

# East Sacramento Valley Natural Vegetation Mapping Standards

*Prepared by the Geographical Information Center, California State University, Chico*

*For Strategic Growth Council and California Department of Water Resources, Sacramento, CA  
January 7, 2013*



**G**EOGRAPHICAL  
**I**NFORMATION  
**C**ENTER

CALIFORNIA STATE UNIVERSITY, CHICO

## **Introduction**

The Geographical Information Center (GIC) at California State University, Chico has completed a map of the natural vegetation of the East Sacramento Valley with funding from the Strategic Growth Council (SGC) and California Department of Water Resources (CDWR). It covers previously unmapped portions of Butte, Yuba, Sutter, Placer and Sacramento Counties. The map was developed for the SGC, CDWR, and its stakeholders and cooperators to facilitate regional planning, conservation, and restoration planning. This document describes the standards used for mapping the East Sacramento Valley Natural Vegetation (ESVNV) project area.

Prior to beginning the ESVNV map project for the SGC, GIC had mapped vegetation in accordance with the National Vegetation Classification System (NVCS) Group level within CDWR's Central Valley Flood Protection Plan (CVFPP) area using 2009 National Agricultural Imagery Program (NAIP) imagery as the base. This map is also known as the "medium scale" map, which refers to its medium thematic (Group level) resolution, not its spatial resolution. In that map, as in the current map, one acre was used for the minimum mapping unit (MMU) for natural vegetation and 10 acres for agriculture and urban polygons. Parts of the CVFPP are within Butte, Yuba, Sutter, Placer and Sacramento Counties.

The ESVNV mapping area was determined in the following steps: from the portions of Butte, Yuba, Sutter, Placer and Sacramento Counties that had not already been mapped at the medium scale, GIC masked out areas already included in the existing Sacramento-San Joaquin Legal Delta or Northern Sierra Nevada Foothills (NSNF) vegetation maps. GIC then mapped areas within the CVFPP that had been previously mapped to the group level to the Alliance level (fine thematic resolution). They also mapped most of the remaining areas outside the CVFPP area to the Alliance level. Agricultural and urban areas were mapped to Anderson Level 1 (i.e., Agriculture or Urban), as discussed below. Approximately 138,000 acres not mapped by GIC were mapped by the Vegetation Classification and Mapping Program (VegCAMP) of the California Department of Fish and Wildlife (CDFW) using the same rules. The areas mapped by CDFW are primarily along the ESVNV and NSNF border, and are mostly Urban and Agriculture.

The map was assessed for accuracy by CDFW's VegCAMP; results are reported in VegCAMP (2013).

## **Minimum mapping resolution**

Data was heads-up digitized at a scale of 1:2,000 using National Agricultural Inventory Program 2009 aerial imagery (USDA Summer 2009). Additional imagery and layers such as Google maps, Normalized Data Vegetation Index, and Color Infrared assisted in interpretation. The MMU for a polygon was one acre with an average width >10m. Exceptions to the MMU rules were allowed for important or obvious types, such as in-stream islands or gravel bars. One other exception was for below MMU polygons that crossed the edge of the mapping boundary.

## **Minimum categorization level**

### **Vegetation Types**

Vegetated polygons were mapped to the alliance level of the NVCS hierarchy if it was possible to discern the vegetation type at the given resolution of the imagery. Otherwise, vegetation was mapped to Group or Macrogroup level.

A list of the mapping units based on the classification in *Vegetation Alliances and Associations of the Great Valley Ecoregion, California* (Buck-Diaz et al. 2012) and in *A Manual of California Vegetation* (Sawyer et al. 2009) is provided at the end of this document. Not all of these types occur within the ESVNV project area, which is just a portion of the Great Valley Ecoregion.

### **Vegetation Cover**

Tree type alliances were mapped when trees were  $\geq 5\%$  of the polygon. The percent of absolute tree cover was estimated taking into account the porosity of the tree canopy. Canopy of vegetation over water was digitized following the canopy line (as opposed to estimating the shore line beneath the canopy). If there was a change in canopy overstory density or size class within the same alliance, the polygon was segregated if it was  $>5$  acres. If it was the understory layer that changed and the alliance remained the same, the polygon was segregated if  $>10$  acres.

Shrub vegetation alliances were mapped when tree cover was  $<5\%$ , and the shrub cover was  $\geq 10\%$ . The percent of absolute shrub cover was estimated taking into account the porosity of the shrub layer. *Heterotheca oregona* is the only exception to this rule and was classified as a shrub type with the cover as low as 3%.

Most of the herbaceous polygons were left at the group level due to the limits of aerial photo interpretation and resolution. Herbaceous vegetation types were mapped to the group/alliance level when tree cover was  $< 5\%$ , shrub cover was  $<10\%$ , and the herbaceous plant cover was  $\geq 10\%$ . The percent of absolute herbaceous cover was estimated taking into account the porosity of the herbaceous layer.

*Note: All vegetation cover was estimated using "Birdseye Total Cover," i.e. what can be seen on the air photo excluding understory layers when covered by an overstory layer.*

### **Agriculture, Urban, Water, Barren Gravel, Sand, and Roads**

The MMU for agricultural polygons (AGR) is 10 acres.

The MMU for urban polygons (URB) is 10 acres.

The MMU for water (WAT) is one acre.

Pasture and grazing land that didn't appear to be irrigated was mapped as CAI, the California Introduced Annual and Perennial Herbaceous group, if over 1 acre in size. If pasture was less than 10 acres and appeared to be irrigated, it was usually grouped with AGR, unless it was in an urban setting, when it was grouped with URB (for example, pastures around ranchette housing). If it was irrigated and over 10 acres, it was mapped as AGR.

Bare Gravel and Sand (BGS) polygons were delineated when the polygon consisted of < 5% tree cover, <10% shrub cover, <10% herbaceous plant cover, and was over one acre in size.

Roads less than 10m were dissolved into other polygon types, while roads wider than 10m were labeled as Urban or Agriculture depending on their adjacency/proximal location. Tree canopy hanging over roads, regardless of road width, was mapped as the tree type.

### **Attributes and Associated Rules**

#### **OBJECTID\_1**

Auto calculated numbers that correspond to each polygon, unique values.

#### **RIP\_GROUP**

The NVCS Group level of the map class.

#### **ALLIANCE**

Polygons were mapped to the alliance level following the membership rules defined in *A Manual of California Vegetation* (Sawyer et al. 2009) and *Vegetation Alliances and Associations of the Great Valley Ecoregion, California* (Buck-Diaz et al. 2012). Alliances that were determined to be identifiable from the imagery are marked with a (YES) and can be found under their associated group in the list that is at the end of this document. If the alliance was not able to be determined it was left at the group level.

#### **EDITOR**

Initials of the editor were entered into this field once the polygon had been assessed and was completely attributed.

#### **HT\_CODE**

Tree heights were estimated and coded using the following ranges:

4 = 2 - 5m

5 = 5 - 10m

6 = 10 - 15m

7 = > 15m

### **SIZE\_CATEGORY**

Tree diameters at breast height were estimated and categorized following *A Guide to Wildlife Habitats of California* (Mayer and Laudenslayer, Jr. 1988).

- 1 = Seedlings (<1")
- 2 = Saplings (1-6")
- 3 = Pole (6-11")
- 4 = Small (11-24")
- 5 = Medium – large (>24")
- 6 = Multi layered medium/large over small

*Note: All of the following vegetation cover classes were estimated using "Birdseye Total Cover," i.e. what can be seen on the air photo excluding understory layers when covered by an over-story layer.*

### **PER\_HARDWOOD**

The percentage of hardwood tree cover was estimated using absolute cover. This is the proportion of the entire polygon that the trees occupy taking into account the porosity of the canopy. Understory portions of trees, shrubs and grasses covered by the overstory layers are not accounted for, as they are not visually observable via aerial photos. The absolute cover value could range from 0-100, with a value over 60 being rare due to vegetative porosity and natural tree growth patterns. A value of 0.2 was used when hardwood cover totaled only a fraction of a percent.

### **PER\_CONIFER**

The same method was used to estimate the percentage of conifers as was used for hardwoods. Conifers were rare in the Central Valley and occur mainly in the foothills.

### **PER\_TREE**

This value is the total absolute cover of trees in a polygon which is the sum of hardwoods plus conifers. In Agricultural (AGR) and Urban (URB) polygons PER\_TREE was coded with 333.

### **PER\_SHRUB**

Absolute cover was used to estimate the percentage of shrubs present in a polygon. **The forty percent rule:** If the overstory layer(s) were greater or equal to 40% then the understory layer(s) would not be visible in the aerial photo and would not be estimated. If tree cover was greater than or equal to 40%, 99 was entered for the shrub value. In Agricultural (AGR) and Urban (URB) polygons PER\_SHRUB was coded with 333. Table 1 summarizes this rule.

## HERB\_CODE

Herb cover is estimated when total tree and shrub cover is <40% and herbs are ≥10%. If tree and shrub cover is greater than or equal to 40%, 99 was entered as the herb cover value. For AGR and URB polygons the herb class is left null.

Herb cover is coded as:

1 = <2%

2 = 2-9%

3 = 10-39%

4 = 40-59%

5 = >60%

TYPE	>40%	>40% Tree &/or Shrub	<40% Tree &/or Shrub
Tree	Increment	Increment	Increment
Shrub	99	Increment	Increment
Herb	99	99	Cover class

**Table 1** Shows how the >40% cover rule is used to code Shrub and Herb categories

## PER\_TOTAL\_COVER

The percent of total cover was calculated by adding the total tree, shrub, and the mean of the herbaceous layers. Mean values for the range of the herbaceous layer were rounded to the values of 1, 5, 25, 50, and 80.

*Note: Due to taking the mean value for the herbaceous layer, for some of the polygons, total cover may be slightly over or underestimated.*

## ISOLATED\_TREE

(Yes) indicates presence of natural or semi-natural isolated trees in agricultural, shrub, and herbaceous polygons when the presence of trees is <5%. Actual percentage of tree cover is reported in the PER\_TREE field. HT\_CODE and SIZE\_CATEGORY are NULL.

Null indicates no natural or semi-natural isolated trees are present.

## **RESTORATION**

If a portion, or the entirety of a polygon, was an obvious restoration site to the interpreter, then a Yes (Y) was entered, otherwise the field was left null. A compilation layer of restored lands from 2007 was also used to assist this decision.

## **CLEARING\_DISTURBANCE**

Clearing disturbances codes were assigned to each natural or semi-natural mapped polygon using the following categories:

High Disturbance: Over 50% of the polygon is affected from roads, trails, disk activity, or scrapes.

Moderate Disturbance: Between 25% and 50% of the polygon is affected from roads, trails, disk activity, or scrapes.

Minimal Disturbance: At least 5% and less than 25% of the polygon is affected from roads, trails, disked activity or scrapes.

No Disturbance: Less than 5% of the polygon is affected from roads, trails, disked activity or scrapes.

## **INVASIVE\_PLANT**

Invasive plant codes were assigned to each natural or semi-natural polygon using the following categories:

High Invasive Plant Content: Over 50% of the polygon is covered with invasive plants; percent cover is determined using absolute cover.

Moderate Invasive Plant Content: Between 25% and 50% of the polygon is covered with invasive plants.

Minimal Invasive Plant Content: Between 5% and 25% of the polygon is covered with invasive plants.

No Invasive Plant Content: Less than 5% of the polygon is covered with invasive plants.

*Note: The only invasive species recorded were those that were clearly interpretable using aerial imagery. There may be invasive species present that are not mapped or recorded. California introduced annual and perennial herbaceous (CAI) polygons are weedy by definition and were coded assuming that the majority of the vegetation was not indigenous.*

## **Vegetation Map Classes**

Following is a list of Groups (beginning with their map codes and bolded) with their associated Alliances based on Buck-Diaz et al. (2012) and Sawyer et al. (2009). Each alliance has been labeled with a (YES) or (NO) indicating whether or not GIC, DFG and CNPS found those alliances distinguishable via aerial interpretation. Note that there are several mapping units that do not correspond to NVCS types.

Note: Not all of these types occur within the ESVNV project area, which is just a portion of the Great Valley Ecoregion.

**CAI - California Introduced Annual and Perennial Herbaceous**

*Avena (barbata, fatua)* Semi-natural Stands (NO)

*Brassica (nigra and other mustards)* Semi-natural Stands (NO)

*Bromus (diandrus, hordeaceus)-Brachypodium distachyon* Semi-natural Stands (NO)

*Centaurea (solstitialis, melitensis)* Semi-natural Stands (NO)

*Conium maculatum-Foeniculum vulgare* Semi-natural Stands (NO)

*Cortaderia (jubata, selloana)* Semi-natural Stands (NO)

*Lolium perenne (=Festuca perennis)* Semi-natural Stands (NO)

**CFG - California Annual Forbs and Grasses**

*Amsinckia (menziesii, tessellata)* Alliance (NO)

*Eschscholzia (californica)* Alliance (NO)

*Lasthenia californica-Plantago erecta-Vulpia (=Festuca) microstachys* Alliance (NO)

*Lotus purshianus (=Acmispon americanus)* Alliance (NO)

*Plagiobothrys nothofulvus* Alliance (NO)

**CMC - Californian Mesic Chaparral**

*Cercocarpus betuloides* Alliance (YES)

*Quercus berberidifolia* Alliance (YES)

*Heteromeles arbutifolia* Alliance (YES)

**CMF - California Montane Conifer Forest**

*Pinus ponderosa* Alliance (YES)

**CPG - California Perennial Grassland**

*Nassella (=Stipa) pulchra* Alliance (YES)

**CSS - Central and South Coastal California Seral Scrub**

*Baccharis pilularis* Alliance (YES)



*Lotus scoparius* Alliance (YES)

*Lupinus albifrons* Alliance (YES)

*Heterotheca oregona* Alliance (YES)

**CXC - California Xeric Chaparral**

*Adenostoma fasciculata* Alliance (YES)

*Arctostaphylos manzanita* Alliance (YES)

*Arctostaphylos myrtifolia* Alliance (YES)

*Arctostaphylos viscida* Alliance (YES)

*Ceanothus cuneatus* Alliance (YES)

*Eriodictyon californicum* Alliance (YES)

**DAM - Western North American Disturbed Alkaline Marsh and Meadow**

*Sesuvium verrucosum* Alliance (YES)

*Cynodon dactylon*–*Crypsis* spp.–*Paspalum* spp. Semi-natural Stands (YES)

**ECW – California Evergreen Coniferous Forest and Woodland**

*Juniperus californica* Alliance (YES)

*Pinus sabiniana* Alliance (YES)

**FEM - Freshwater Emergent Marsh**

*Phragmites australis* Alliance (most considered weedy types) (NO)

*Schoenoplectus (californicus, acutus)* Mapping Unit (YES)

*Typha (angustifolia, domingensis, latifolia)* Mapping Unit (YES)

**IMF - Introduced North American Mediterranean Forest**

*Ailanthus altissima* Provisional Semi-natural Stands (YES)

*Eucalyptus (globulus, camaldulensis)* Semi-natural Stands (YES)

*Robinia pseudoacacia* Provisional Semi-natural Stands (YES)

Ornamental Trees Mapping Unit (YES)

**NRW - Naturalized Warm-Temperate Riparian/Wetland**

*Lepidium latifolium* Semi-natural Stands (NO)

*Persicaria lapathifolia*-*Xanthium strumarium* Alliance (YES)

Managed annual wetland vegetation Mapping Unit (i.e. duck clubs) (YES)

#### **NTF - Naturalized Temperate Pacific Freshwater Vegetation**

*Eichhornia crassipes* Provisional Semi-natural Stands (YES)

*Ludwigia (hexapetala, peploides)* Semi-natural Stands (YES)

*Myriophyllum* spp. Alliance (YES)

#### **RIS - Riparian Introduced Scrub**

*Arundo donax* Semi-natural Stands (YES)

Note: Although technically an herb, *Arundo donax* is grouped in Scrub

*Tamarix* spp. Semi-natural Stands (YES)

*Rubus armeniacus* Semi-natural Stands (YES)

#### **RWF - Riparian Evergreen and Deciduous Woodland**

*Acer negundo* Alliance (YES)

*Juglans hindsii* Special and Semi-natural Stands (YES)

*Platanus racemosa* Alliance (YES)

*Populus fremontii* Alliance (YES)

*Quercus lobata* riparian Alliance (YES)

*Salix gooddingii* Alliance (YES)

*Salix laevigata* Alliance (YES)

#### **RWS - Southwestern North American Riparian Wash/Scrub**

*Baccharis salicifolia* Alliance (NO)

*Cephalanthus occidentalis* Alliance (YES)

*Rosa californica* Alliance (YES)

*Salix exigua* Alliance (YES)

*Salix lasiolepis* Alliance (YES)

*Sambucus nigra* Alliance (YES)

*Vitis californica* Provisional Alliance (YES)

**SAM - Southwestern North American Alkali Marsh/Seep Vegetation**

*Sporobolus airoides* Alliance (YES)

**SSB - Southwestern North American Salt Basin and High Marsh**

*Allenrolfea occidentalis* Alliance (YES)

*Atriplex spinifera* Alliance (YES)

*Isocoma acradenia* Alliance (YES)

*Suaeda nigra* Alliance (YES)

*Frankenia salina* Alliance (NO)

**TBM - Temperate Pacific Tidal Salt and Brackish Meadow**

*Distichlis spicata* Alliance (YES)

*Salicornia pacifica* Alliance (NO)

**TFF - Temperate Freshwater Floating Mat**

*Azolla (filiculoides, mexicana)* Alliance (NO)

*Lemna (minor)* and Relatives Alliance (NO)

**VCM – Vancouverian Coastal/Tidal Marsh and Meadow**

*Juncus effusus* Alliance (NO)

**VPB - Californian Mixed Annual/Perennial Freshwater Vernal Pool / Swale Bottomland**

*Centromadia (pungens)* Alliance (NO)

*Cressa truxillensis–Distichlis spicata* Alliance (NO)

*Lasthenia fremontii–Distichlis spicata* Alliance (NO)

*Layia fremontii–Achyrrachaena mollis* Alliance (NO)

*Trifolium variegatum* Alliance (NO)

**VPG - California Vernal Pool and Grassland Matrix Mapping Unit (YES)**

This mapping unit is used for areas that contain below-MMU vernal pools and swales (VPG) in an upland matrix of California Annual Forbs and Grasses (CFG).

**VRF - Vancouverian Riparian Deciduous Forest**

*Alnus rhombifolia* Alliance (YES)

*Fraxinus latifolia* Alliance (YES)

*Salix lucida* Alliance (YES)

**WTM - California Warm Temperate Marsh/Seep**

*Artemisia douglasiana* Alliance (YES)

*Carex barbarae* Alliance (NO)

*Juncus (balticus, mexicanus)* Alliance (NO)

*Juncus (oxymetris, xiphioides)* Provisional Alliance (NO)

*Leymus (=Elymus) triticoides* Alliance (NO)

*Mimulus (guttatus)* Alliance (NO)

**WVO - California Broadleaf Forest and Woodland**

*Aesculus californica* Alliance (YES)

*Quercus agrifolia* Alliance (NO)

*Quercus chrysolepis* Alliance (NO)

*Quercus douglasii* Alliance (YES)

*Quercus lobata* upland Alliance (YES)

*Quercus wislizeni* Alliance (YES)

*Umbellularia californica* (YES)

Non-Vegetation Types

AGR - Agriculture

BGS - Bare Gravel and Sand

WAT - Open water

URB- Urban

**Literature Cited**

Buck-Diaz, J., S. Batiuk and J. Evens. 2012. Vegetation alliances and associations of the Great Valley Ecoregion, California. California Native Plant Society.

Mayer, K. and W. Laudenslayer, Jr. (eds.) 1988. A Guide to Wildlife Habitats of California. State of California, Resources Agency, Department of Fish and Game Sacramento, CA. 166 pp.

Sawyer, J.O., T. Keeler-Wolf, and J.M. Evens. 2009. A Manual of California Vegetation, 2<sup>nd</sup> Edition. California Native Plant Society, Sacramento, CA.

Vegetation Classification and Mapping Program (VegCAMP). 2013. Accuracy assessment of the East Sacramento Valley Natural Vegetation Map. California Department of Fish and Wildlife. Sacramento, Ca.