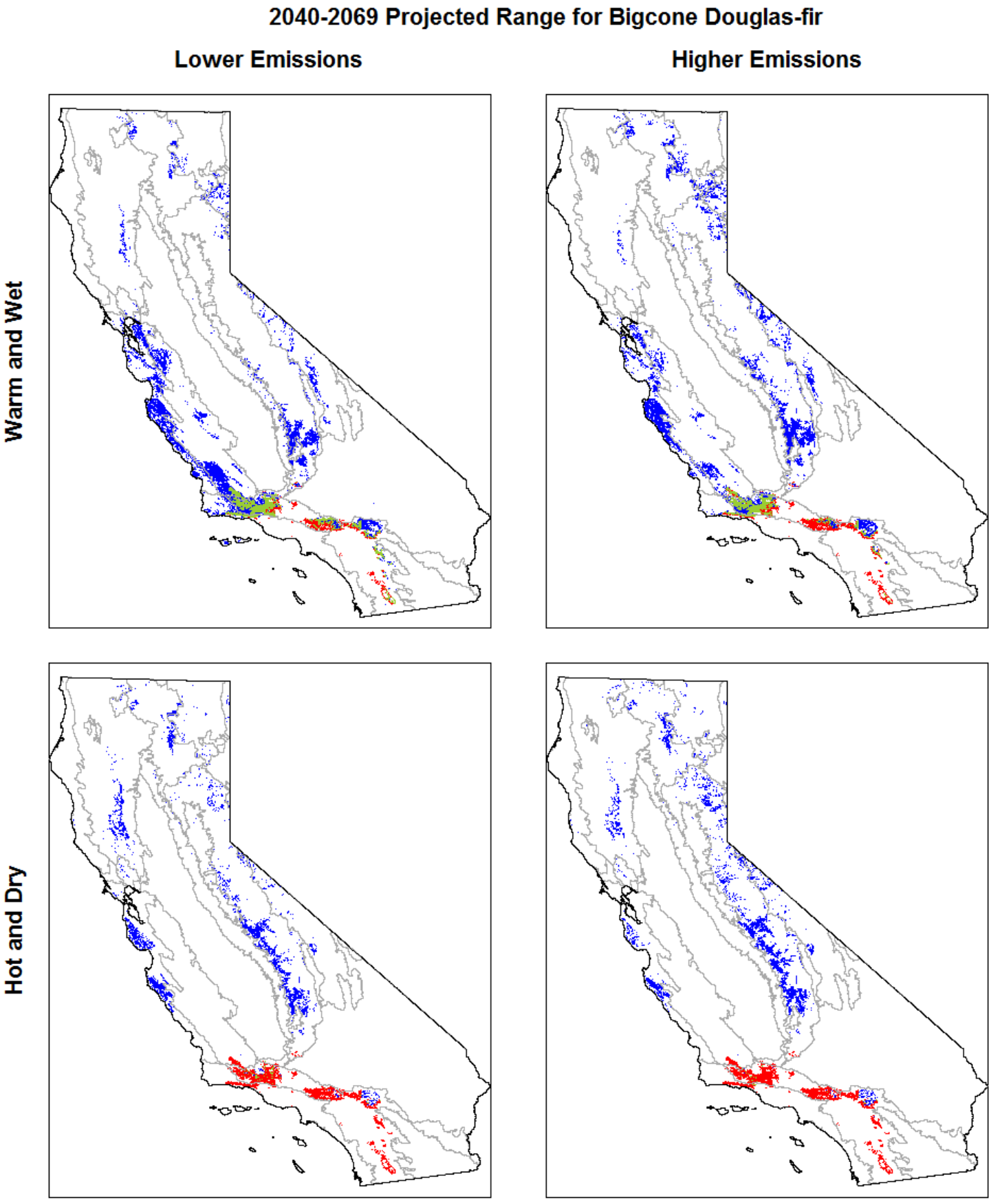
Table 5: AICc results of logistic regression models to predict mortality as a function of elevation, slope, aspect, and prior evidence of fire for big-cone Douglas fir stand in the Angeles National Forest. The number of fitted parameters in the model is given by df (degrees of freedom), a colon in the model description indicates a statistical interaction.

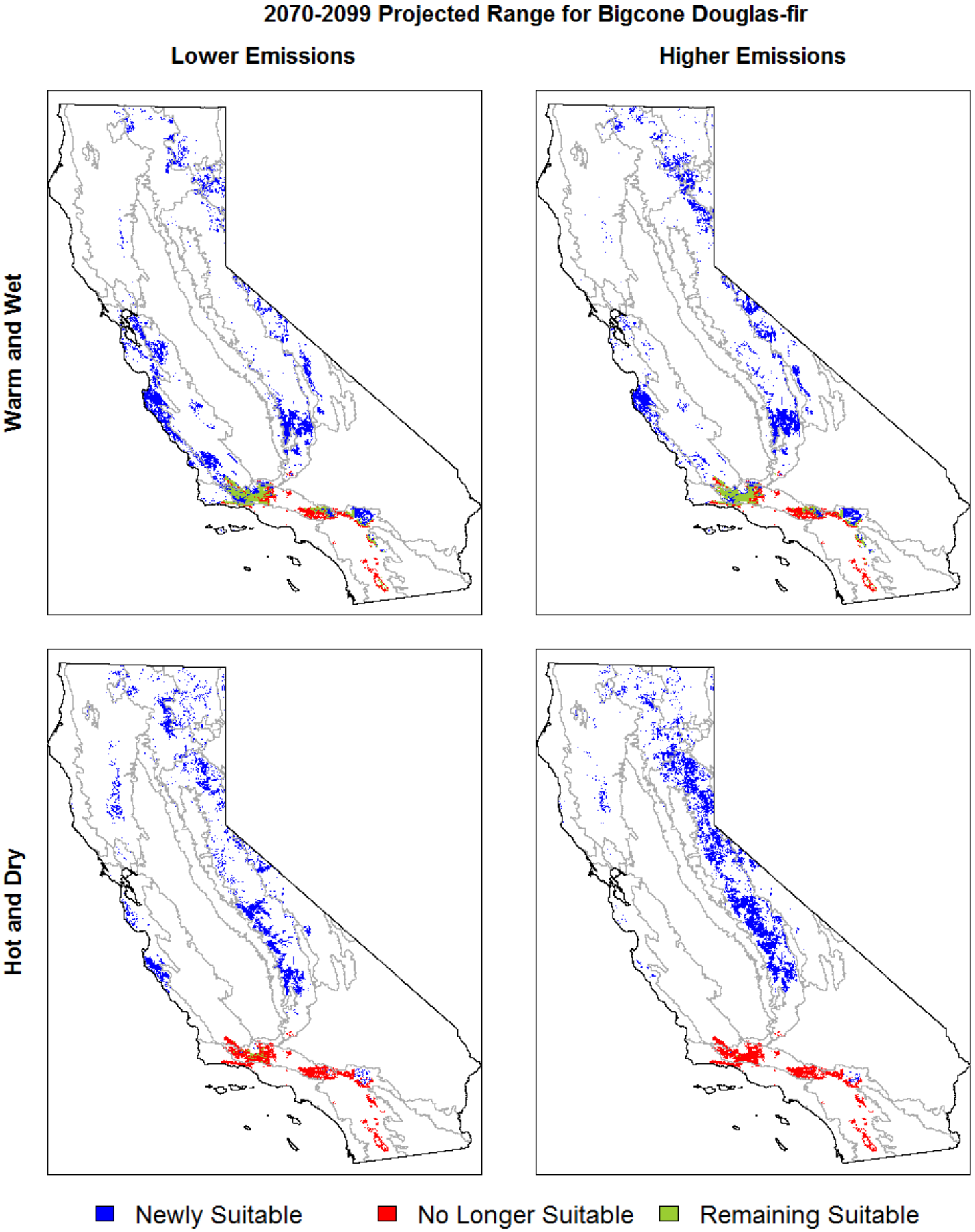
Model	df	log(Likelihood)	AICc	ΔAICc	Model weight	Cumulative weight
Elevation + StationFire + Elevation:StationFire	4	-166.6	341.38	0.00	0.75	0.75
Elevation + StationFire	3	-169.3	344.76	3.38	0.14	0.88
Elevation + Slope + StationFire	4	-169.2	346.62	5.24	0.05	0.94
StationFire	2	-171.8	347.70	6.32	0.03	0.97
Slope + StationFire	3	-171.5	349.13	7.75	0.02	0.99
Elevation + Aspect + StationFire	6	-169.2	350.63	9.25	0.01	0.99
Elevation + Slope + Aspect + StationFire	7	-169.1	352.53	11.15	0.00	1.00
Aspect + StationFire	5	-171.6	353.36	11.98	0.00	1.00
Elevation + Slope + Aspect + StationFire + Elevation:Slope	8	-168.8	354.02	12.64	0.00	1.00
Slope + Aspect + StationFire	6	-171.3	354.93	13.55	0.00	1.00
Elevation + Slope + Aspect + StationFire + Elevation:Aspect	10	-168.4	357.52	16.14	0.00	1.00
Elevation + FireY/N	3	-179.1	364.36	22.98	0.00	1.00
Elevation + Slope + FireY/N	4	-179.1	366.41	25.03	0.00	1.00
Elevation + Aspect + FireY/N	6	-178.4	369.04	27.65	0.00	1.00
Elevation + Slope + Aspect + FireY/N	7	-178.4	371.08	29.69	0.00	1.00
FireY/N	2	-184.1	372.16	30.78	0.00	1.00
Elevation + Slope + Aspect + FireY/N + Elevation:Slope	8	-177.9	372.18	30.80	0.00	1.00
Slope + FireY/N	3	-184.0	374.09	32.71	0.00	1.00
Aspect + FireY/N	5	-182.8	375.86	34.48	0.00	1.00
FireNum	2	-186.3	376.65	35.27	0.00	1.00
Elevation + Slope + Aspect + FireY/N + Elevation:Aspect	10	-178.0	376.79	35.41	0.00	1.00
Elevation + FireNum	3	-185.6	377.28	35.90	0.00	1.00
Slope + FireNum	3	-185.8	377.66	36.28	0.00	1.00
Slope + Aspect + FireY/N	6	-182.8	377.93	36.55	0.00	1.00
Elevation + Slope + FireNum	4	-185.0	378.15	36.77	0.00	1.00
Aspect + FireNum	5	-184.6	379.46	38.08	0.00	1.00
Slope + Aspect + FireNum	6	-183.9	380.00	38.62	0.00	1.00

Model	df	log(Likelihood)	AICc	ΔAICc	Model weight	Cumulative weight
Elevation + Aspect + FireNum	6	-184.0	380.24	38.86	0.00	1.00
Elevation + Slope + Aspect + FireNum	7	-183.2	380.67	39.29	0.00	1.00
Elevation + Slope + Aspect + FireNum + Elevation:Slope	8	-183.1	382.74	41.36	0.00	1.00
Elevation + Slope + Aspect + FireNum + Elevation:Aspect	10	-182.7	386.05	44.67	0.00	1.00
Elevation + FireYrs	3	-192.0	389.99	48.61	0.00	1.00
Elevation + Slope + FireYrs	4	-191.9	391.98	50.59	0.00	1.00
Elevation + Aspect + FireYrs	6	-190.0	392.21	50.83	0.00	1.00
Elevation + Slope + Aspect + FireYrs	7	-189.8	393.99	52.61	0.00	1.00
Elevation + Slope + Aspect + FireYrs + Elevation:Slope	8	-189.7	395.94	54.56	0.00	1.00
Elevation	2	-196.2	396.37	54.99	0.00	1.00
Elevation + Slope	3	-196.2	398.40	57.02	0.00	1.00
Elevation + Aspect	5	-194.4	398.95	57.57	0.00	1.00
Elevation + Slope + Aspect + FireYrs + Elevation:Aspect	10	-189.6	399.85	58.47	0.00	1.00
Elevation + Slope + Elevation:Slope	4	-196.0	400.16	58.78	0.00	1.00
Elevation + Slope + Aspect + Elevation:Slope	6	-194.3	400.80	59.42	0.00	1.00
Elevation + Slope + Aspect	6	-194.3	400.90	59.52	0.00	1.00
FireYrs	2	-199.9	403.88	62.50	0.00	1.00
Aspect + FireYrs	5	-197.1	404.41	63.03	0.00	1.00
Elevation + Aspect + Elevation:Aspect	8	-194.3	405.04	63.66	0.00	1.00
Elevation + Slope + Aspect + Elevation:Aspect	8	-194.3	405.04	63.66	0.00	1.00
Slope + FireYrs	3	-199.9	405.79	64.40	0.00	1.00
null	1	-202.1	406.13	64.75	0.00	1.00
Slope + Aspect + FireYrs	6	-197.1	406.48	65.10	0.00	1.00
Aspect	4	-199.4	407.03	65.65	0.00	1.00
Slope	2	-202.0	407.99	66.61	0.00	1.00
Slope + Aspect	5	-199.4	409.10	67.71	0.00	1.00

Appendix 9: Climate Modeling Outputs for Bigcone Douglas-fir (by Jim Thorne and Hyeyeong Choe for CalFire 2016)




2040-2069 Projected Range for Bigcone Douglas-fir
Lower Emissions
Higher Emissions
Warm and Wet
Hot and Dry
Newly Suitable
No Longer Suitable
Remaining Suitable


2070-2099 Projected Range for Bigcone Douglas-fir
Lower Emissions
Higher Emissions
Warm and Wet
Hot and Dry
Newly Suitable
No Longer Suitable
Remaining Suitable

From:
Thorne, J. H., H. Choe, J. A. Stewart, and R. M. Boynton. 2017. Range Dynamics of Selected Tree and Shrub Species and Climate Exposure Projections for Forest and Woodland Habitats in California under Four Climate Projections. Information Center for the Environment, University of California, Davis, CA.

Table 1. List of species that were modeled. The last five columns of the table show the number of each species' occurrence data in each data source used in the modeling.

Common Name	Jepson Scientific Name	USDA	Alternate code	Rapid	Relevé	FRAP plots	UC Jeps Herbarium	CA Gap
Conifer trees								
Bigcone Douglas-fir	*Pseudotsuga macrocarpa (Vasey) Mayr*	PSMA		245	0	0	0	0
Coulter Pine	*Pinus coulteri D. Don*	PICO3		0	108	0	0	47
Single-leaf Pinyon	*Pinus monophylla Torr. & Frém.*	PIMO		194	219	0	0	0
Sugar Pine	*Pinus lambertiana Douglas*	PILA		580	2389	204	0	0
Hardwood trees								
Canyon Live Oak	*Quercus chrysolepis Liebm.*	QUCH2		1368	2039	20	0	0

Table 2. The change in modeled climatically suitable range for 5 tree and shrub species from current time to 2010-2039. All values are in square miles. CNRM is warm/wet, MIROC is hot/dry for California.

Species	Current Modeled Range	Individual Species Range Change in Square Miles											
		CNRM RCP4.5			CNRM RCP8.5			MIROC RCP4.5			MIROC RCP8.5		
		Remaining Suitable	No Longer Suitable	Newly Suitable	Remaining Suitable	No Longer Suitable	Newly Suitable	Remaining Suitable	No Longer Suitable	Newly Suitable	Remaining Suitable	No Longer Suitable	Newly Suitable
Canyon Live Oak	32,338	28,085	4,253	12,485	28,303	4,035	13,477	26,606	5,731	7,402	26,375	5,963	6,868
Sugar Pine	23,709	21,415	2,294	13,420	20,990	2,719	12,462	18,943	4,766	7,787	19,148	4,561	8,866
Single-leaf Pinyon	7,627	5,213	2,414	11,613	4,908	2,719	9,783	4,816	2,811	11,913	5,520	2,106	15,342
Coulter Pine	4,695	2,591	2,105	4,150	2,763	1,932	4,397	2,251	2,444	3,147	2,313	2,382	3,971
Bigcone Douglas-fir	2,583	2,167	416	11,237	2,058	526	9,041	293	2,290	4,153	382	2,201	4,979

Table 3. The change in modeled climatically suitable range for 5 tree and shrub species from current time to 2040-2069. All values are in square miles. CNRM is warm/wet, MIROC is hot/dry for California.

Species	Current Modeled Range	Individual Species Range Change in Square Miles											
		CNRM RCP4.5			CNRM RCP8.5			MIROC RCP4.5			MIROC RCP8.5		
		Remaining Suitable	No Longer Suitable	Newly Suitable	Remaining Suitable	No Longer Suitable	Newly Suitable	Remaining Suitable	No Longer Suitable	Newly Suitable	Remaining Suitable	No Longer Suitable	Newly Suitable
Canyon Live Oak	32,338	27,657	4,681	12,186	26,619	5,718	15,901	22,667	9,671	9,888	20,438	11,900	11,637
Sugar Pine	23,709	19,858	3,851	11,425	20,099	3,610	13,994	16,364	7,345	6,651	14,540	9,169	7,244
Single-leaf Pinyon	7,627	4,846	2,781	10,113	4,117	3,509	7,910	4,359	3,267	14,118	4,070	3,557	16,729
Coulter Pine	4,695	1,837	2,859	2,828	1,503	3,192	2,562	678	4,017	2,681	415	4,280	3,263
Bigcone Douglas-fir	2,583	1,760	823	7,979	1,309	1,274	7,664	150	2,434	4,555	75	2,508	4,889

Table 4. The change in modeled climatically suitable range for 5 tree and shrub species from current time to 2070-2099. All values are in square miles. CNRM is warm/wet, MIROC is hot/dry for California.

Species	Current Modeled Range	Individual Species Range Change in Square Miles											
		CNRM RCP4.5			CNRM RCP8.5			MIROC RCP4.5			MIROC RCP8.5		
		Remaining Suitable	No Longer Suitable	Newly Suitable	Remaining Suitable	No Longer Suitable	Newly Suitable	Remaining Suitable	No Longer Suitable	Newly Suitable	Remaining Suitable	No Longer Suitable	Newly Suitable
Canyon Live Oak	32,338	26,025	6,312	13,986	21,437	10,901	19,398	20,560	11,777	11,936	14,100	18,238	12,875
Sugar Pine	23,709	18,926	4,783	11,968	15,192	8,517	12,061	14,998	8,711	6,882	8,970	14,740	6,792
Single-leaf Pinyon	7,627	4,158	3,469	8,144	1,702	5,924	2,526	3,924	3,702	14,325	2,448	5,179	13,393
Coulter Pine	4,695	1,139	3,556	2,536	557	4,139	3,269	378	4,318	2,713	12	4,683	4,586
Bigcone Douglas-fir	2,583	1,430	1,153	7,507	1,232	1,351	6,453	121	2,463	5,641	5	2,578	7,541