Vegetation Mapping of Eastman and Hensley Lakes and Environs,
Southern Sierra Nevada Foothills, California

By

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I. INTRODUCTION

The California Native Plant Society (CNPS) received a private donation to conduct field sampling, produce a vegetation classification, and fine-scale, spatially and floristically accurate vegetation map in the southern Sierra Nevada Foothills (SSNF). A pilot mapping area in this region was chosen based on input from the Sierra Foothills Conservancy, and encompasses approximately 35,000 acres (including about 2,300 acres of reservoir) around Eastman and Hensley Lakes in Madera County. This area was immediately adjacent to the Northern Sierra Nevada Foothills vegetation map produced by Aerial Information Systems in an effort led by the California Department of Fish and Game and completed in 2011. The mapping area included mostly private lands except for the areas adjacent to Eastman and Hensley Lakes, which are owned by the Army Corps of Engineers. Some of the privately owned properties have easements with the Sierra Foothills Conservancy.

The classification of vegetation types used in the map was based on a previous vegetation classification of 47 native vegetation alliances and semi-natural stands from surveys collected between 2008 and 2010 across a larger region of about 300,000 acres (Roach et al. 2011). Guidelines for assessing and mapping the plant communities are found in the widely accepted California standards for interpreting vegetation patterns and for initiating local and regional ecological assessments (see *A Manual of California Vegetation*, Sawyer et al. 2009).

II. OBJECTIVES

The primary goal of the project was to create an accurate and detailed baseline vegetation map with supporting field surveys and classification in the Eastman and Hensley Lakes area of the southern Sierra Nevada Foothills. The fine-scale map will assist in long-term management of many characteristic and sensitive foothill plant communities. In producing a vegetation map of the area, CNPS completed the following objectives:

1) Coordinate with SFC to determine area of interest,
2) Represent vegetation as alliances and land cover types,
3) Provide a crosswalk to other classification systems,
4) Digitize vegetation/habitat features using 2012 imagery and existing vegetation surveys,
5) Coordinate with land managers to access lands,
6) Field verify the map,
7) Construct revisions and complete digitizing, and
8) Produce a vegetation mapping metadata report.

III. METHODS

Study area

The study area for the 2013-2014 mapping effort includes the town of Raymond, which is about 20 miles NNE of the city of Madera, in Madera County (Figure 1). It extends from the northern end of Eastman Lake to the southern end of Hensley Lake (Figure 2). This area is largely comprised of private lands, several of which have conservation easements through the Sierra Foothills Conservancy. The mapping area encompasses the majority of the USGS 7.5 minute Raymond quadrangle as well as portions of the Knowles, Daulton, Little Table Mountain, and Ben Hur quadrangles.

The region contains a variety of habitat types, including rolling hills of oak woodlands and forests, valleys with vernal pool and grassland matrices, rock outcrops of locally rare shrub types, pine woodlands, deciduous riparian woodlands, ceanothus chaparral, and lupine scrub. Many seeps, perennial and seasonal watercourses, wetland ponds and reservoir habitats also occur in the area.

Field Sampling and Classification

Prior to the 2013-2014 mapping effort, field surveys were conducted in 2008, 2009, and 2010 for vegetation classification of the central and southern Sierra Nevada Foothills region (Figure 1). During this field data collection the CNPS-CDFW protocol for combined vegetation rapid assessment and relevé sampling was used to capture detailed information on vegetation types. The rapid assessment method is stand-based while the relevé method is plot-based; both methods are used to categorize and classify vegetation stands at a fine-scale. A stand is defined as an area of vegetation that has both compositional and structural integrity and represents a relatively homogeneous vegetation type that repeats across the landscape. Stands can be selected on site or using aerial imagery. Once a stand is selected, field forms are completed to record both vegetation and environmental data (see Appendix A-1).

Field data in the 2011 mapping project area (Roach et al. 2011), as well as in the greater southern foothills region, were analyzed to confirm vegetation alliances and higher level group names for all vegetation stands sampled. For the current map, CNPS staff adapted the existing key and classification (see Appendix B) used for the 2011 mapping project in the southern foothills (along the southern boundary of Madera County (Roach et al. 2011)), and the mapping project of the northern Sierra Nevada Foothills (Klein et al. 2007, Menke et al. 2011).

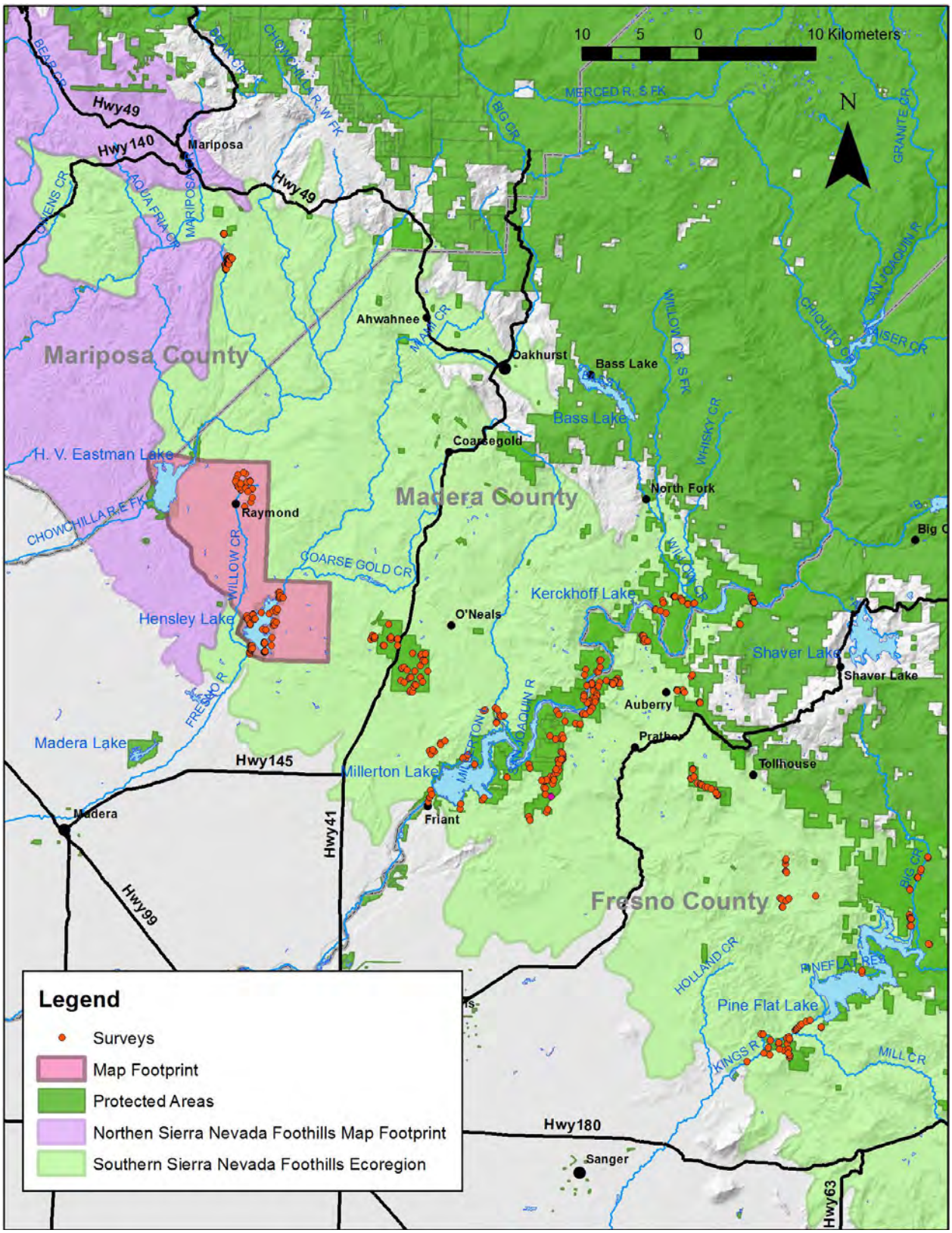

Figure 1. Mapping area and survey sites used in the vegetation classification.

The classification in this report is based upon the U.S. National Vegetation Classification (NVC) standard and *A Manual of California Vegetation* (MCV). The NVC and MCV support the development and use of consistent national and state vegetation classifications that produce uniform statistics about vegetation resources across the nation, based on vegetation data gathered at local, regional or national levels (FGDC 2008, Sawyer et al. 2009). Refinements to the classification have occurred during its application by CNPS, NatureServe, and California Department of Fish and Wildlife (CDFW, previously Department of Fish and Game), which can be seen using the NatureServe website of http://www.natureserve.org/explorer and the CDFW website of http://www.dfg.ca.gov/biogeodata/vegcamp/natural_comm_list.asp.

Vegetation Mapping and Field Verification Methods

The current fine-scale vegetation map illustrates vegetation as separately delineated vegetation map units defined by the alliances and non-vegetated (urbanized) types listed in the key for the project area. Vegetation mapping required the aerial interpretation of imagery and was conducted by skilled field botanists and ecologists. By using existing reconnaissance points along with other existing field surveys and keys, aerial photo signatures (color-texture-tone combinations that the photo-interpreter views on digital aerial photos) were associated with their corresponding vegetation type as recorded in the field. These correlations between the vegetation units and photo signatures were evaluated and refined to ensure that the map would consistently represent the different vegetation types at a fine-scale resolution.

The vegetation map units were interpreted across the pilot mapping area using heads-up digitizing and a polygon geodatabase. Heads-up digitizing is a process in Geographic Information Systems (GIS) of interpreting digital aerial photo images on-screen and then manually using a mouse to delineate and digitize vegetation polygons. Custom ArcMap 10.1 tools including the geodatabase were developed by CNPS and CDFW for fine-scale vegetation mapping projects throughout the state.

As a general rule, common and widespread vegetation units were delineated down to a minimum mapping unit (MMU) of approximately a half hectare (1 acre). Wetlands, riparian habitat and locally rare types, along with other special features, were delineated to approximately one-quarter hectare (a half acre). Additional MMU considerations were applied for structural breaks in the overstory and understory, as described in Appendix C mapping rules.

Multiple sets of digital imagery were used in aiding the photo interpretation for delineating and labeling the polygons:

- 1-Meter Natural Color from the National Agricultural Inventory Program (NAIP) – from Summer 2012, 2010, and 2009 (1:12,000 spatial accuracy)
- Color infrared (CIR) representation of NAIP 2005 and 2012 aerial imagery.
- A Normalized Difference Vegetation Index (NDVI) applied to the source NAIP 2012 imagery.
- USA Topo Maps Basemap layer from ArcGIS online
- Bing Maps aerial imagery web mapping service for orthographic aerial and satellite imagery

Upon producing a draft map of the study area, ambiguous or other indiscernible photo signatures encountered during the photo-interpretation process were flagged for additional field verification or reconnaissance. The primary goals of the field reconnaissance included the following:

- Acquire point observations for each vegetation type (map class) and capture variation within each type to later correlate with imagery for establishing photo signatures.
- Acquire ground-based photos and descriptions of the vegetation to associate with the digital aerial imagery.
- Establish relationships between the vegetation and bio-physical attributes (e.g., vernal pool grasslands matrices).

The mapping polygons were transferred to both digital PDA's and hard copy maps showing the polygons in question along with all of the other mapped polygons. In February 2014, three field staff visited approximately 150 polygons, which included a set of polygons with questionable signatures and a subset of all vegetation map units to verify their attributes. Additionally, five rapid assessment surveys were conducted in locally rare shrub and woodland types or grassland types in flower. Information obtained in the field was used by the photo-interpreters and incorporated into a final map product. To ensure the accuracy and completeness of the photo-interpretations and delineations, a comprehensive quality control effort also was conducted.

IV. RESULTS

The vegetation sampling from 2008 and 2010 resulted in 375 stand and plot-based surveys in the general region of the central and southern Sierra Nevada foothills (Figure 1), of which 79 surveys were in the pilot mapping area. The classification of these vegetation surveys resulted in 47 native alliances and semi-natural stands across the general region of around 300,000 acres (see Appendix B and D). Seventy-nine surveys were within the pilot mapping area, and in addition, about 150 reconnaissance surveys were recorded there in 2014 as part of the mapping process (see Figure 2).

Upon interpreting the data and aerial imagery in the pilot area, the vegetation map resulted in 31 different floristic/mapping units, which were crosswalked to the California Wildlife Habitat Relationships system (see Table 1). These map units are hierarchically arranged by life form (tree, shrub, herbaceous) and by other ecological or land-use characters. Woody vegetation types are mapped at the alliance and group levels, including seven tree alliances, one semi-natural tree type and nine shrub alliances. Some riparian woodland and scrub types are difficult to determine at the alliance level in the aerial imagery and therefore are described at the group level. Herbaceous types are represented by three general groups (or higher level map classes) because the imagery did not afford signature recognition of the various herbaceous alliances. However, one herbaceous wetland alliance was discerned from survey and reconnaissance points. The mapping classification in Appendix D provides a list of the varied herbaceous types.

As shown in Figures 3 & 4 and Table 2, a total of 34,625 acres were mapped. The oak woodland map units have the largest aerial coverage (about 17,500 acres) in the mapping area, followed by annual and perennial grasslands (about 12,700 acres). A total number of 4,310 polygons are delineated, and the average polygon size is 3.2 hectares (or 8 acres).

In general, the study area includes more common tree types of Buckeye (*Aesculus californica*), Blue Oak (*Quercus douglasii*), Interior Live Oak (*Q. wislizeni*), and Ghost Pine (*Pinus sabinana*) alliances, mapped in about 51% of the area. Less common tree types include riparian forests of Fremont Cottonwood (*Populus fremontii*), Goodding's Willow (*Salix gooddingii*), and Red Willow (*Salix laevigata*) alliances (in 0.2% of the area). Shrubland habitats represent a small proportion of the map at 2% of the total area; with Wedgeleaf Ceanothus (*Ceanothus cuneatus*) and Silver Bush Lupine (*Lupinus albifrons*) alliances covering the most area. The wetland marsh and vernal pool /upland grassland matrix habitats are also uncommon (about 1% of the area), as compared to the upland herbaceous vegetation (about 37% of the area). Other habitats include water features of Eastman and Hensley Lakes, perennial stream channels, and small ponds (about 7% of the area).

In addition to the detailed vegetation type field (of 31 mapping units), the attribute table includes information about the NVC hierarchy, such that the map can also be symbolized at the Group level, reducing the number of classes to eleven. The largest Group level class is California Broadleaf Forest & Woodland which includes the more common tree types except for *Pinus sabiniana* alliance. The map can also be symbolized at the Macrogroup level, which results in nine classes, or the Formation level of five classes. The attribute table also includes the primary CWHR habitat (see Table 1), which translates the fine-scale map to twelve classes.

The resulting vegetation map includes seven native tree alliances, one semi-natural tree type, nine shrub alliances, two woody group-level mapping units, three general herbaceous groups,

one herbaceous alliance, and eight land-use or land-cover types. This map and field data will serve as baseline information to assess future conservation efforts, adaptively manage resources, assess impacts of climate change, and effect other land-use decisions.

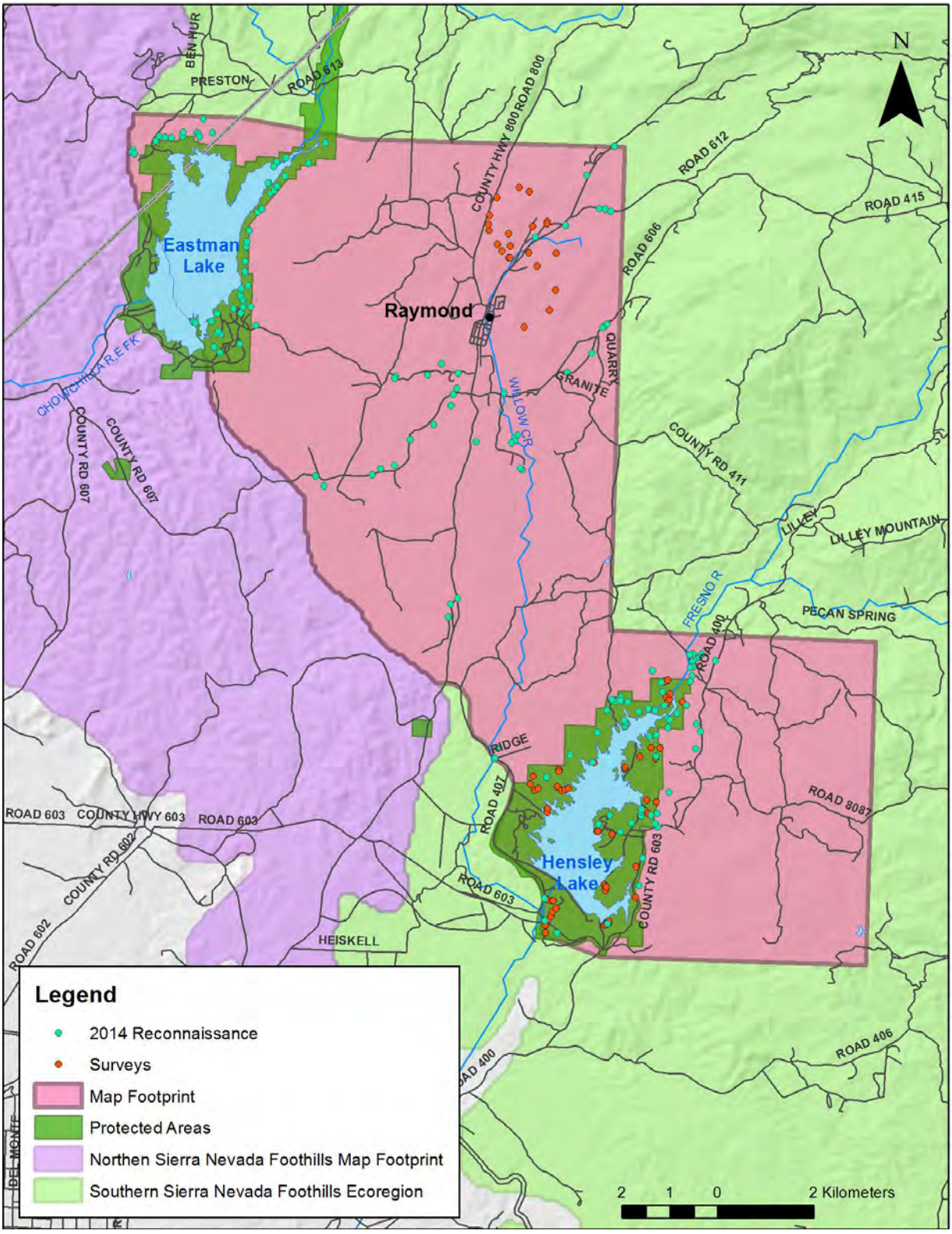

Figure 2. Locations of vegetation stand/plot surveys and reconnaissance surveys in the pilot mapping area

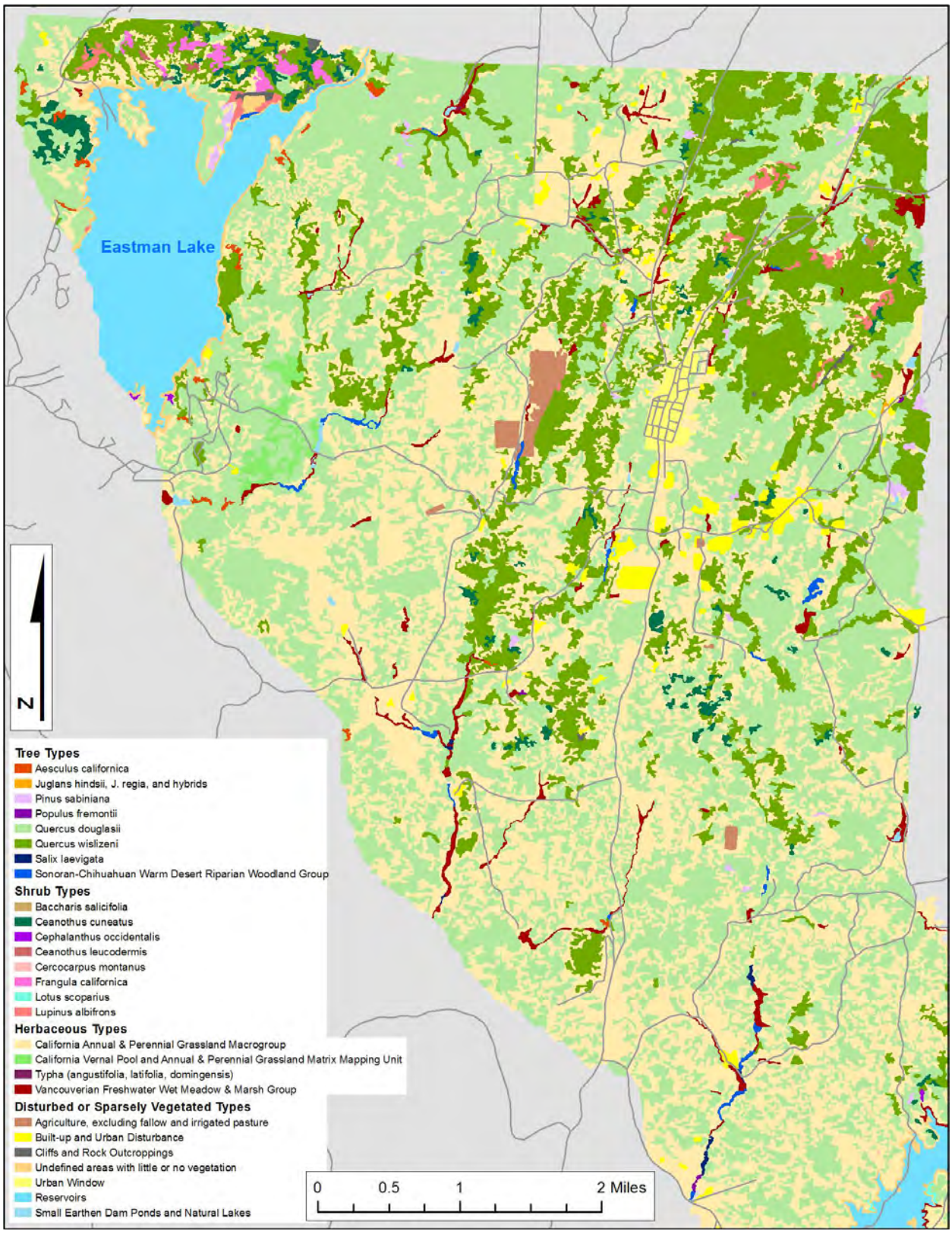

Figure 3. Northern Portion of the Mapping Area

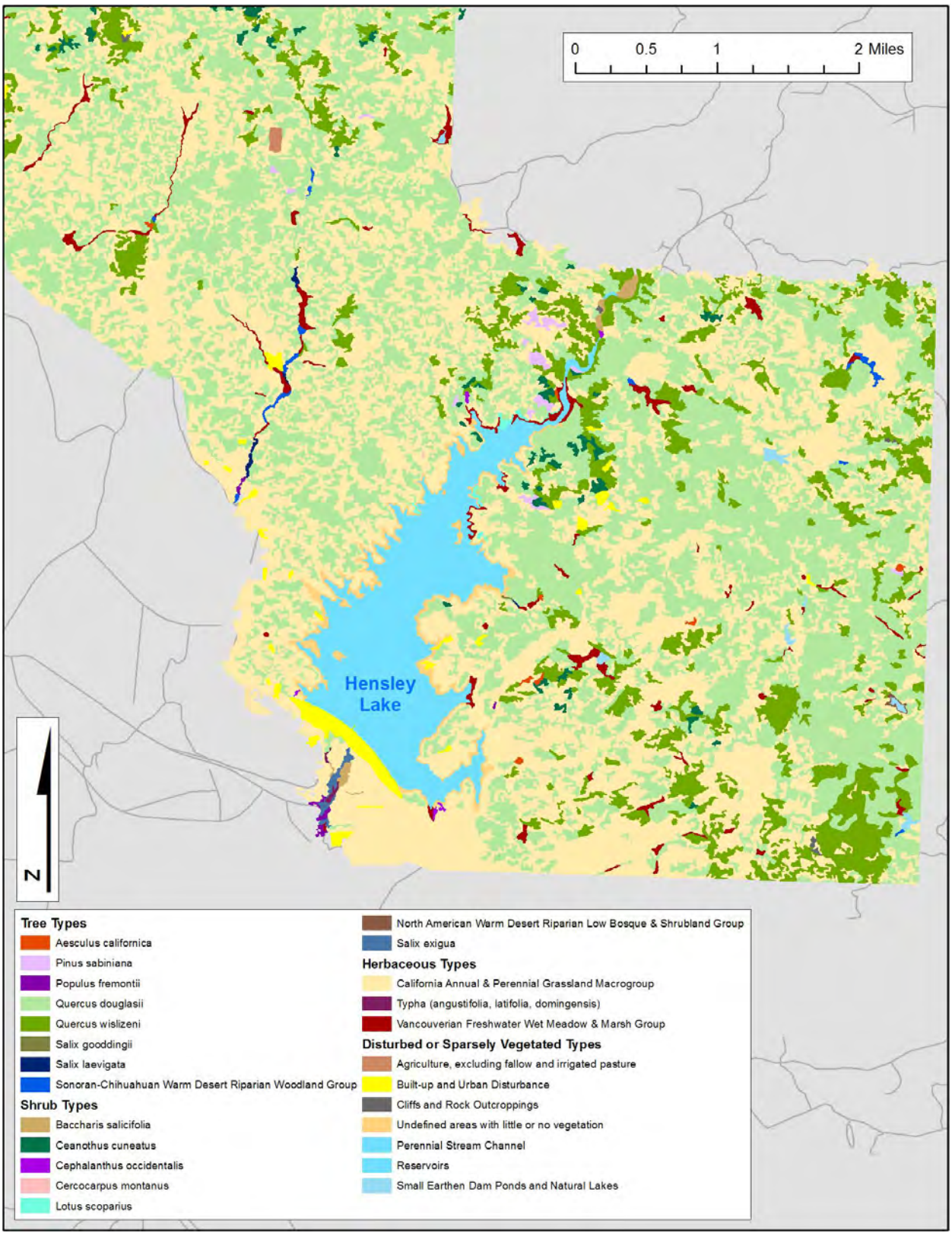

Figure 4. Southern Portion of the Mapping Area

Table 1. Vegetation classification crosswalk between the NVC floristic/mapping units and the CDFW Wildlife Habitat Relationships (WHR) units for mapped types

VegCode	Alliance or Other Map Unit	WHR Name (*primary*)	WHR Name (*secondary*)
1111	*Quercus wislizeni* Alliance	Blue Oak Woodland	Blue Oak–Foothill Pine, Valley Foothill Riparian
1210	*Pinus sabiniana* Alliance	Blue Oak–Foothill Pine	
1310	*Aesculus californica* Alliance	Blue Oak Woodland	Blue Oak–Foothill Pine
1311	*Quercus douglasii* Alliance	Blue Oak Woodland	Blue Oak–Foothill Pine
3100	Sonoran-Chihuahuan Warm Desert Riparian Woodland Group	Valley Foothill Riparian	
3110	*Populus fremontii* Alliance	Valley Foothill Riparian	
3111	*Salix laevigata* Alliance	Valley Foothill Riparian	
3112	*Salix gooddingii* Alliance	Valley Foothill Riparian	
4113	*Ceanothus cuneatus* Alliance	Mixed Chaparral	
4211	*Cercocarpus montanus* Alliance	Mixed Chaparral	
4501	*Frangula californica* Alliance	Mixed Chaparral	
4710	*Lupinus albifrons* Alliance	Coastal Scrub	Mixed Chaparral
4711	*Lotus scoparius* Alliance	Coastal Scrub	Mixed Chaparral
4811	*Ceanothus leucodermis* Alliance	Mixed Chaparral	
6200	North American Warm Desert Riparian Low Bosque & Shrubland Group	Valley Foothill Riparian	
6210	*Baccharis salicifolia* Alliance	Valley Foothill Riparian	Freshwater Emergent Wetland
6211	*Salix exigua* Alliance	Valley Foothill Riparian	
6214	*Cephalanthus occidentalis* Alliance	Valley Foothill Riparian	
7100	California Annual & Perennial Grassland Macrogroup	Annual Grassland	Perennial Grassland
7200	Vancouverian Freshwater Wet Meadow & Marsh Group	Fresh Emergent Wetland	Wet Meadow
7310	*Typha* (*angustifolia*, *latifolia*, *domingensis*) Alliance	Fresh Emergent Wetland	Wet Meadow
7400	California Vernal Pool and Annual & Perennial Grassland Matrix Mapping Unit	Annual Grassland	Wet Meadow
9200	Agriculture, excluding fallow and irrigated pasture Mapping Unit	Orchard - Vineyard	Cropland
9300	Built Up & Urban Disturbance	Urban	

VegCode	Alliance or Other Map Unit	WHR Name (*primary*)	WHR Name (*secondary*)
9310	Urban Window Mapping Unit	Urban	
9400	Undefined areas with little or no vegetation Mapping Unit	Barren	
9401	Cliffs & Rock Outcroppings	Barren	
9502	*Juglans hindsii*, *J. regia*, and hybrids Semi-natural Stands	Valley Foothill Riparian	
9801	Perennial Stream Channel Mapping Unit	Riverine	
9802	Reservoirs Mapping Unit	Lacustrine	
9803	Small Earthen Dam Ponds and Natural Lakes Mapping Unit	Lacustrine	

Table 2. Total acreage and number of polygons mapped

VegCode	Vegetation Type	Acreage mapped	# Polys mapped
1111	*Quercus wislizeni* Alliance	4,713	801
1210	*Pinus sabiniana* Alliance	87	29
1310	*Aesculus californica* Alliance	45	25
1311	*Quercus douglasii* Alliance	12,791	1,543
3100	Sonoran-Chihuahuan Warm Desert Riparian Woodland Group	58	29
3110	*Populus fremontii* Alliance	11	7
3111	*Salix laevigata* Alliance	10	8
3112	*Salix gooddingii* Alliance	1	1
4113	*Ceanothus cuneatus* Alliance	322	127
4211	*Cercocarpus montanus* Alliance	0.4	1
4501	*Frangula californica* Alliance	52	9
4710	*Lupinus albifrons* Alliance	78	24
4711	*Lotus scoparius* Alliance	12	7
4811	*Ceanothus leucodermis* Alliance	6	3
6200	North American Warm Desert Riparian Low Bosque & Shrubland Group	3	1
6210	*Baccharis salicifolia* Alliance	24	7
6211	*Salix exigua* Alliance	15	3
6214	*Cephalanthus occidentalis* Alliance	8	7
7100	California Annual & Perennial Grassland Macrogroup	12,682	1,317
7200	Vancouverian Freshwater Wet Meadow & Marsh Group	365	151
7310	*Typha* (*angustifolia*, *latifolia*, *domingensis*) Alliance	5	3
7400	California Vernal Pool and Annual & Perennial Grassland Matrix Mapping Unit	91	2
9200	Agriculture, excluding fallow and irrigated pasture Mapping Unit	113	12
9300	Built-up and Urban Disturbance Mapping Unit	380	125
9310	Urban Window Mapping Unit	106	1
9400	Undefined areas with little or no vegetation Mapping Unit	305	22
9401	Cliffs and Rock Outcroppings Mapping Unit	29	18
9502	*Juglans hindsii*, *J. regia*, and hybrids Semi-natural Stands	1	1
9801	Perennial Stream Channel Mapping Unit	11	2
9802	Reservoirs Mapping Unit	2,253	2
9803	Small Earthen Dam Ponds and Natural Lakes Mapping Unit	50	22
	Sum Total	**34,625**	**4,310**

V. REFERENCES

Federal Geographic Data Committee (FGDC). 2008. National Vegetation Classification Standard, Version 2, FGDC-STD-005-2008 (Version 2). Vegetation Subcommittee of the Federal Geographic Data Committee, Reston, VA.

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VI. APPENDICES

Appendix A. CNPS Field Sampling Forms

Field Verification Form: SSNF Vegetation Mapping (02/2014)

Surveyors (circle recorder): Smt, dlh, NR **Date:** 2/11/2014

Waypoint ID: D-2804B

Polygon UID: D-2804

GPSname: 4 **Projected? Yes / No / Base** If yes, enter base Waypoint ID:
Bearing: _____(degrees) **Distance:** _____ (meters)
'Base' UTMs: UTME 246431 UTMN 4151629 **PDOP:** +/-1.7
Projected UTMs: UTME _____ UTMN _____ (if necessary)

Strata	Species	% cover	Strata	Species	% cover	Strata	Species	% cover
S	Cephalanthus occ	20	S	Baccharis salis.	3			
S	Salix exigua	12	T	Fraxinus (velutina)	1			
T	Salix (lasiol.)	+						

Notes: (including recommendations for line-work revision, state of veg. "discernibility" based on season and topography, classification interpretation, homogeneity and unusual sightings of plants or animals)
- absolute cover @ early phenology
- @ N end of section (that abuts 2904A) has more mixture of B. salicifolia ~ S. exigua

Map Unit (name): Cephalanthus occidentalis

Camera/Photos: CAM3 N-W 27-30

Conifer Cover	**<1%**	1-9%	10-19%	20-29%	30-39%	40-49%	50-59%	60-69%	70-79%	80-89%
Hardwood Cover	<1%	**1-9%**	10-19%	20-29%	30-39%	40-49%	50-59%	60-69%	70-79%	80-89%
Total Tree Cover	<1%	**1-9%**	10-19%	20-29%	30-39%	40-49%	50-59%	60-69%	70-79%	80-89%
Shrub Cover	<1%	1-9%	10-19%	20-29%	**30-39%**	40-49%	50-59%	60-69%	70-79%	80-89%
Herb Cover		**<2%**	2-9%	10-39%	40-59%	60-100%				
Non Native Plants	None or not visible	**1**	2	3	Not Applicable					
Development	**None or not visible**	1	2	3	Not Applicable					
Roads/Trails	**None or not visible**	1	2	3	Not Applicable					
Other Impact	Type trash	**1**	2	3	Not Applicable					

WHR Size Class for trees (if tree cover is >/= 10%): **T1** (<1" dbh), **T2** (1-6" dbh), **T3** (6-11" dbh), **T4** (11-24" dbh), **T5** (>24" dbh)

Estimated area of identifiable vegetation viewed: Rough % of polygon viewed from point _____

Is this a "multiple" point assessment? NO **YES** if yes: 2 of 2 points for this polygon

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Reconnaissance Form SSNF: Date 2/11/2014 GPS_Name 4 Surveyor(s) Smt, dbh, jR

CNPS_ID or OBS ID	Dist./Bearing	% Cover T/S/H	WHR CON/HWD	PI Alliance/Field Alliance	UTM / Photo Info
D-2470A	m/ °	17/17/	T4	Q.wiz / Q.wiz	E 246520 N 4115911 / CAM39-12 N-W
Comments: 2- moderate heterogeneity, needs an A added to end of UID in database; cwss: 1					
D-2470B	m/ °	19/21/	T4 T4	Qwiz / Qwiz	E 246568 N 4115837 / 1.9 pdp cam3 13-16 N-W
Comments: split out because of conifer cover & shrub cover; disturbance: cwss-1					
D-2466A	m/ °	2/19/		Q.doug / C.canicatus	E 246609 N 4115971 / cam 3 N-W 17-20 2.1
Comments: maybe this can be pulled out? ± 1 acre; disturbance: cwss-1					
D-2466B	m/ °	15/2/	T4	Q.doug / Q.doug	E 246614 N 4115896 / 2.1 pdp cam 3 N-W 21-24
Comments: disturbance: cwss-1					
D-2905	m/ °	/ /		9401 / 9401	E 246434 N 4115904 / pdp
Comments: disturbance: cwss-1					
D-2806	240 m/ 268 ° 5° incl.	28/+/	X	Q.doug / Q.wiz	E 246369 N 4115899 / pdp
Comments: stand delineated by D.wiz; disturbance: cwss-1					
D-2536	m/ °	/ /		7100 / 7100	E N /
Comments: confirmed					

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Appendix B. Key to Vegetation Mapping Classification of the Central and Southern Sierra Nevada Foothills Region

Class A. Trees evenly distributed and conspicuous throughout stand. In areas where vegetation cover is greater than about 20 percent, tree canopy may be as low as 10 percent over denser layers of shrub and herbaceous species. In areas where vegetation is < 20 percent total cover, trees may cover somewhat < 10 percent (as low as about 8 percent) but are evenly distributed across the stand = **Tree-Overstory Vegetation**

Class B. Woody shrubs or sub-shrubs conspicuous throughout stand. When total vegetation cover is over ca. 20 percent, the tree layer, if present, generally less than 10 percent cover; herbaceous species may total higher cover than shrubs. Shrubs are always at least 10 percent cover. In areas where vegetation is < 20 percent total cover, shrubs may cover < 10 percent, but are evenly distributed across the stand = **Shrub-Overstory Vegetation**

Class C. Non-woody herbaceous vegetation, including graminoid and forb species, dominant throughout stand. When total vegetation cover is greater than about 20 percent, the layers for shrubs, subshrubs, and trees, if present, are of lower cover than herbs and < 10 percent. If total vegetation cover is less than about 20 percent, shrubs, subshrubs, and/or trees may be present but are < 8 percent cover and are not evenly distributed across stand. **= Herbaceous Vegetation**

Class D. Stand is not vegetated with a conspicuous cover of native plants; OR the stand has naturalized or planted species at > 10% cover. This may include more strongly dominated agricultural cover rather than naturalized plants, or a mix of native and non-native plants in urban settings. = **Unvegetated or Urbanized**

Note: Vegetation types identified in the region are included in the key below, based on field samples and observations between 2008 and 2010. Some types found in the study area or *general foothills region, but not mapped in pilot study area, are included with an asterisk (*) after their classification name's map unit number.*

Class A. Tree-Overstory (Woodland / Forest Vegetation)

1. Riparian or wetland stands in cismontane California (west of the Cascades–Sierra Nevada and Transverse–Peninsular crests).

2. Stands with non-natives or semi-natural and planted stands of natives strongly dominant.

Californian Semi-natural Forest and Temperate Tree Developed Vegetation Groups (9500)
***Juglans hindsii* and Hybrids Special and Semi-natural Stands (9502)**

2' Stands with native trees dominant or co-dominant.

3. Forest or woodland stands with high summer temperatures (mostly below 1500 m elevation). Typical winter deciduous trees or tall shrubs in the following genera: *Populus*, *Salix*, *Fraxinus*, *or Platanus*.

Sonoran-Chihuahuan Warm Desert Riparian Woodland Group (3100)

4. Fremont cottonwood (*Populus fremontii*) and/or California Cottonwood (*Platanus racemosa*) has equal or greater than 5% cover in overstory.

5. Fremont cottonwood (*Populus fremontii*) has equal or greater than 5% cover in overstory usually as a dominant or co-dominant in the overstory with willows.

***Populus fremontii* Woodland/Forest Alliance (3110)**

The following associations with cottonwood are found in the region:

***Populus fremontii/Vitis californica* Association**

***Populus fremontii-Salix laevigata* Association**

5' California sycamore (*Platanus racemosa*) has equal or greater than 5% absolute cover in the overstory. Other species may intermix in the overstory, including California buckeye (*Aesculus californica*), California bay (*Umbellularia californica*), and/or Oregon ash (*Fraxinus latifolia*). If sycamore co-occurs with cottonwood, stands are keyed here.

Platanus racemosa* Woodland/Forest Alliance (3310)

The following association is found in the region:

***Platanus racemosa* / (annual grass) Association**

***Platanus racemosa/Toxicodendron diversilobum* Association**

4' Other trees dominant or co-dominant in overstory, and Fremont cottonwood is not at least 5% cover.

6. A willow is dominant in the stands and usually with at least 10% absolute cover.

7. Red willow (*Salix laevigata*) is the dominant in the overstory. Arroyo willow (*Salix lasiolepis*) may occur as a sub- or co-dominant as a shrub or low tree.

***Salix laevigata* Woodland/Forest Alliance (3111)**

The following associations with red willow are found in the region:

***Salix laevigata - Salix lasiolepis* Woodland Association**

***Salix laevigata* Woodland Association**

7' Black willow (*Salix gooddingii*) is dominant in the overstory, though other tall shrubs or low trees may be present and sub-dominant to co-dominant.

***Salix gooddingii* Woodland/Forest Alliance (3112)**

***Salix gooddingii* Association**

6' Valley oak (*Quercus lobata*) or California buckeye (*Aesculus californica*) is dominant or co-dominant with other trees including other oaks.

8. California buckeye is dominant, though valley oak and/or interior live oak (*Quercus wislizeni*) may be present with other riparian species in the overstory or understory.

***Aesculus californica* Woodland/Forest Alliance (1310)**

***Aesculus californica* Riparian Association**

8' Valley oak is dominant or co-dominant with other trees including oaks and alder.

Quercus lobata* Woodland/Forest Alliance (1313)

The following riparian associations with valley oak are found in the region:

***Quercus lobata* / *Rubus armeniacus* Association**
***Quercus lobata* - *Alnus rhombifolia* Association**
***Quercus lobata* / Herbaceous Semi-Riparian Association**

3' Forest or woodland stands usually associated closely to flowing water during the growing season. Generally with cooler and moister soil conditions than previous group, and dominated or characterized by *Alnus, Fraxinus,* or shining willow (*S. lucida*).

North Pacific Lowland Riparian Forest & Woodland Group (3200)*

9' White alder (*Alnus rhombifolia*) is dominant, co-dominant or sub-dominant with other trees such as valley oak and willow.

Alnus rhombifolia* Woodland/Forest Alliance (3210)

The following associations with white alder are found in the region:

***Alnus rhombifolia/Carex* sp. Association**
***Alnus rhombifolia* - *Platanus racemosa* - *Salix laevigata* Association**
***Alnus rhombifolia/Salix exigua* Association**

9. Oregon ash (*Fraxinus latifolia*) is dominant or co-dominant with other trees, including white alder and willows, and ash is at least 5% absolute cover.

Fraxinus latifolia* Woodland/Forest Alliance (3211)

The following associations with white alder are found in the region:

***Fraxinus latifolia/Toxicodendron diversilobum* Association**
***Fraxinus latifolia* - *Alnus rhombifolia* Association**

1'. Stands of upland forests and woodlands, not generally tied to immediate vicinity of permanent water bodies or with prevalent fluvial disturbance and seasonally flooding.

7. Stands with non-native, semi-natural and planted trees which are strongly dominant.

Californian Semi-natural Forest and Temperate Tree Developed Vegetation Groups (9500)

10. Tree overstory dominated by Eucalyptus species.

Eucalyptus* spp. Semi-natural Stands (9501)

7' Stands with native trees dominant or co-dominant with high summer temperatures (mostly below 1500 m elevation).

11. Stands with conifer trees (e.g., pines) trees strontly dominant. If oaks are co-dominant (i.e., oaks usually at least 30% relative cover, then see next step in key).

California Conifer Forest & Woodland Group (1200)

12. Ghost pine (*Pinus sabiniana*) is the dominant tree in the overstory, and it is generally greater than 8% absolute cover in overstory.

***Pinus sabiniana* Woodland/Forest Alliance (1210)**

The following associations with ghost pine are found in the region:

***Pinus sabiniana*/Herbaceous Association**
***Pinus sabiniana/Ceanothus cuneatus* Association**
***Pinus sabiniana/Arctostaphylos viscida* Association**

11' Stands with broad-leaf hardwood species dominant, or co-dominant with conifers.

Californian Broadleaf Forest & Woodland Group (1100)

13. One or more oak (*Quercus* spp.) species are the primary overstory canopy tree, or oaks share dominance with conifers.

14. Blue oak (*Quercus douglasii*) and/or interior live oak is the dominant oak species at greater than 50% relative cover in the overstory. Other trees, such as foothill pine (*Pinus sabiniana*), buckeye (*Aesculus californica*), or other oaks, may be present, but blue and/or interior oak generally have greater cover.

15. Blue oak is dominant or co-dominant with trees such as foothill pine and buckeye. Interior live oak is usually less than 40% in relative cover to blue oak.

***Quercus douglasii* Woodland/Forest Alliance (1311)**

The following associations with blue oak are found in the region:

***Quercus douglasii - Aesculus californica* / Herbaceous Association**
***Quercus douglasii - Quercus wislizeni* / Herbaceous Association**
***Quercus douglasii - Pinus sabiniana* / Herbaceous Association**
***Quercus douglasii* / *Ceanothus cuneatus* / Herbaceous Association**
***Quercus douglasii* / Annual Grass - Forb Sub-Alliance**
***Quercus douglasii* / Perennial Grass - Forb Sub-Alliance**

15' Interior live oak (*Quercus wislizeni*) is dominant or co-dominant at >30% relative cover, with other trees in the overstory. Scrub oak (*Q. berberidifolia*) and canyon live oak (*Q. chrysolepis*), if present, have low cover.

***Quercus wislizeni* Woodland/Forest Alliance (1111)**

The following associations with interior live oak are found in the region:

***Quercus wislizenii - Salix laevigata / Rhamnus tomentella* Association**
***Quercus wislizenii - Quercus douglasii - Aesculus californica* Association**
***Quercus wislizenii - Aesculus californica* Association**
***Quercus wislizeni - Quercus douglasii - Pinus sabiniana* Association**
***Quercus wislizeni - Quercus douglasii* / Herbaceous Association**
***Quercus wislizeni - Pinus sabiniana* Woodland Association**
***Quercus wislizeni* / *Arctostaphylos viscida* Association**
***Quercus wislizenii* / *Heteromeles arbutifolia* Association**
***Quercus wislizenii* / *Toxicodendron diversilobum* Association**

14' Valley oak (*Quercus lobata*) is usually the dominant species in the overstory, though sometimes other oaks or riparian species may be co-dominant.

Quercus lobata* Woodland/Forest Alliance (1313)

The following associations with valley oak are found in the region:

***Quercus lobata* / *Rubus armeniacus* Association**
***Quercus lobata* - *Quercus wislizeni* Association**
***Quercus lobata* / *Rhus trilobata* Association (Provisional)**
***Quercus lobata* / Herbaceous Semi-Riparian Association**

13' California bay (*Umbellularia californica*) and/or California buckeye (*Aesculus californica*) is dominant in the overstory as a tree or tall shrub. If co-dominant with interior live oak (*Quercus wislizeni*), see above and below.

16. California buckeye is dominant as a tree or tall shrub in the overstory though oaks may be present at relatively low cover. If buckeye is co-dominant with blue or interior live oak, see the Blue Oak (*Quercus douglasii*) and Interior Live Oak (*Quercus wislizeni*) Alliances.

***Aesculus californica* Woodland/Forest Alliance (1310)**

The following associations with buckeye are found in the region:

***Aesculus californica* Riparian Association**
***Aesculus californica* / *Toxicodendron diversilobum* / Moss Association**

16' California bay is dominant at a tree or tall shrub in the overstory, and stands may be small in size.

Umbellularia californica* Woodland/Forest Alliance (1110)

The following association with California bay is found in the region:

***Umbellularia californica–Quercus wislizeni* Association**

Class B. Shrubland Vegetation

1. Stands dominated by sclerophyllous temperate shrubs (with leaves hardened by a waxy cuticle). They are dominated by typical chaparral shrubs such as deerbrush (*Ceanothus*) manzanita (*Arctostaphylos*), chamise (*Adenostoma fasciculatum*), scrub oaks (*Quercus*), etc.

2. Stands occur in dry upland slopes and ridges, usually dominated by a *Ceanothus* and/or other chaparral plants.

California Xeric Chaparral Group (4100)

3. Stands dominated by wedgeleaf ceanothus (*Ceanothus cuneatus*) or California yerba santa (*Eriodictyon californicum*) as the dominant or in shared dominance together or other shrubs such as chamise or flannelbush (*Fremontodendron californicum*).

4. Wedgeleaf ceanothus dominant or co-dominant in the shrub canopy.

***Ceanothus cuneatus* Shrubland Alliance (4113)**

The following associations with wedgeleaf ceanothus are found in the region:

***Ceanothus cuneatus* / Herbaceous Association**
***Ceanothus cuneatus* - *Eriodictyon californicum* - (*Fremontodendron californicum*) Association**

4' California yerba santa dominant in the shrub canopy.
Eriodictyon californicum* Shrubland Alliance (4114)
***Eriodictyon californicum*/herbaceous Association**

3' Stands dominated by manzanita or other ceanothus, or they may be co-dominant with chamise, poison oak, or other shrubs.
California Xeric Chaparral and California Mesic & Pre-montane Chaparral Groups

5. Whiteleaf manzanita dominant or co-dominant in stands.
Arctostaphylos viscida* Shrubland Alliance (4112)

The following associations with whiteleaf manzanita are found in the region:
***Arctostaphylos viscida* Association**
***Arctostaphylos viscida - Quercus wislizeni* Association**

5' Chaparral whitethorn (*Ceanothus leucodermis*) dominant or co-dominant in stands.
***Ceanothus leucodermis* Shrubland Alliance (4811)**

The following associations with chaparral whitethorn are found in the region:
***Ceanothus leucodermis* Association**
***Ceanothus leucodermis/Toxicodendron diversilobum* Association**

2' Stands occur in moister settings including north-facing slopes, draws, and stream terraces with one or more dominant shrub species, and tree species may be present though less than 10% cover.
California Mesic & Pre-montane Chaparral Group

6. Birch leaf mountain-mahogany (*Cercocarpus montanus = C. betuloides*) is dominant or co-dominant with other shrubs such as wedgeleaf ceanothus and manzanita.
***Cercocarpus montanus* Shrubland Alliance (4211)**

The following associations with birchleaf mountain-mahogany are found in the region:
***Cercocarpus montanus* Association**
***Cercocarpus montanus - Ceanothus cuneatus* Association**

6' Other plants are dominant to co-dominant in the shrub layer.

7. Hoary coffeeberry (*Frangula californica* ssp. *tomentella = Rhamnus tomentella*) is dominant.
***Frangula californica* Shrubland Alliance (4501)**
***Frangula californica* ssp*. tomentella* Association**

7' Tree anemone (*Carpenteria californica*) is dominant or co-dominant with other shrubs and small trees including California redbud (*Cercis orbiculata = C. occidentalis*), poison oak (*Toxicodendron diversilobum*), buckeye, and others.
Carpenteria californica* Shrubland Special Stands (4220)

1' Stands dominated by other shrubs that are soft-leaved and either evergreen or deciduous. They include both riparian and upland stands.

8. Stands with riparian conditions where shrubs generally tap into moisture or water table for most of the growing season. Shrubs include willows (*Salix),* button-willow (*Cephalanthus occidentalis*), redbud (*Cercis occidentalis*), blackberry (*Rubus*).
North American Warm Desert Riparian Low Bosque & Shrubland Group (6200)

9. One or more willow species (*Salix* spp.) dominate the shrub layer, generally considered to be 5 m or less in height.

10. Arroyo willow (*Salix lasiolepis*) dominant as a shrub or low tree. Other shrubs may be present and sub-dominant to co-dominant.

Salix lasiolepis* Shrubland Alliance (3115)
***Salix lasiolepis /Baccharis salicifolia* Association**

10' Narrow-leaf willow (*Salix exigua*) dominant or co-dominant. Other willow species may be present and sub-dominant with low cover.

***Salix exigua* Shrubland Alliance (6211)**
***Salix exigua* Association**

9' Other riparian species are dominant or co-dominant in the shrub layer.

11. Button-willow (*Cephalanthus occidentalis*) forms an open to intermittent shrub canopy along streambeds and rivers.

***Cephalanthus occidentalis* Shrubland Alliance (6214)**
***Cephalanthus occidentalis* Association**

11' Mulefat (*Baccharis salicifolia*) is dominant in the open to intermittent shrub overstory.

***Baccharis salicifolia* Shrubland Alliance (6210)**
***Baccharis salicifolia* Association**

8' Stands in upland or moist conditions including on rocky, volcanic or granitic slopes.

12. Stands dominated by poison oak (*Toxicodendron diversilobum*), elderberry (*Sambucus*), or basket bush (*Rhus trilobata*).

13. Poison oak dominates the shrub overstory. Other shrubs such as wedgeleaf ceanothus, and blue elderberry (*Sambucus nigra*) may intermix at low cover.

Toxicodendron diversilobum* Shrubland Alliance (6301)

The following associations occur in the region:

***Toxicodendron diversilobum/*herbaceous Association**
***Toxicodendron diversilobum–Philadelphus lewisii* Association**

13' Other shrubs dominate.

14. Mexican/Blue elderberry (*Sambucus nigra=Sambucus mexicana*) dominates the shrub canopy, especially on rocky substrates.

Sambucus nigra* Shrubland Alliance (6302)
***Sambucus nigra* Association**

14' Basket bush dominates, especially adjacent to oak woodlands/forests on mesic hillslopes and stream terraces.

Rhus trilobata* Provisional Shrubland Alliance (6601)

12' Stands dominated by other soft-leaved (non-sclerophyll) shrubs (including *Eriodictyon, Lupinus, Lotus* spp., *Eriogonum fasciculatum*), often transitional with grasslands or seral in disturbed areas such as along road-cuts, steep slopes, stream terraces, etc.

Central & Southern California Coastal Sage Scrub Group (4700)

15. California yerba santa (*Eriodictyon californicum*) dominant in the shrub canopy.

Eriodictyon californicum* Shrubland Alliance (4114)
***Eriodictyon californicum/* herbaceous Association**

15' Silver bush lupine (*Lupinus albifrons*) and/or Deerweed (*Lotus scoparius*) dominant or co-dominant together or with other shrubs in the shrub canopy.

16. Silver bush lupine dominant or co-dominant in stands with other shrubs.
***Lupinus albifrons* Shrubland Alliance (4710)**

The following associations with silver bush lupine are found in the region:
***Lupinus albifrons* Association**
***Lupinus albifrons - Lotus scoparius* Association**

16' Deerweed (*Lotus scoparius*) dominant in stands.
***Lotus scoparius* Shrubland Alliance (4711)**
***Lotus scoparius* Association**

Class C. Herbaceous Vegetation

Herbaceous stands found in wetland settings or in seasonally moist to dry areas. Includes marshes, meadows, upland grasslands, mesa tops, swales, and vernal pools (water or wet ground present throughout the growing season). Stand identification is contingent upon appropriate phenology.

1. Stands are passively irrigated pasture lands that mostly contain non-native herbs.
Western North American Semi-natural Wet Shrubland, Meadow & Marsh Group (7102)*

1' Stands are not passively irrigated; either upland or naturally riparian and/or wetland.

2. Stands are wetland with soils saturated or moist through the growing season, not including vernal pools.

3. Stands of tall obligate wetland herbaceous species such as bulrushes (*Schoenoplectus, Scirpus)* and cattails (*Typha)* that are typically emergent from water at least in the early portion of the growing season.
Arid West Interior Emergent Marsh Group (7300)

4. A species of cattail dominates the herbaceous overstory.
***Typha* (*angustifolia, latifolia, domingensis*) Herbaceous Alliance (7310)**
***Typha latifolia* Association**

3' Stands of largely perennial wetland graminoids or forbs, but not usually perpetually wet or saturated through the summer months, which are generally shorter-stature and less tied to permanent or semi-permanent bodies of water than above group.

5. Stands of native obligate or facultative wetland perennial plants (including *Carex barbarae, Juncus balticus, J. mexicanus, Leymus triticoides, Mimulus guttatus, Muhlenbergia rigens*) with typically moist soils through the growing season due to flooding or high water table.
Vancouverian Freshwater Wet Meadow & Marsh Group (7200)

6. Stands with deergrass (*Muhlenbergia rigens*) dominant or co-dominant.
Muhlenbergia rigens* Alliance (7210)

6' Stand where either smartweed (*Persicaria, Polygonum* species) and/or cocklebur (*Xanthium strumarium*) dominant to codominant.

Temperate Pacific Freshwater Wet Mudflat Group (7250)*
Persicaria lapathifolia–Xanthium strumarium* Alliance (7251)

5' Stands of native wetland graminoids and forbs (including *Lasthenia, Deschampsia danthonioides, Downingia, Eleocharis macrostachya, Eryngium, Limnanthes, Sidalcea, Trifolium,* etc.) usually with high annual plant cover and with typically vernally wet soils, which dry through the growing season, including vernal pools and swales that meet the minimum mapping unit (MMU).

California Vernal Pool Group (7600)*
Various alliances exist in the study area (see classification table in Appendix D)

2' Stands are upland or vernally moist with soils drying during the growing season.

6. Stands are upland grasslands with some native plant component, including rocky volcanic tablelands with grasses and forbs, and the typical "California Annual Grasslands".

Californian Annual & Perennial Grasslands Macrogroup (7100)
Various groups and alliances exist in the study area (see classification table in Appendix D)

6' Stands are complexes with vernal pool and grassland vegetation, thus, consisting of two types listed above (the 7600 but below MMU, and the 7100).

California Vernal Pool and Annual & Perennial Grassland Matrix Mapping Unit (7400)

Class D. Unvegetated or Urbanized

1. Areas impacted by agriculture and urban development.

2. Agriculture including orchards, hayfields without fallow annual grasses dominating, and horse ranches (including corrals, tracks, associated farm buildings).

Agriculture (9200)

2' Developed areas including urban, suburban, and isolated residential areas with groups of houses, areas with commercial, industrial, and extractive land uses, and areas cleared for potential development.

Built up & Urban Disturbance (9300)

3. Fully developed areas with build up and disturbance, originating from an intensely developed urban core, and includes large built-up areas usually composed of 7-13 houses per 8 acre and at least 1 square mile (640ac) in size.

Urban Window (9310)

1' Areas of open water, rocky substrates or streams with little or no vegetation cover.

4. Areas with little or no vegetation in upland habitats.

5. Areas with rock outcrops, rocky slopes, canyons, and cliffs with sparse vegetation cover.

Cliffs & Rock Outcroppings (9401)

5’ Areas appearing sparsely vegetated such as recently cleared areas.

Undefined Areas with Little or No Vegetation (9400)

4’ Areas of riparian/lakeshore habitats with little/no vegetation, or areas with open water.

6. Areas along riparian streams or along lakeshores.

7. Riparian stream corridors with open water and perennial flooding.

Perennial Stream Channels (9801)

7’ Riparian and lakeshore areas with sparse vegetation cover, and usually with seasonal flooding.

Riverine & Lacustrine Flats & Streambeds (9402)*

6’ Areas of open water including lakes, reservoirs, and ponds.

8. Large man-made lakes and other larger basins with water.

Reservoirs (9802)

8’ Smaller man-made ponds as well as natural lake basins with water.

Small Earthen Dam Ponds & Natural Lakes (9803)

Appendix C. Map Metadata and Mapping Rules for the Polygon Attributes

Primary Items in the Polygon Attribute Geodatabase

ITEM NAME	DATA TYPE	COLUMN WIDTH	OUTPUT (# characters)	DOMAIN
ObjectID		4	4	
VegCode	N	8	4	VegCode
NVCS_level	T	15	15	
Heterogeneity	I	4	1	Heterogen
ConifCover	I	2	2	Cover10pct
HdwdCover	I	2	2	Cover10pct
TreeCover	I	2	2	Cover10pct
ShrubCover	I	2	2	Cover10pct
HerbCover	I	4	2	Cover
NonNative_Plants	I	1	1	HiLo_1
Roads_Trails	I	1	1	HiLo_1
OtherImpact	T	20	20	
Level_OtherImpact	I	2	1	HiLo_1
Method_ID	I	4	1	Methods
UID	T	10	10	
Shape_Area	N	8	14	
Conif_WHR_Size	I	2	1	CWHR
Hdwd_WHR_Size	I	2	1	CWHR
Riparian	T	5	1	YesNo
Sambucus	T	5	1	YesNo

Data Type Codes

T = Text
N = Numeric
I = Integer

Primary Item Name and Basic Attribute Information

VegCode: Mapping code for vegetation type or other type, including water and land use
ConifCover: Cover (birdseye view) of conifers in polygon
HdwdCover: Cover (birdseye view, not overlapping with taller conifers) of hardwoods in polygon
TreeCover: Cover (birdseye view) of trees in polygon (combination of both conifer and hardwood cover)
ShrubCover: Cover (birdseye view, not overlapping with trees) of shrubs in polygon
HerbCover: Cover (birdseye view, not overlapping with woody plants) of herbs in polygon
Riparian: Riparian modifier (see map rules for more information)
Sambucus: *Sambucus nigra* modifier (see map rules for more information)
UID: unique record number for each polygon
Shape_Area: Area in square meters
Other items: See below in Attribute table for more information

File Specifications

ArcGIS Layer Format
Personal Geodatabase

Coordinate System

NAD83 UTM projection – Meters, Zone 11

General Specifications for Mapping and Attributing Polygons

Mapping Rules	Specifications of the Rules
Minimum Mapping Unit (MMU)	0.5 acres for localized vegetation stands and special types (including wetland, vernal pool, riparian, pond/earthen dam, or other types)
	1 acre for typical vegetation types (distinguished largely by overstory layer, and vegetation is not a specialized type)
	There is a 1 acre grid to compare to MMU and a 50 acre grid to track goals for day (average 250 acre a day mapping goal).
Polygon breaks (based on attributes other than map unit)	3 acres MMU for cover class break in overstory cover (when adjacent vegetation is of the same map unit but cover class is different)
	5 acres MMU for cover class break in understory cover (when adjacent vegetation is of the same map unit)
	5 acres for non-floristic breaks (e.g., height, clearing, other urban features or for impact changes of 2 classes difference (so only between Hi and Lo)
Delineation	Scale of 1:2000 to 1:4000 (can vary)
Imagery	Base imagery is NAIP 2012 though other sources may be used to interpret
Cover Estimates	Percent of Birdseye Cover = what can be seen on an air photo image. Cover of understory layers obscured by overstory layers is not counted.
Other mapping decisions	Note for mapping tree type, your polygon must have >10% canopy cover of trees, and for shrub types, trees must be <10% cover and shrubs >10% cover
	For stands containing pine and oaks as the dominants, an oak alliance is typically mapped
	For most mixed stands of blue oak (QUDO) and interior live oak (QUWI), interior live oak alliance is attributed
	Mean separation distance for including peripheral trees in oak-dominated polygons = average separation distance within the stand
	Threshold for the attribution of wedgeleaf ceanothus alliance (CECU) is 30% relative cover of the ceanothus

Attributes	Additional Specifications for Attributes
Heterogeneity	Internal heterogeneity of the map unit type (e.g. alliance or vegetation type) within the polygon: <5%, 5-40%, and >40%
Cover (bird's eye percent cover)	Tree and shrub layers: Estimated in 10% cover class intervals. Result is midpoint of each class (e.g., 5 for 1-10%)
	For hardwood cover, estimate cover not obscured by conifer trees.
	Herb layer: Estimate in the WHR cover classes 1 = <2%, 2 = 2-9%, 3 = 10-39%, 4 = 40-59%, 5 = 60-100%
	For shrub and herb cover: estimated cover not obscured by an overstory (such as trees over herbs)
	Herb cover classes for woody and upland herbaceous types are typically 2-9% and 10-39%
	Herb cover classes for vernal pool types are usually 40-59.9% or 60-100%
Non-Native Plants	Low = Any polygon with <33% relative cover of non-native to native plants
	Moderate = Any with >33-66% relative cover
	High = Any with >66% relative cover
Roads and Trails	Based on percent cover of road and/or trail disturbance
	Low = 1-33% of polygon affected by disturbance
	Medium = 33% - 66% of polygon affected by disturbance
	High = 66% - 100% of polygon affected by disturbance
Other Impact	Other means of unnatural disturbance visible including the following:
	OHV activity, Disking/grading, Development, Erosion/runoff, Ungulate trails, Riparian modification, none
Level of Other Impact	Choose impact levels using same disturbance categories as Roads and Trails (amount of area affected/impacted).
Method_ID	Method for digitizing/assessing the polygons characteristics:
	1 = RA or Releve field data (within polygon) 3 = Field reconnaissance (after polygon delineation) 4 = Photo interpretation 5 = other information (e.g ancillary data layer) 6 = Pre-map reconnaisance (before polygon delineation, it may be based on a sample point that is not within the polygon OR adjacent alliance of a survey)
DB_ID	If Method is based on an existing sample, list the sample id of the survey that you used as a reference

Attributes	Additional Specifications for Attributes
Comments	Comments during digitizing, reconnaissance, and/or explanation of low or medium confidence
Confidence	Applies specifically to the VegCode attribute, with comments entered to clarify low or medium ranking
CWHR	Crosswalk to classification names of the Department of Fish and Game's California Wildlife Habitat Relationships system. Translation for the tree map units required inspection of hardwood and conifer types/covers
Riparian	yes/no. Yes, if a stream is present in the polygon as based on reconnaissance data, rapid assessment/relevé data, or Hydrologic or DRG notation. This is used to show that a larger polygon has a riparian component.
Conifer and Hardwood WHR Size	Tree size based on California Wildlife Habitat Relationships (WHR) size classes, based on crown diameter and cover, including the following: 1=seedling, 2=sapling, 3=pole, 4=small, 5=medium-large, 6 = multi layered, 0=not determined/not applicable when tree cover is <10% These are the same as the T codes on the combined datasheet, see below for more info.
Formation, Macrogroup and Group	Higher level vegetation classification units per the National Vegetation Classification System hierarchy, associated with the VegCode
CNPS_ID	A temporary identification of a polygon that was used in the field check process.
Delineater, Attributer, QCer	These are names of the staff (Domain = Staff) who delineated, attributed, or Quality Checked the polygon.
NVCS_level	the level in the NVC hierarchy to which the polygon is mapped

Additional WHR Size Class Information for Tree Polygons

WHR Classes	Conifer crown diameter	Hardwood crown diameter
1 = Seedlings (< 1")	n/a	n/a
2 = Saplings (1-6")	n/a	<15'
3 = Pole (6-11")	<12'	15–29.9'
4 = Small (11-24")	12–24'	30–45'
5 = Medium – Large (> 24")	>24'	>45'
6 = Multi Layered (Medium to large canopy trees over smaller trees in cover/densities >60%)	Size class 5 trees over a distinct layer of size class 4 or 3 trees. Total tree canopy exceeds 60% closure. (Layers must have ≥10.0% canopy cover and distinct height separation)	
0 = Not Determined / Not Applicable		

Appendix D. Vegetation Mapping Classification for the Pilot Mapping Area in the Southern Sierra Nevada Foothills

The floristic/mapping classification is arranged in structural order (tree, shrub and herbaceous life forms) and in hierarchical order, beginning with the broader map class of the Formation, and ending in the finer map class of the Alliance (per the National Vegetation Classification hierarchy). An example of the hierarchy's organization is displayed before the classification.

Formations may occasionally repeat across shrub and herbaceous life forms. Vegetation types identified in the region are included in the key below, based on field samples and observations between 2008 and 2010. Some types found in the study area or general foothills region, but not mapped in pilot study area, are included with an asterisk (*).

LEVEL 1 FORMATION CLASS

Level 2 or 3 Formation Subclass or Formation

Levels 4, 5, or 6: Divisions, Macrogroups, & Groups or Other Non-hierarchy Land-Use or Land-Cover Types

Level 7: California Scientific Name (Alliance) or Other Map Units

Level 1.A. Mesomorphic Tree Vegetation (Forest and Woodland) Formation Class

1000 – Warm Temperate Forest Formation

1100, 1300 – California Broadleaf Forest & Woodland Group

1310 – *Aesculus californica*
1311 – *Quercus douglasii*
1313 – *Quercus lobata**
1111 – *Quercus wislizeni*
1312 – *Quercus kelloggii**
1410 – *Quercus chrysolepis**
1110 – *Umbellularia californica**

1200 – California Conifer Forest & Woodland Group

1210 – *Pinus sabiniana*

3000 – Temperate Flooded and Swamp Forest Formation

3100 – Sonoran-Chihuahuan Warm Desert Riparian Woodland Group

3110 – *Populus fremontii*
3111 – *Salix laevigata*
3112 – *Salix gooddingii*
3310 – *Platanus racemosa**

3200 –North Pacific Lowland Riparian Forest & Woodland Group

3210 – *Alnus rhombifolia**
3211 – *Fraxinus latifolia**

Level 1.B. Mesomorphic Shrub and Herb Vegetation (Shrubland and Grassland) Formation Class

4000 (except 4500) – Mediterranean Scrub & Grassland Formation

4100 – California Xeric Chaparral Group

4111 – *Adenostoma fasciculatum**
4112 – *Arctostaphylos viscida**
4113 – *Ceanothus cuneatus*
4114 – *Eriodictyon californicum**

4700 Central & Southern California Coastal Sage Scrub Group

4710 – *Lupinus albifrons*
4711 – *Lotus scoparius*

4200, 4500 and 4800 – California Mesic & Pre-montane Chaparral Group

4211 – *Cercocarpus montanus*
4220 – *Carpenteria californica**
4501 – *Frangula californica (*including *F. c.* ssp*. tomentella*)
4811 – *Ceanothus leucodermis*

6000 (except 6200) – Temperate Grassland, Meadow & Shrubland Formation

6100 – Central Rocky Mountain Montane-Foothill Dry Deciduous Shrubland Group

6110 – *Ceanothus integerrimus**

6300 – California North Coastal & Mesic Scrub Group

6301 – *Toxicodendron diversilobum*[*]

6600 – Central Rocky Mountain Montane-Foothill Dry Deciduous Shrubland Group

6611 – *Rhus trilobata**

6200 – Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland Formation

6200 – North American Warm Desert Riparian Low Bosque & Shrubland Group

6210 – *Baccharis salicifolia*
6211 – *Salix exigua*
6214 – *Cephalanthus occidentalis*
6302 – *Sambucus nigra**

7100 – Mediterranean Scrub & Grassland Formation

7100 – California Annual & Perennial Grassland Macrogroup (including alliances below, which would be mapped in this macrogroup)

Amsinckia (*menziesii, tessellata*)[*]
Bromus (*hordeaceus, diandrus*)*–Brachypodium distachyon*[*]
Lasthenia californica–Plantago erecta–Vulpia microstachys[*]
Lotus purshianus[*]
*Nassella cernua**
Plagiobothrys nothofulvus[*]

7102 – Western North American Semi-natural Wet Shrubland, Meadow & Marsh Group*

7200 to 7600 – Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland Formation

7200 – Vancouverian Freshwater Wet Meadow & Marsh Group
Eleocharis acicularis[*]
Eleocharis macrostachya[*]
Juncus effusus[*]
7210 – *Muhlenbergia rigens*[*]

7250 – Temperate Pacific Freshwater Wet Mudflat Group
7251 – *Persicaria lapathifolia–Xanthium strumarium*[*]

7300 – Arid West Interior Emergent Marsh Group
7310 – *Typha (angustifolia, latifolia, domingensis*)

7400 –Californian Vernal Pool and Annual & Perennial Grassland Matrix Mapping Unit (including alliances in 7100 and 7600 groups)

7600 – California Vernal Pool Group (including alliances below, which would be mapped in this group)
Lasthenia fremontii – Downingia (*cuspidata*)[*]
Layia fremontii – Achyrachaena mollis[*]
Montia fontana – Sidalcea calycosa[*]
Trifolium variegatum[*]

Level 1.C. Sparsely Vegetated, Water, & Urbanized Land-Use and Land-Cover Types

9200 – Agriculture (Without fallow annual grasses dominating)

9300 – Built Up & Urban Disturbance (includes development, mines and borrow pits)
9310 – Urban Window

9400 – Undefined areas with little or no vegetation
9401 – Cliffs & Rock Outcroppings
9402 – River & Lacustrine Flats & Streambeds*

9500 – Californian Semi-natural Forest and Temperate Tree Developed Vegetation Groups
9501 – *Eucalyptus* spp.*
9502 –*Juglans hindsii, Juglans regia,* and hybrids

9800 – Water
9801 – Perennial Stream Channel
9802 – Reservoirs
9803 – Small Earthen Dam Ponds and Natural Lakes