

# **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.

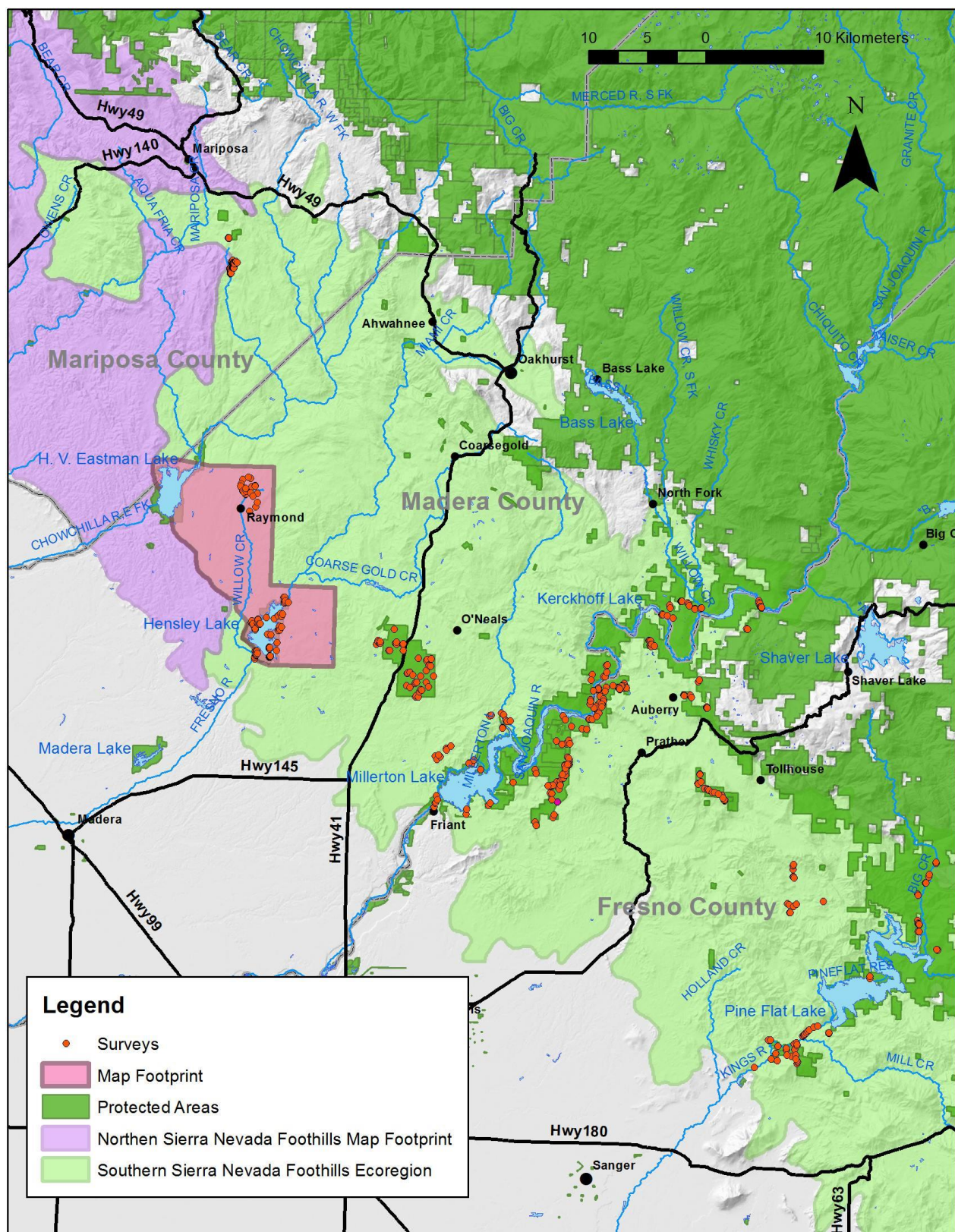
The region contains a variety of habitat types, including rolling hills of oak woodlands and forests, valleys with vernal pool and grassland matrices, rock outcrops of locally rare shrub types, pine woodlands, deciduous riparian woodlands, ceanothus chaparral, and lupine scrub. Many seeps, perennial 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).







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](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.

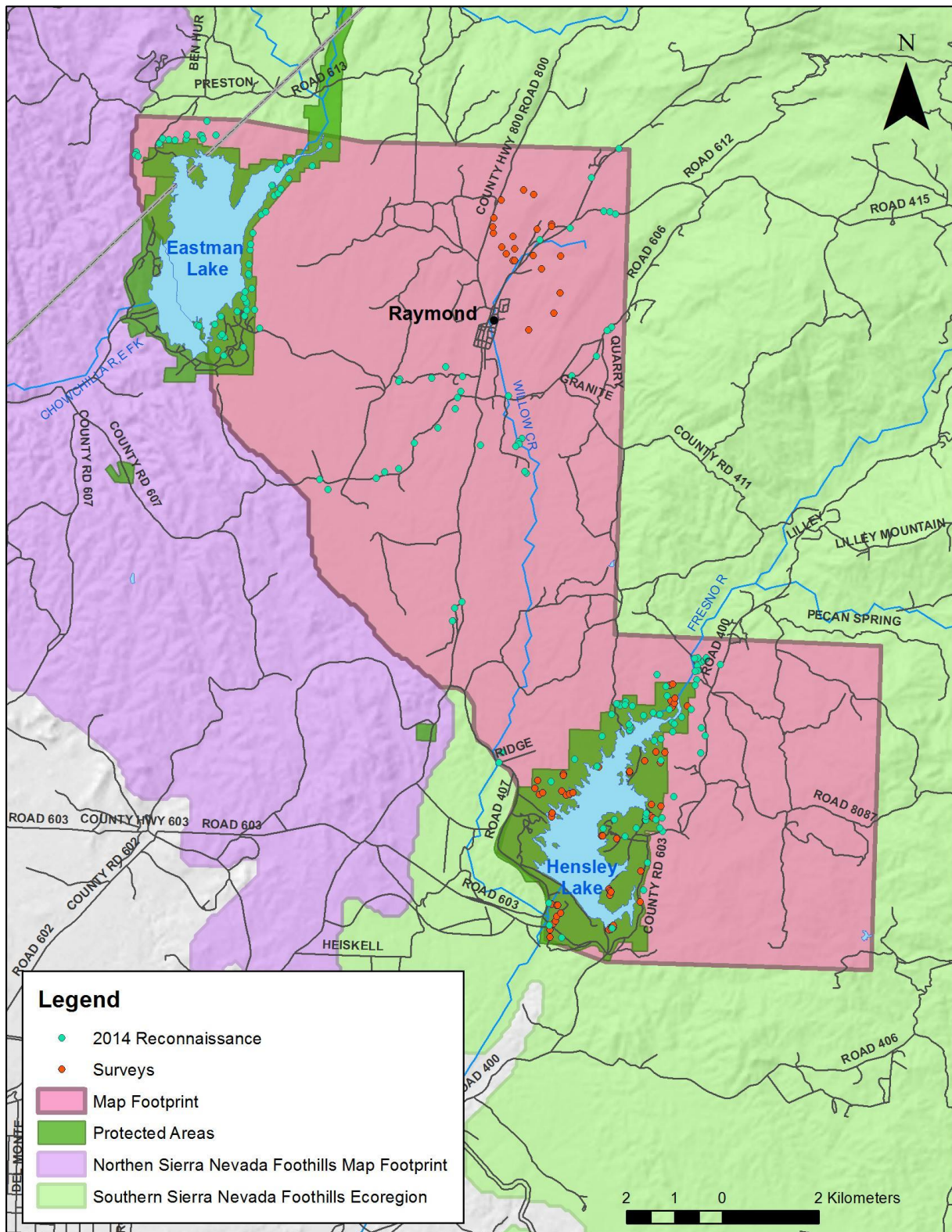
As shown in Figures 3 & 4 and Table 2, a total of 34,625 acres were mapped. The oak woodland map units have the largest aerial coverage (about 17,500 acres) in the mapping area, followed by annual and perennial grasslands (about 12,700 acres). A total number of 4,310 polygons are delineated, and the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

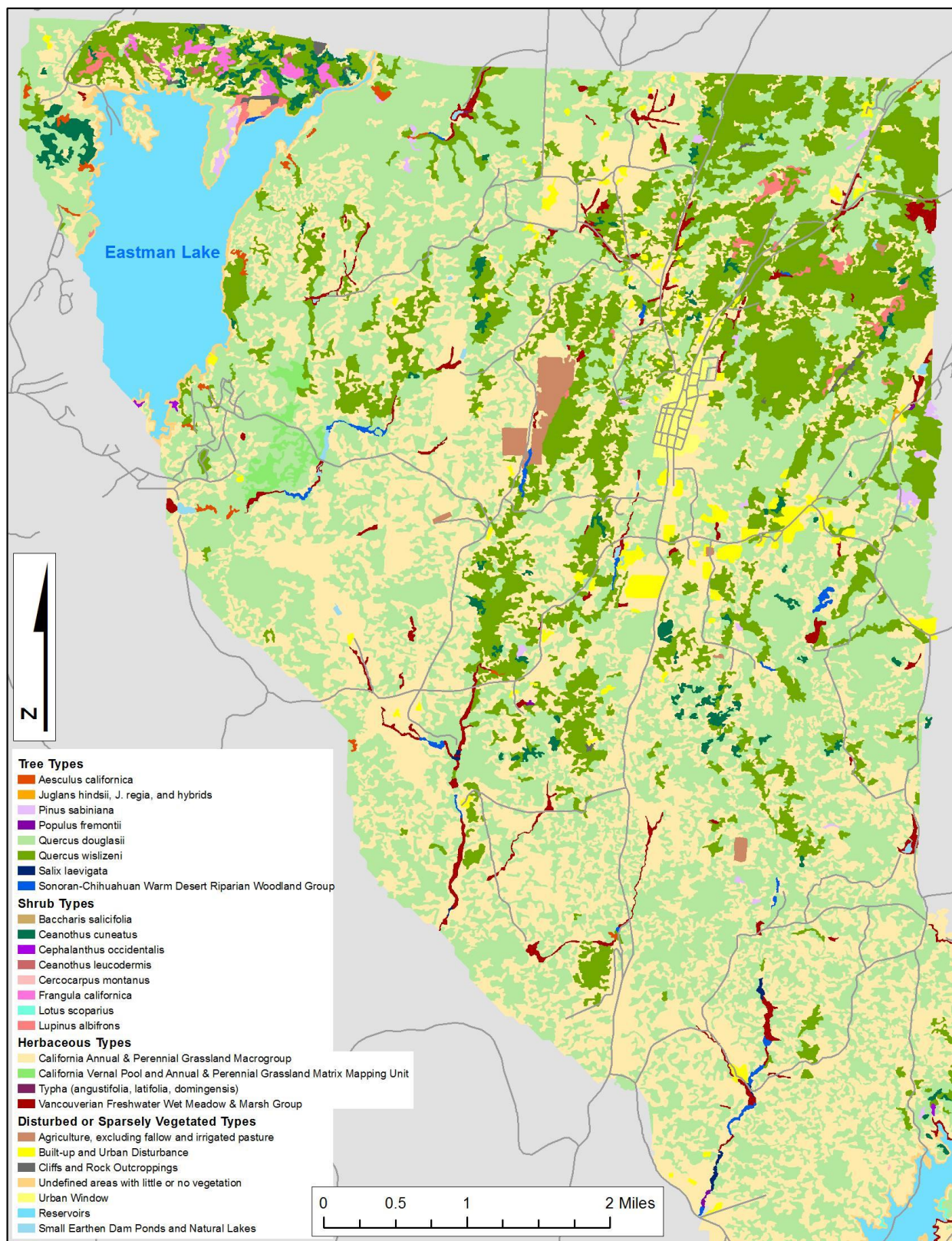
The resulting vegetation map includes seven native tree alliances, one semi-natural tree type, nine shrub alliances, two woody group-level mapping units, three general herbaceous groups, one herbaceous alliance, and eight land-use or land-cover types. This map and field data will

serve as baseline information to assess future conservation efforts, adaptively manage resources, assess impacts of climate change, and effect other land-use decisions.



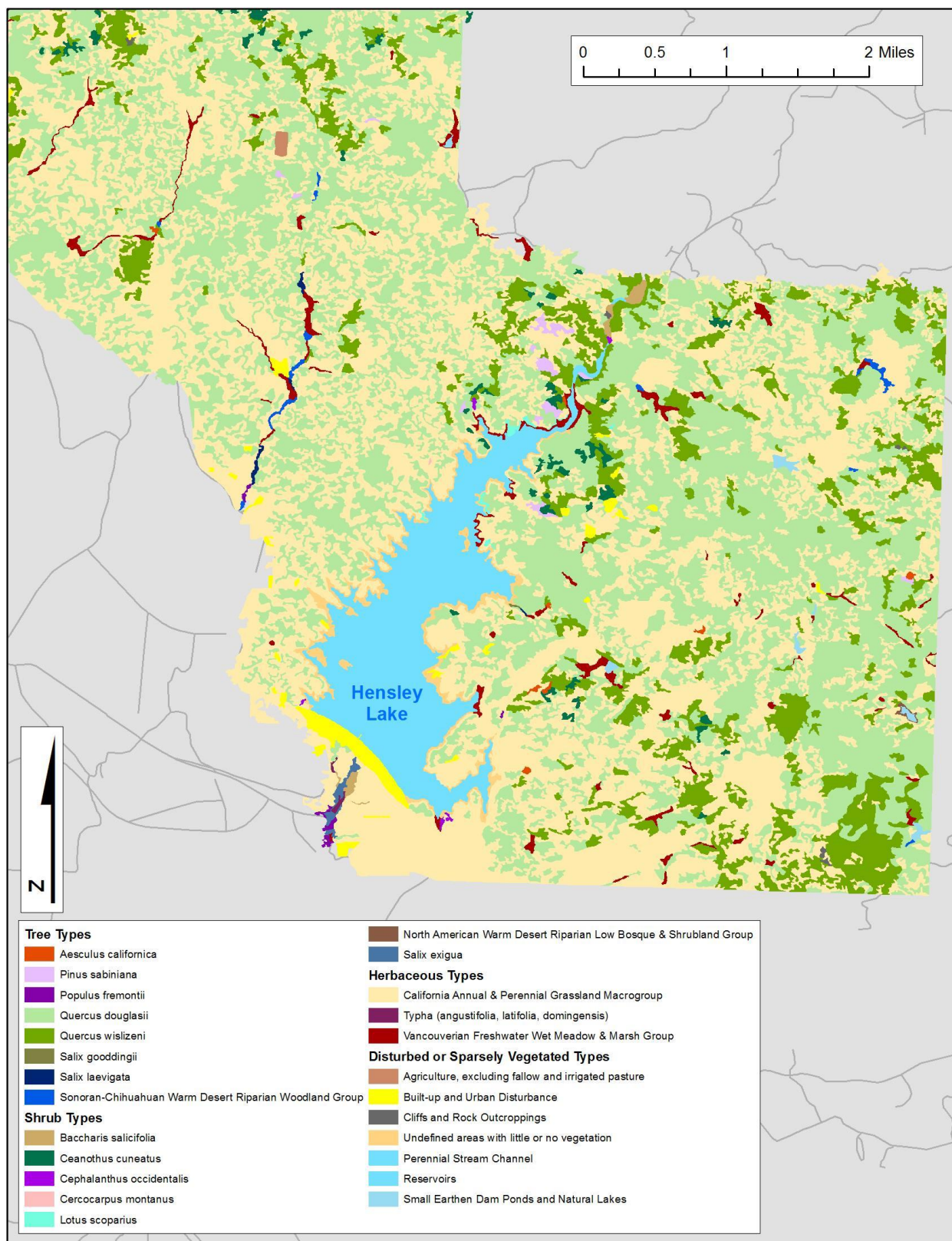
**Figure 2.** Locations of vegetation stand/plot surveys and reconnaissance surveys in the pilot mapping area





**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

| <b>VegCode</b> | <b>Alliance or Other Map Unit</b>   | <b>WHR Name<br/>(<i>primary</i>)</b> | <b>WHR Name<br/>(<i>secondary</i>)</b>           |
|----------------|---|--------------------------------------|--|
| 1111           | <i>Quercus wislizeni</i> Alliance   | Blue Oak Woodland                    | Blue Oak–Foothill Pine, Valley Foothill Riparian |
| 1210           | <i>Pinus sabiniana</i> Alliance   | Blue Oak–Foothill Pine               |  |
| 1310           | <i>Aesculus californica</i> Alliance  | Blue Oak Woodland                    | Blue Oak–Foothill Pine                           |
| 1311           | <i>Quercus douglasii</i> Alliance   | Blue Oak Woodland                    | Blue Oak–Foothill Pine                           |
| 3100           | Sonoran-Chihuahuan Warm Desert Riparian Woodland Group                      | Valley Foothill Riparian             |  |
| 3110           | <i>Populus fremontii</i> Alliance   | Valley Foothill Riparian             |  |
| 3111           | <i>Salix laevigata</i> Alliance   | Valley Foothill Riparian             |  |
| 3112           | <i>Salix gooddingii</i> Alliance  | Valley Foothill Riparian             |  |
| 4113           | <i>Ceanothus cuneatus</i> Alliance  | Mixed Chaparral                      |  |
| 4211           | <i>Cercocarpus montanus</i> Alliance  | Mixed Chaparral                      |  |
| 4501           | <i>Frangula californica</i> Alliance  | Mixed Chaparral                      |  |
| 4710           | <i>Lupinus albifrons</i> Alliance   | Coastal Scrub                        | Mixed Chaparral                                  |
| 4711           | <i>Lotus scoparius</i> Alliance   | Coastal Scrub                        | Mixed Chaparral                                  |
| 4811           | <i>Ceanothus leucodermis</i> Alliance                                       | Mixed Chaparral                      |  |
| 6200           | North American Warm Desert Riparian Low Bosque & Shrubland Group            | Valley Foothill Riparian             |  |
| 6210           | <i>Baccharis salicifolia</i> Alliance                                       | Valley Foothill Riparian             | Freshwater Emergent Wetland                      |
| 6211           | <i>Salix exigua</i> Alliance  | Valley Foothill Riparian             |  |
| 6214           | <i>Cephalanthus occidentalis</i> 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           | <i>Typha (angustifolia, latifolia, domingensis)</i> 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                                |  |

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

**Table 2.** Total acreage and number of polygons mapped

| <b>VegCode</b>   | <b>Vegetation Type</b>  | <b>Acreage mapped</b> | <b># Polys mapped</b> |
|------------------|---|-----------------------|-----------------------|
| 1111             | <i>Quercus wislizeni</i> Alliance   | 4,713                 | 801                   |
| 1210             | <i>Pinus sabiniana</i> Alliance   | 87                    | 29                    |
| 1310             | <i>Aesculus californica</i> Alliance  | 45                    | 25                    |
| 1311             | <i>Quercus douglasii</i> Alliance   | 12,791                | 1,543                 |
| 3100             | Sonoran-Chihuahuan Warm Desert Riparian Woodland Group                      | 58                    | 29                    |
| 3110             | <i>Populus fremontii</i> Alliance   | 11                    | 7                     |
| 3111             | <i>Salix laevigata</i> Alliance   | 10                    | 8                     |
| 3112             | <i>Salix gooddingii</i> Alliance  | 1                     | 1                     |
| 4113             | <i>Ceanothus cuneatus</i> Alliance  | 322                   | 127                   |
| 4211             | <i>Cercocarpus montanus</i> Alliance  | 0.4                   | 1                     |
| 4501             | <i>Frangula californica</i> Alliance  | 52                    | 9                     |
| 4710             | <i>Lupinus albifrons</i> Alliance   | 78                    | 24                    |
| 4711             | <i>Lotus scoparius</i> Alliance   | 12                    | 7                     |
| 4811             | <i>Ceanothus leucodermis</i> Alliance                                       | 6                     | 3                     |
| 6200             | North American Warm Desert Riparian Low Bosque & Shrubland Group            | 3                     | 1                     |
| 6210             | <i>Baccharis salicifolia</i> Alliance                                       | 24                    | 7                     |
| 6211             | <i>Salix exigua</i> Alliance  | 15                    | 3                     |
| 6214             | <i>Cephalanthus occidentalis</i> Alliance                                   | 8                     | 7                     |
| 7100             | California Annual & Perennial Grassland Macrogroup                          | 12,682                | 1,317                 |
| 7200             | Vancouverian Freshwater Wet Meadow & Marsh Group                            | 365                   | 151                   |
| 7310             | <i>Typha (angustifolia, latifolia, domingensis)</i> 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             | <i>Juglans hindsii</i> , <i>J. regia</i> , 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                    |
| <b>Sum Total</b> |   | <b>34,625</b>         | <b>4,310</b>          |

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## VI. APPENDICES

### Appendix A. CNPS Field Sampling Forms

| Field Verification Form: SSNF Vegetation Mapping (02/2014)  |   |         |        |                     |         |        |         |                        |  |
|---|---|---------|--------|---------------------|---------|--------|---------|------------------------|--|
| Surveyors (circle recorder): <u>Smt. di. NR</u>   |   |         |        |                     |         |        |         | Date: <u>2/11/2014</u> |  |
| Waypoint ID:<br><u>D-2804B</u>  | GPSName: <u>4</u> Projected? Yes / No / Base If yes, enter base Waypoint ID:<br>Bearing: _____ (degrees) Distance: _____ (meters) |         |        |                     |         |        |         |                        |  |
| Polygon UID:<br><u>D-2804</u>   | 'Base' UTM: UTME <u>246431</u> UTMN <u>4115628</u> PDOP: +/- <u>1.7</u><br>Projected UTM: UTME _____ UTMN _____                   |         |        |                     |         |        |         |                        |  |
| Strata  | Species   | % cover | Strata | Species             | % cover | Strata | Species | % cover                |  |
| S   | Cephalanthus occ.   | 20      | S      | Bradburia salis.    | 3       |        |         |                        |  |
| S   | Salix exigua  | 12      | T      | Fraxinus (velutina) | 1       |        |         |                        |  |
| T   | Salix (laev.)   | +       |        |                     |         |        |         |                        |  |
| <p>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)</p> <p><u>absolute cover @ early phenology</u><br/><u>@ N end of section (that club 2804A) has more mixture of B. salis. folia - S. exigua</u></p> |   |         |        |                     |         |        |         |                        |  |
| Map Unit (name): <u>Cephalanthus occidentalis</u>   |   |         |        |                     |         |        |         |                        |  |
| Camera/Photos: <u>CAM3 N-W 27-30</u>  |   |         |        |                     |         |        |         |                        |  |
| Conifer Cover   | <u>&lt;1%</u> 1-9% 10-19% 20-29% 30-39% 40-49% 50-59% 60-69% 70-79% 80-89%  |         |        |                     |         |        |         |                        |  |
| Hardwood Cover  | <u>&lt;1%</u> <u>1-9%</u> 10-19% 20-29% 30-39% 40-49% 50-59% 60-69% 70-79% 80-89%   |         |        |                     |         |        |         |                        |  |
| Total Tree Cover  | <u>&lt;1%</u> <u>1-9%</u> 10-19% 20-29% 30-39% 40-49% 50-59% 60-69% 70-79% 80-89%   |         |        |                     |         |        |         |                        |  |
| Shrub Cover   | <u>&lt;1%</u> 1-9% 10-19% 20-29% <u>30-39%</u> 40-49% 50-59% 60-69% 70-79% 80-89%   |         |        |                     |         |        |         |                        |  |
| Herb Cover  | <u>&lt;2%</u> 2-9% 10-39% 40-59% 60-100%  |         |        |                     |         |        |         |                        |  |
| Non Native Plants   | None or not visible <u>1</u> 2 3 Not Applicable   |         |        |                     |         |        |         |                        |  |
| Development   | None or not visible <u>1</u> 2 3 Not Applicable   |         |        |                     |         |        |         |                        |  |
| Roads/Trails  | None or not visible <u>1</u> 2 3 Not Applicable   |         |        |                     |         |        |         |                        |  |
| Other Impact  | Type <u>trash</u> <u>1</u> 2 3 Not Applicable   |         |        |                     |         |        |         |                        |  |
| WHR Size Class for trees (if tree cover is >= 10%): <u>T1</u> (<1" dbh), <u>T2</u> (1-6" dbh), <u>T3</u> (6-11" dbh), <u>T4</u> (11-24" dbh), <u>T5</u> (>24" dbh)  |   |         |        |                     |         |        |         |                        |  |
| Estimated area of identifiable vegetation viewed: Rough % of polygon viewed from point  |   |         |        |                     |         |        |         |                        |  |
| Is this a "multiple" point assessment? NO YES if yes: <u>2</u> of <u>2</u> points for this polygon  |   |         |        |                     |         |        |         |                        |  |



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## Reconnaissance Form SSNE:

Date 2/11/2014GPS\_Name 4Surveyor(s) Smt. Deb, J R

| 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 W-W                      |
| Comments: 2- moderate heterogeneity, needs for A added to end of UID in database; cause: 1 |               |               |             |                            |  |
| D-2470B  | m/ °          | 19/21/        | T4 T4       | Q.wiz / Q.wiz              | E 246568 N 4115937/ 1.9 <sup>pat cam 3</sup> 13-16 N-W |
| Comments: split out because of conifer cover & shrub cover; disturbance: cause - 1         |               |               |             |                            |  |
| D-2460A  | m/ °          | 2/19/         |             | Q.doug / C.cuneatus        | E 246609 N 4115971/ 3 <sup>cam</sup> N-W 17-20 7.2.1   |
| Comments: maybe this can be pulled out? ± 1 acre; disturbance: cause - 1                   |               |               |             |                            |  |
| D-2460B  | m/ °          | 15/2/         | T4          | Q.doug / Q.doug            | E 246614 N 4115996/ 2.1 <sup>pat</sup> Cam 3 N-W 21-24 |
| Comments: disturbance: cause - 1   |               |               |             |                            |  |
| D-2805   | m/ °          | 1/1/          |             | 9401 / 9401                | E 246434 N 4115904/ <sup>pat</sup>                     |
| Comments: disturbance: cause - 1   |               |               |             |                            |  |
| D-2806   | 240 m/ 268°   | 28/1/         | X/ NA       | Q.doug / Q.wiz             | E 246368 N 4115999/ <sup>pat</sup>                     |
| Comments: 5° incl. stand dominated by Q.wiz; disturbance: cause - 1                        |               |               |             |                            |  |
| D-2536   | m/ °          | 1/1/          |             | 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.*

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### **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 strongly 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**

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## **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**

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### **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 vernal 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 vernal 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)**

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**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**

| <b>Mapping Rules</b>  | <b>Specifications of the Rules</b>   |
|---|--|
| 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<br>(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:<br><5%, 5-40%, and >40%   |
| Cover<br>(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%   |
| Non-Native Plants                   | Herb cover classes for vernal pool types are usually 40-59.9% or 60-100%   |
|                                     | Low = Any polygon with <33% relative cover of non-native to native plants  |
|                                     | Moderate = Any with >33-66% relative cover   |
| Roads and Trails                    | High = Any with >66% relative cover  |
|                                     | Based on percent cover of road and/or trail disturbance  |
|                                     | Low = 1-33% of polygon affected by disturbance   |
| Other Impact                        | 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)<br>3 = Field reconnaissance (after polygon delineation)<br>4 = Photo interpretation<br>5 = other information (e.g ancillary data layer)<br>6 = Pre-map reconnaissance (before polygon delineation, it may be based on a sample point that is not within the polygon OR adjacent alliance of a survey) |

| <b>Attributes</b>               | <b>Additional Specifications for Attributes</b>  |
|---------------------------------|--|
| DB_ID                           | If Method is based on an existing sample, list the sample id of the survey that you used as a reference  |
| 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:<br>1=seedling, 2=sapling, 3=pole, 4=small, 5=medium-large, 6 = multi layered,<br>0=not determined/not applicable when tree cover is <10%<br>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**

| <b>WHR Classes</b>  | <b>Conifer crown diameter</b>  | <b>Hardwood crown diameter</b>   |
|---|--|--|
| 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 $\geq 10.0\%$ canopy cover and distinct height separation) | Size class 5 trees over a distinct layer of size class 4 or 3 trees. Total tree canopy exceeds 60% closure. (Layers must have $\geq 10.0\%$ 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