Vegetation: Central Valley Flood Protection Planning Area 2016 Update

2017

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Introduction

Vegetation abundance and composition is considered to be the single best indicator for identifying important habitats and ecosystems within a region. Vegetation community data has played an increasingly vital role in wildlife and natural lands conservation and management over the years, and is now among the principal tools involved in land management and planning. Vegetation maps and classifications are used for:

- identifying areas with high biological value
- modeling species distribution
- identifying critical habitat and conservation priorities
- developing land management plans
- identifying research study areas
- identifying and evaluating potential lands for restoration and/or acquisition
- fire management and mitigation

Unique or highly valuable vegetation types often require avoidance and mitigation measures when large-scale projects are being sited. Identifying these areas early in the planning process can save time and resources. With a slight change in mapping protocol, future mapping efforts will be able to track regional changes in habitat types or acreage. Detailed vegetation maps can also provide a scientific baseline for climate change and land conversion studies in the future.

Purpose

The Central Valley Riparian Mapping developed by the Geographic Information Center (GIC) is used as a planning tool for the Department of Water Resources (DWR) and stakeholders in planning regional flood management projects and plans associated with the Central Valley Flood Protection Plan (CVFPP). These data are used to assess current areas of vegetation and habitat within the flood protection system, set measurable objectives within CVFPP Conservation Planning areas for the enhancement of specific types of habitat, and create initial assessments of potential impacts of proposed multi-benefit projects associated with the State Plan of Flood Control. This dataset was developed as part of the California Department of Water Resource's Central Valley Flood Protection Program to facilitate regional planning and conservation and enhancement of biological resources by the Department of Water Resources, project partners, and regional stakeholders.

History of the Project

The Riparian Habitat Joint Venture (RHJV), a consortium of experts in hydrology, ecology, and biology of California riparian systems from agencies, Non-Governmental Organizations and academia, had been striving for years to accomplish a statewide uniform assessment of the riparian resources of California. A good portion of the state has a complete vegetation map; however, it is still a work in progress with a significant amount of the state being unmapped. The Department of Water Resources hired the Geographical Information Center (GIC) in early 2010 to complete a riparian vegetation map of the Central Valley Flood Protection Plan's (CVFPP) footprint. The total acreage of the CVFPP footprint is approximately 2,645,600 acres and spans portions of the following 22 counties: Amador, Butte, Calaveras, Colusa, Fresno, Glenn, Kings, Madera, Mariposa, Merced, Placer, Sacramento, San Joaquin, Shasta, Stanislaus, Sutter, Tehama, Tulare, Tuolumne, Yolo, and Yuba.

Figure 1. Footprint or Extent of Central Valley Flood Protection Plan Mapping Area

The map covers major riparian waterways from Keswick Dam in Redding to the Kings River near Visalia. The first mapping effort mapped to the "Group" classification level, which will be explained in further detail later in the report. Once the "Group" level map was Accuracy Assessed

with a passing score, DWR and the California Department of Fish and Game (CDFW) decided to have the GIC attempt an “Alliance” level map, which is one level finer than “Group.” Over time, interest in the vegetation mapping grew and a map for the entire Great Valley Eco-region was eventually funded and completed. DWR in 2017 contracted with the GIC to remap the CVFPP mapping area and to do “change detection.” Change detection compares the two map areas of equal size and reports the number of acres that has increased or decreased for each mapping unit. The original mapping effort used 2009 as the base year for the photointerpreters to map to. The remap of the CVFPP mapping area used 2016 imagery. One can think of these maps as a snapshot in time, where the imagery used is recorded by flying planes over California in a matter of a few days, usually done in the summertime when weather permits. National Agriculture Inventory Program (NAIP) is responsible for collecting and publishing this imagery. Mapping efforts and imagery years are as follows:

CVFFP mapping area original effort: 2009 NAIP

CVFFP mapping area remap effort: 2016 NAIP

Process for Making a Vegetation Remap

Step 1: Data Collection Process

- Going out in the field and sampling vegetation, attempting to sample all of the major plant communities throughout the mapping area
- These sample areas are determined by lead biologists at CDFW by thoroughly reviewing all available data on plant communities and species potentially found in the mapping area
- Field data is entered, quality-controlled, then sent to CDFW

Step 2: Data Analysis

- CDFW's Vegetation Classification and Mapping Program (VegCAMP) is responsible for running the cluster analysis of the data
- CDFW uses these data to create a hierarchy of the vegetation communities, classification, and a key for the photointerpreters to use while mapping

Step 3: Making the Digital Remap

- The GIC uses ESRI's ArcMap computer program to create the digital map
- Linework is retained as much as possible from the previous mapping effort, but is redrawn when necessary to improve old linework, compensate for a shift in imagery, or due to change that naturally or anthropogenically occurred
- Once the polygons are evaluated for linework changes they are then attributed with the Alliance type and several other attributes that will be mentioned later
- The map is then sent back to CDFW to determine Accuracy Assessment (AA) locations

Step 4: Accuracy Assessment of the Mapping Effort

- CDFW assigns polygons to visit in the field
- GIC visits a required number of sites and surveys each of the assigned polygons following a given protocol
- Data is again entered into an Access database and sent to CDFW for scoring

Step 5: Accuracy Assessment Corrections

- The GIC reviews the scoring of the AA's and makes corrections to the map as needed or indicated by the results
- The map is then sent back to DFW for a final crosswalk
- DFW's crosswalk adds several additional fields to the map such as the global and state community rarity ranking and other attributes that are described in the metadata of the map

Step 6: Change Detection

- This process is only used for remapping projects and is used to calculate changes between the original mapping effort and the remapping effort

- The acreages of change for each mapping unit are summarized in a table that can be found later in the report

Step 7: Report, Metadata, and Publishing

- A summary report is created by the GIC
- Metadata is added to the map by the GIC
- The deliverables are then sent to CDFW to package and post to the BIOS website, which is a storage site for GIS data
- Link to vegetation datasets: https://wildlife.ca.gov/Data/GIS/Vegetation-Data

Data Collection Process and Survey Types

During the spring and summer months of 2011, the GIC collected 808 Rapid Assessment and Relevé surveys in accordance with California Native Plant Society protocols, which can be found in Appendix B. The Rapid Assessment protocol is a reconnaissance-level method of vegetation and habitat sampling. It may be used to quickly assess and map the extent of all vegetation types in relatively large, ecologically defined regions. In the field, once a center point for the survey has been selected in a homogenous part of the stand, a perimeter is determined depending on stand size and composition, typically averaging a 30 meter radius. Within this perimeter, species are recorded from each strata (tree, shrub, herbaceous, and even non-vascular plants). Many other attributes are recorded: location, date, surveyors, UTM coordinates, photos taken, stand size, aspect, gradient, topography, geology, soil texture, surface substrate covers, bioturbation presence, fire evidence, disturbance codes (such as evidence of grazing or off-road vehicles), site history, stand age, general comments, tree diameter at breast height, shrub maturity, vegetation strata height, and field Alliance. The Relevé survey is very similar to the Rapid Assessment and was utilized by the GIC for herbaceous stands only. A standard 10 x 10 meter plot was used for the survey area, unless the vegetation stand was more accurately sampled by using a different plot shape. The only other difference between a Relevé and a Rapid Assessment (besides the size of area surveyed) is that the species list is comprehensive in a Relevé, whereas the list for a Rapid Assessment stops at a set number of species. Survey locations were predetermined by lead biologists at CDFW and followed specific criteria such as public accessibility and avoiding surveying the same type within 1000 meters of each other. The 808 surveys completed by the GIC were compiled with other existing survey data, which wound up being a total of 2,615 surveys that went into the classification analysis for the entire Great Valley Eco-region. A full key developed from the classifications for the Great Valley Ecoregion by Buck-Diaz et al. (2012) and Sawyer et al. (2009) can be found in Appendix C.

Following is a summary of the projects and surveys that went into the Great Valley Eco-region classification:

Project Citation and Survey Count

- Barbour et al. 2003: 129 surveys
- Buck-Diaz et al. 2011: 120 surveys
- CDFG 2004: 58 surveys
- CDFG 2005: 155 surveys
- CDFG-CNPS 2008: 436 surveys
- CNPS Chapter 1993-2007:49 surveys
- Evans et al. 2006: 24 surveys
- TNC 2008:9 surveys
- GIC 2011: 808 surveys
- Hickson and Keller-Wolf 2007: 377 surveys
- Hopkinson et al. 2009: 3 surveys
- Klein et al. 2007: 220 surveys
- Olson and Anacker 2009: 31 surveys
- Solomeshch 2004: 61 surveys
- Witham 2003-2008: 135 surveys

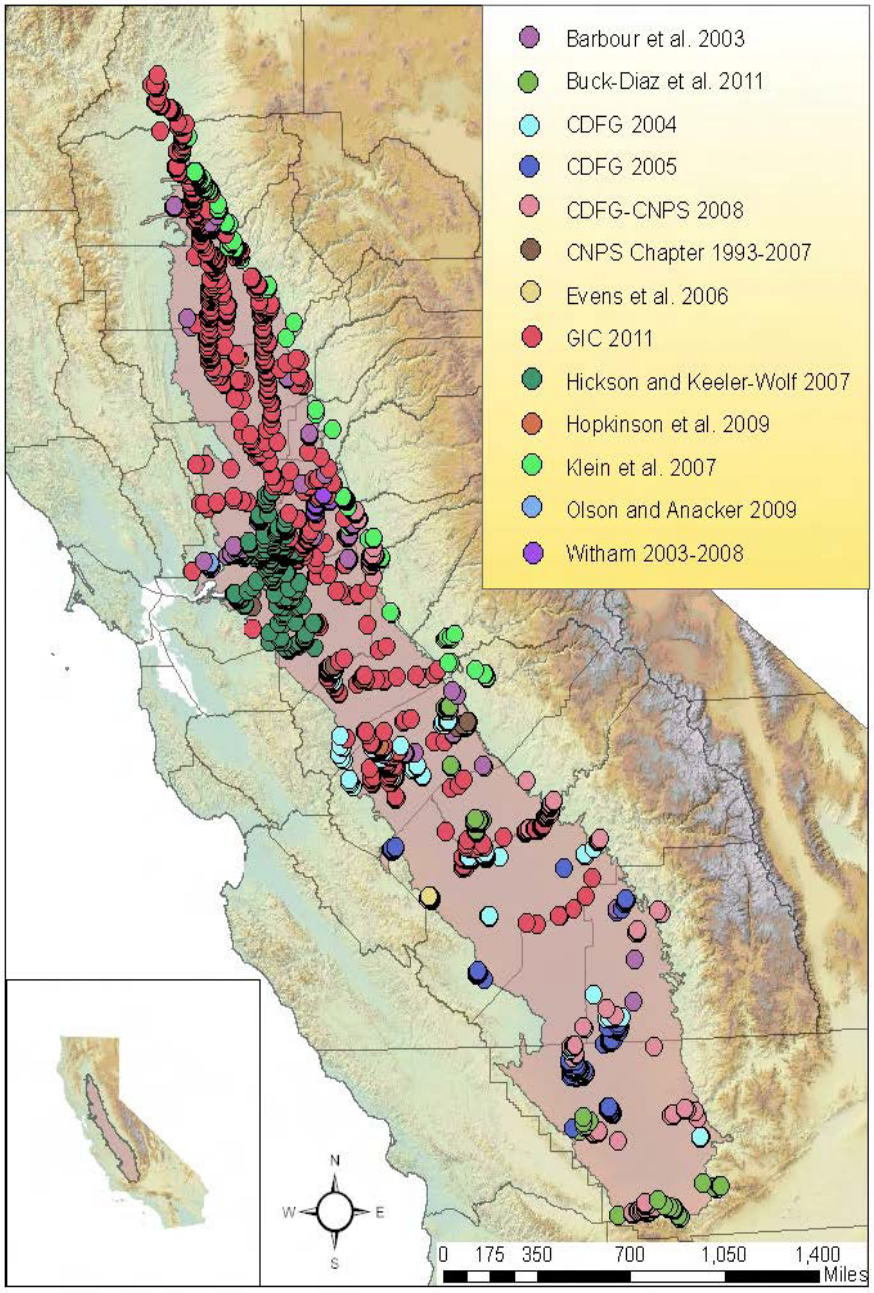

Figure 2. All field survey locations that went into the Great Valley Eco-region classification (map by CNPS)

Mapping Standards

For estimating the percentage of vegetation cover, one can use either absolute or relative cover. **Absolute cover** is the actual percentage of ground covered by a vertical structure, taking into account porosity (i.e., holes in the canopies of individual trees or shrubs) (Todd Keeler Wolf et. al 2009). **Relative cover** is a measure of the cover of a species in relation to that of other species within a defined area or sample of vegetation. This is usually calculated for species that occur in the same layer (or stratum) of vegetation, and this measure can be calculated across a group of samples. Relative cover will always total 100% even when absolute cover is low.

All vegetation was mapped using absolute cover from the birds-eye view perspective, looking straight down on the vegetation, and taking into account porosity. GIC and DFW standardized the porosity for this mapping effort to be near 60%. This means that if you had a tree canopy that covered the polygon edge-to-edge, 60% of light would still penetrate the canopy throughout the day, and a value of 40% absolute cover would be chosen. **The 40% rule:** If the tree layer is 40% or greater absolute cover (trees completely covering the polygon, taking into account porosity, as above), the shrub and herbaceous layers were not evaluated, and '99' was entered as a placeholder value for shrub cover and the herbaceous class was attributed as '>40% woody'. If the combined absolute cover of trees plus shrubs totaled 40% or greater, the herbaceous class '>40% woody' was again used. If the photointerpreter determined that the canopy being evaluated was extremely dense, the maximum absolute cover could exceed 40 due to less porosity.

A stand is defined by two main unifying characteristics:

Compositional integrity: Throughout the site, the combination of species is similar. The stand is differentiated from adjacent stands by a discernable boundary that may be abrupt or gradual.

Structural integrity: The stand has a similar history or environmental setting, affording relatively similar horizontal and vertical spacing of plant species. For example, a hillside forest formerly dominated by the same species, but that has burned on the upper part of the slope and not the lower, is divided into two stands. Likewise, a sparse woodland occupying a slope with shallow rocky soils is considered a different stand from an adjacent slope of a denser woodland/forest with deep moister soil and the same species composition.

Tree: A one-stemmed woody plant that normally grows to be greater than 5 meters tall. In some cases, trees may be multiple-stemmed following a fire or other disturbance, but the size of mature plants is typically greater than 5 meters and undisturbed individuals of these species are usually single-stemmed.

- Tree stands must have at least 5% absolute cover of tree species to be determined a tree stand.
- If the tree canopy was estimated to be 40% or greater absolute cover, the underlying vegetation was not evaluated due to a full overlying canopy (**the 40% rule**).

Shrub: A woody plant that generally has two to several stems from its base, giving it a broad crown, and which is usually below 5 meters in height. Includes dwarf shrubs and low or short woody vines such as *Vitis* or *Aristolochia*.

- Trees must be <5% absolute cover.
- Shrubs must be >10% absolute cover.
- If the sum absolute cover of the tree and shrub layers was estimated to be 40% or greater, the underlying vegetation was not evaluated due to a full overlying canopy.

Exceptions were made to the minimum 10% absolute shrub cover rule for shrub stands that never get very dense. *Heterotheca oregona, Allenrolfea occidentalis, Suaeda moquinii, Atriplex lentiformis,* and *Frankenia salina* are the exceptions to this rule and are classified as shrub types if evenly distributed at 2% cover or greater. Common environments for these exceptions were gravel bars and alkali flats. *Heterotheca oregona* is a sub-shrub that could be mapped as both a shrub and an herb; in this mapping effort and in the 2009 effort, *Heterotheca oregona* was mapped as a shrub.

Herbaceous: Plant that is above ground, is generally non-woody, and contains the characteristics of an herb. Herbs can be annual, biennial, or perennial.

- Trees must be <5% absolute cover.
- Shrubs must be <10% absolute cover.
- Herbaceous layer must be >10% absolute cover.

If none of the minimum vegetation cover values were met the polygon was classified as **Barren, Gravel, Sand (BGS).**

Minimum Mapping Units (MMU)

- For natural vegetation the MMU was 1 acre.
- For rare stands, gravel bars, and small island inclusions, the MMU was ½ acre.
- Agriculture, Urban, and Quarries had an MMU of 10 acres.
- Water MMU was 1 acre.
- Originally, roads 10 meters or wider would be pulled out. This led to too much fragmentation of the vegetation polygons. Smaller roads were typically merged with adjacent vegetation polygons and a disturbance code was applied.
- Minimum width for a polygon was 10 meters. The width could be less than 10 meters when the photointerpreter was attempting to keep two stands of the same mapping class together.

Classification of Groups and Alliances Utilized in CVFPP Remap
(from Buck-Diaz, J.S. Batiuk and J. Evens. 2012).

Not all of the Groups and Alliances from the Great Valley Ecoregion classification occurred in the CVFPP mapping area. Following is an example of the classification hierarchy and a list of Groups and Alliances utilized in the CVFPP mapping.

Example Hierarchy

1. **Class**: Temperate Forest
2. **Formation:** Temperate Flooded and Swamp Forest
3. **Division:** Western North America Warm Temperate Flooded and Swamp Forest
4. **Macrogroup:** Southwestern North American Riparian, Flooded and Swamp Forest
5. **Group:** Southwestern North American riparian evergreen and deciduous woodland
6. **Alliance:** *Quercus lobata*
7. **Association:** *Quercus lobata/Rubus ursinus-Rosa californica*

Trees

- ECW: California Evergreen Coniferous Forest and Woodland Group
  - *Juniperus californica* Alliance
  - *Pinus sabiniana* Alliance
- IMF: Introduced North American Mediterranean Forest Group
  - *Ailanthus altissima* – provisional Alliance
  - *Eucalyptus (globulus, camaldulensis)* Alliance
  - Ornamental trees Mapping Unit
  - *Prosopis glandulosa* Alliance
  - *Robinia pseudoacacia* Alliance
- RWF: Riparian Evergreen and Deciduous Woodland Group
  - *Acer negundo* Alliance
  - *Juglans hindsii* and hybrids Alliance
  - *Platanus racemosa* Alliance
  - *Populus fremontii* Alliance
  - *Quercus lobata* Alliance
  - *Salix gooddingii* Alliance
  - *Salix laevigata* Alliance
- VRF: Vancouverian Riparian Deciduous Forest Group
  - *Alnus rhombifolia* Alliance
  - *Fraxinus latifolia* Alliance
  - *Salix lucida* Alliance
- WVO: California Broadleaf Forest and Woodland Group
  - *Aesculus californica* Alliance

- *Quercus douglasii* Alliance
- *Quercus lobata* Alliance
- *Quercus wislizenii* – tree Alliance

Shrubs

- RIS: Riparian Introduced Scrub Group
  - *Arundo donax* Alliance
  - *Rubus armeniacus* Alliance
  - *Sesbania punicea* Alliance
  - *Tamarix spp.* Alliance
  - *Phragmites australis - Arundo donax - Alopecurus pratensis* Semi-natural Stands
- RWS: Southwestern North American Riparian Wash/Scrub Group
  - *Baccharis salicifolia* Alliance
  - *Cephalanthus occidentalis* Alliance
  - *Rosa californica* Alliance
  - *Salix exigua* Alliance
  - *Salix lasiolepis* Alliance
  - *Sambucus nigra* Alliance
  - *Vitis californica* – provisional Alliance
- CSS: Central and South Coastal California Seral Scrub
  - *Baccharis pilularis* Alliance
  - *Heterotheca oregona* Alliance
  - *Lupinus albifrons* Alliance
- SSB: Southwestern North American Salt Basin and High Marsh Group
  - *Allenrolfea occidentalis* Alliance
  - *Atriplex lentiformis* Alliance
  - *Atriplex spinifera* Alliance
  - *Frankenia salina* Alliance
  - *Isocoma acradenia* Alliance
  - *Suaeda moquinii* Alliance

Herbaceous

- CAI: California Introduced Annual and Perennial Herbaceous Group
- CFG: California Annual Forbs and Grasses Group
- CPG: California Perennial Grassland Group
- DAM: Western North American Disturbed Alkaline Marsh and Meadow Group
  - *Bassia hyssopifolia* Alliance
- DUP: Dry Upland Perennial Grassland Group
  - *Elymus glaucus* Alliance
- FEM: Freshwater Emergent Marsh Group
  - *Schoenoplectus (acutus, californicus)* Alliance
  - *Typha (angustifolia, domingensis, latifolia)* Alliance
- NRW: Naturalized Warm-Temperate Riparian/Wetland Group

    - *Crypsis (schoenoides, vaginiflora)* Provisional Alliance
    - Managed annual and perennial wetland vegetation Alliance
    - *Persicaria lapathifolia - Xanthium strumarium* Alliance
    - *Lepidium latifolium* Alliance
- NTF: Naturalized Temperate Pacific Freshwater Vegetation Group
    - *Eichhornia crassipes* Alliance
    - *Ludwigia (hexapetala, peploides)* Alliance
    - *Myriophyllum spp.-Egeria densa* Provisional Alliance
- SAM: Southwestern North American Alkali Marsh/Seep Vegetation Group
    - *Sporobolus airoides* Alliance
- TBM: Temperate Pacific Tidal Salt and Brackish Meadow Group
    - *Distichlis spicata* Alliance
    - *Sarcocornia pacifica*-annual grasses Alliance
- TFF: Temperate Freshwater Floating Mat Group
    - *Azolla (filiculoides, mexicana)* Alliance
    - *Lemna minor* and Relatives Alliance
- VCM: Vancouverian Coastal/Tidal Marsh and Meadow Group
    - *Juncus effusus* Alliance
- VPG: California Vernal Pool and Grassland Matrix Mapping Unit
- VPB: Californian Mixed Annual/Perennial Freshwater Vernal Pool/Swale Bottomland Group
    - *Lasthenia fremontii-Distichlis spicata* Alliance
- SVP: Sparsely Vegetated Playa/Pool Group
- AGP: Alkali Grassland - Playa/Pool Matrix Mapping Unit
- WTM: California Warm Temperate Marsh/Seep Group
    - *Artemisia douglasiana* – provisional Alliance
    - *Carex barbarae* Alliance
    - *Leymus cinereus - Leymus triticoides* Alliance
- CCS: Central and South coastal Californian coastal sage scrub Group
    - *Eriogonum fasciculatum* Alliance
- LDS: Lower Bajada and Fan Mojavean-Sonoran desert scrub Group
    - *Atriplex polycarpa* Alliance
- BDS: California Coastal evergreen bluff and dune scrub Group
    - *Frangula californica* Alliance
- NMS: Naturalized non-native Mediterranean scrub Group
    - Broom (*Cytisus scoparius* and others) Alliance
- RMM: Western North American Ruderal Marsh, Wet Meadow & Shrubland Group
    - *Phalaris arundinacea* Western Marsh Alliance

Non-Natural-Vegetation Mapping Units

- AGR: Agriculture
- BGS: Barren, Gravel, Sand
- URB: Urban
- WAT: Water
- CRO: Cliff and Rock Outcrop

- QMG: Strip-mines, Quarries and Gravel pits

Accuracy Assessment 2011 (Great Valley Eco-region)

Accuracy Assessment (AA) analysis helps map users determine how much confidence can be assigned to each of the mapped units, and provides an understanding of the map's appropriateness for various applications. Federal Geographic Data Committee standards (FGDC 2008) and California standards require a minimum accuracy of 80% for vegetation maps.
From March 19, 2012 to June 18, 2013, VegCAMP collected 1530 AA field verification surveys following the CNPS AA protocol. Of the 1530 surveys collected, 224 were discarded for reasons such as the vegetation had been removed or had dramatically changed since mapping. The "users'" score - what accuracy can be expected while using the map in the field - was 88.4%. Note: this score was for the Greater Valley Eco-region, which contains the CVFPP remap area within it, but is much larger. A more detailed report on the Accuracy Assessments completed in 2011 can be found here: https://wildlife.ca.gov/Data/VegCAMP/Reports-and-Maps
Fuzzy logic is a logic operations method based on many-valued logic rather than binary logic (two-valued logic). Two-valued logic often considers 0 to be false and 1 to be true. However, fuzzy logic deals with truth values between 0 and 1, and these values are considered as intensity (degrees) of truth (Techopedia 2021). This logic is utilized for scoring Accuracy Assessments; scoring rules can be found in the Table below.

Table 1. Fuzzy logic scoring rules

Code	Reason for Score	Score
A	Photointerpreter (PI) completely correct	5
B	Correct Group OR next level up in hierarchy	4
C	Threshold/transition between PI call and Final call	4
D	Correct Macrogroup OR next level up in hierarchy	3
E	Based on close ecological similarity	3
F	Correct Division	2
G	Some floristic/hydrologic similarity	2
H	Correct only at Life Form	1
I	No similarity above Formation and incorrect Life Form	0
J	Survey removed because of a significant change in polygon	no score
K	Survey removed because an inadequate portion of the polygon was viewed	no score
L	Survey removed because field/PI data is incomplete, inadequate or confusing	no score
M	Survey removed; supplementary point (e.g., second point in polygon)	no score

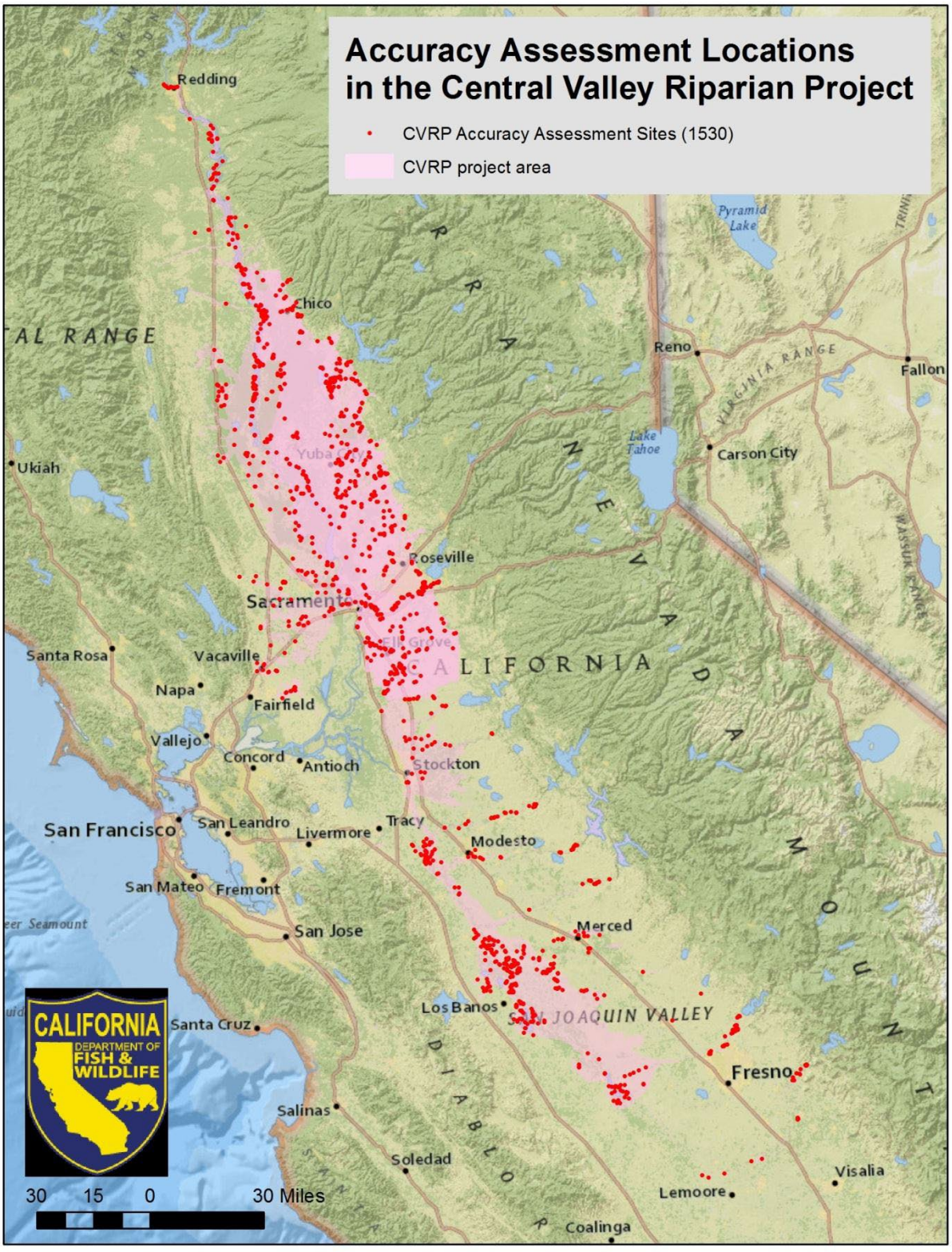

Figure 3: Location of Accuracy Assessment Samples within the Mapping Area (Map by CDFW)

Accuracy Assessment 2020 (Central Valley Flood Protection Plan Area)

From June 1, 2020, to September 3, 2020, 323 Accuracy Assessment surveys were collected by the GIC staff. Out of the 323 Accuracy Assessments completed, 18 were not scored for reasons such as the vegetation had been removed or significantly changed since the year of the imagery. 87.1% accuracy was the final score for the 305 surveys reviewed and scored by CDFW. As discussed regarding the 2011 Accuracy Assessment, because vegetation is not always black and white, a fuzzy logic scoring system was developed for Accuracy Assessment scoring; the rules for scoring can be found in Table 1 (Gopal, S. and C. Woodcock. 1994). Scoring compared the Alliance/Group vegetation type assigned to each polygon in the map (i.e., the photointerpreted map unit attribute) with the Alliance/Group vegetation type assigned by the field crews and reviewed by CDFW senior staff. Other attributes (cover, disturbance, and height) were not scored but results were provided to GIC so the photointerpreters could learn from and correct any systematic errors and apply this knowledge to future mapping efforts.

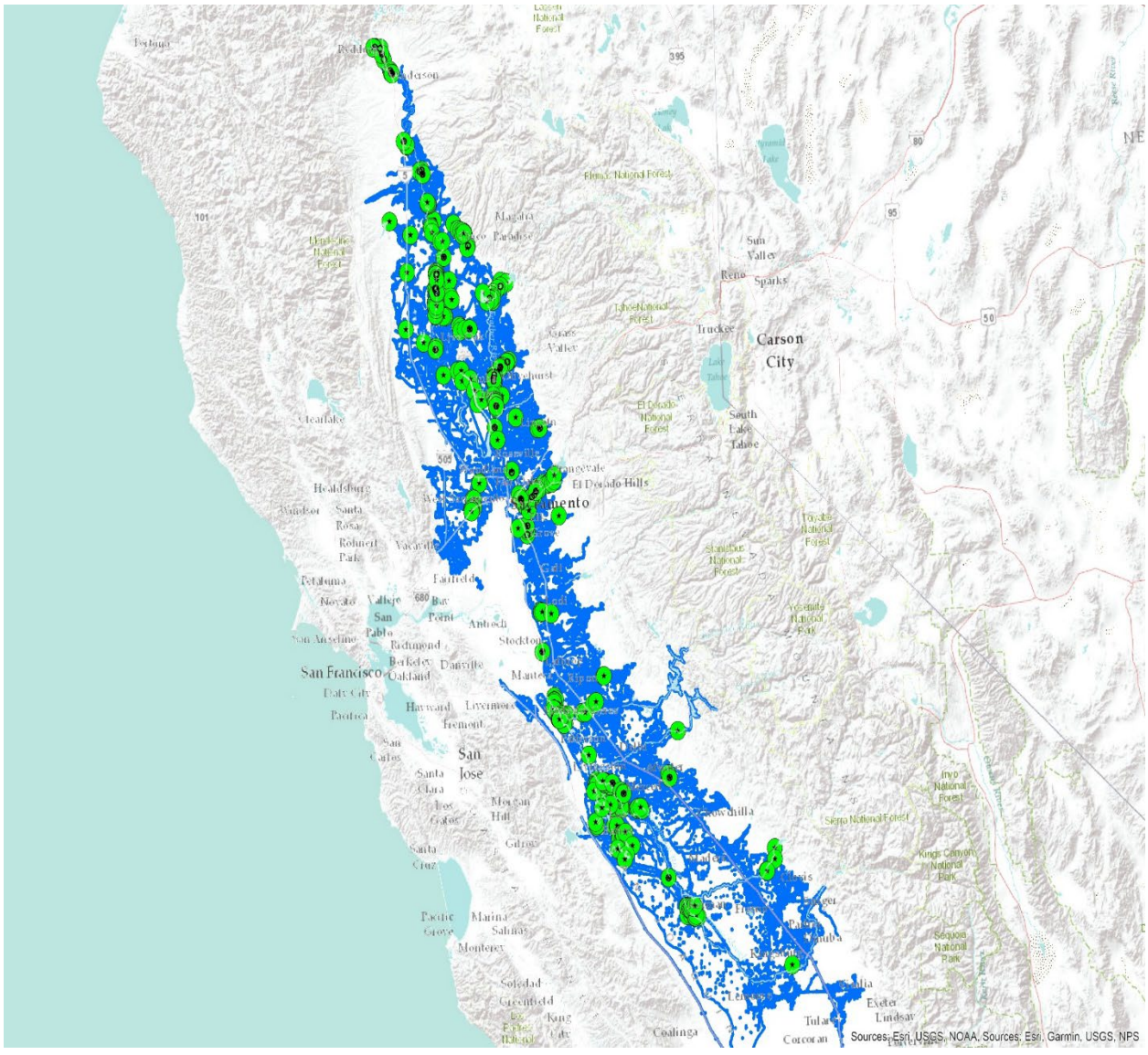

Figure 4. Location of 323 Accuracy Assessments completed Summer 2020

Table 2. Contingency table for Accuracy Assessments completed summer 2020 (use magnifying tool to view)

Accuracy assessment contingency table: Row headings are classes observed in the field. Column headings are classes as mapped by the photointerpreters. The diagonal indicates completely correct AAs. Producers' (omission) errors can be seen by reading across the table, showing how many polygons in each map class were correctly labeled. Users' (commission) errors are read down the table, and show how many stands of a vegetation class were not mapped (missed). Use the “Zoom” tool under the “View” tab to magnify table.
For an Excel version of this table please contact bkreb@csuchico.edu.

		Map Unit																																																									
SortOrder	**Final Call**	Pinus sabiniana	Quercus douglasii	Quercus lobata (upland)	Quercus wislizeni - tree	Acer negundo	Juglans hindsii and hybrids	Platanus racemosa	Populus fremontii	Quercus lobata (riparian)	Salix gooddingii	RWF - Riparian Evergreen and Deciduous Woodland	Alnus rhombifolia	Fraxinus latifolia	VRF -Vancouverian Riparian Deciduous Forest	Salix lucida	Ailanthus altissima Semi-natural Stands	Eucalyptus (globulus, camaldulensis) Semi-natural Stands	Robinia pseudoacacia Semi-natural Stands	Ornamental trees	IMF - Introduced North American Mediterranean Forest	Salix lasiolepis	Salix exigua	Cephalanthus occidentalis	Sambucus nigra	Vitis californica	RWS - Southwestern North American Riparian Wash/Scrub	Arundo donax	Rubus armeniacus	RIS - Riparian Introduced Scrub	Baccharis pilularis	Heterotheca oregona	Allenrolfea occidentalis	Atriplex lentiformis	Frankenia salina	Suaeda moquinii	Distichlis spicata	SVP - Sparsely Vegetated Playa/Pool	AGP -Alkali Grassland - Playa/Pool Matrix	VPB - Californian Mixed Annual/Perennial Freshwater Vernal P	VPG - California Vernal Pool and Grassland Matrix	CFG - California Annual Forbs and Grasses	Centaurea (solstitialis, mexicana)	CAI - California Introduced Annual and Perennial Herbaceous	Artemisia douglasiana	WTM - California Warm Temperate Marsh/Seep	Juncus effusus	Persicaria lapathifolia - Xanthium strumarium	NRW - Naturalized Warm-Temperate Riparian/Wetland	Managed annual and perennial wetland vegetation	Schoenoplectus (acutus, californicus)	Typha (angustifolia, domingensis, latifolia)	FEM - Freshwater Emergent Marsh	Azolla (filiculoides, mexicana)	Lemna minor and Relatives	TFF - Temperate Freshwater Floating Mat	Ludwigia (hexapetala, peploides)	Myriophyllum spp. - permanently flooded herbaceous alliance	NTF - Naturalized Temperate Pacific Freshwater Vegetation	BGS - Barren gravel and sand	
1	Pinus sabiniana	3																																																											3
2	Quercus douglasii		4																																																										4
3	Quercus lobata (upland)			4																																																									4
4	Quercus wislizeni - tree	1	2		6																1																																									10
5	Acer negundo					6					1																	1																																	8
6	Juglans hindsii and hybrids						4	1																	1																																					6
7	Platanus racemosa							3							1																																														4
8	Populus fremontii	1					1		3	1		1		1					1				1																																					10
9	Quercus lobata (riparian)			2	1		1			6			1																																															11
10	Salix gooddingii						1		1		4			1	1							1						1																							1											11
11	RWF - Riparian Evergreen and Deciduous Woodland					1					1	3	1		1														1																																			8
12	Alnus rhombifolia													4		1				1																																											6
13	Fraxinus latifolia					1	1							1																																														3
14	VRF -Vancouverian Riparian Deciduous Forest																																																												0
15	Salix lucida													1																																														1
16	Ailanthus altissima Semi-natural Stands																6																																													6
17	Eucalyptus (globulus, camaldulensis) Semi-natural Stands											1						6																																											7
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19	Ornamental trees									1				1						8																																										10
20	IMF - Introduced North American Mediterranean Forest														1						3																																									4
21	Salix lasiolepis																					5					1																																			6
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27	Arundo donax																											4																																4
28	Rubus armeniacus																												7																															7
29	RIS - Riparian Introduced Scrub																							1						1																						1								3
30	Baccharis pilularis																					1					2				6																													9
31	Heterotheca oregona																															7																												7
32	Allenrolfea occidentalis																																8																											8
33	Atriplex lentiformis																																	8							1																			9
34	Frankenia salina																																				3																							3
35	Suaeda moquinii																																			5																								5
36	Distichlis spicata																																				2			2																				4
37	SVP - Sparsely Vegetated Playa/Pool																																					7																						7
38	AGP -Alkali Grassland - Playa/Pool Matrix																																				1		5	1																				7
39	VPB - Californian Mixed Annual/Perennial Freshwater Vernal Pool / Swale Bottomland																																							1																				1
40	VPG - California Vernal Pool and Grassland Matrix																																								3																			3
41	CFG - California Annual Forbs and Grasses																																																												0
42	Centaurea (solstitialis, mexicana)																																																1												1
43	CAI - California Introduced Annual and Perennial Herbaceous																																						1			1		2																4
44	Artemisia douglasiana																																												2	1			1												4
45	WTM - California Warm Temperate Marsh/Seep																																																												0
46	Juncus effusus																																																				1								1
47	Persicaria lapathifolia - Xanthium strumarium																																													2			1	2											1		6
48	NRW - Naturalized Warm-Temperate Riparian/Wetland																																									1				2			3													6
49	Managed annual and perennial wetland vegetation																																																	5				1							6
50	Schoenoplectus (acutus, californicus)																																																		5	4	2								11
51	Typha (angustifolia, domingensis, latifolia)																																						1											2	2	1								6
52	FEM - Freshwater Emergent Marsh																																																				3								3
53	Azolla (filiculoides, mexicana)																																																								1			1
54	Lemna minor and Relatives																																																					1	2	1					4
55	TFF - Temperate Freshwater Floating Mat																																																						1						1
56	Ludwigia (hexapetala, peploides)																																																							1	4		3		8
57	Myriophyllum spp. - permanently flooded herbaceous alliance																																																					1			1				2
58	NTF - Naturalized Temperate Pacific Freshwater Vegetation																																																							1			2		3
59	BGS - Barren gravel and sand																															1																												1
	Grand Total	5	6	6	7	8	8	5	4	8	6	5	6	5	5	0	7	6	7	8	4	8	6	6	6	7	6	7	7	2	7	8	8	8	0	5	6	7	7	4	4	2	0	2	3	5	0	0	6	7	8	7	7	3	3	3	6	0	6	0	303

Table 3. Accuracy Assessment scoring of each mapping unit

Summary table showing users' and producers' scores. Values in bold meet the minimum sample size criteria n=>5 and those italicized are above minimum sample size and below 80% accuracy based on a 5 point scale for each survey where 5 is completely correct and 0 is completely incorrect (even lifeform is incorrect). Scores italicized did not meet the 80% standard and should be treated with more caution for use.

Map Code	Map Class	Producer's Accuracy (%)	Producer's count	User's Accuracy (%)	User's count
3	**Pinus sabiniana**	**84**	**5**	100	3
28	**Quercus douglasii**	**93.33**	**6**	100	4
30	**Quercus lobata**	**86.67**	**6**	100	4
31	**Quercus wislizenii - tree**	**97.14**	**7**	**88**	**10**
12	**Acer negundo**	**92.5**	**8**	**90**	**8**
13	**Juglans hindsii and hybrids**	**87.5**	**8**	**86.67**	**6**
14	**Platanus racemosa**	**84**	**5**	90	4
15	Populus fremontii	95	4	**80**	**10**
16	**Quercus lobata**	**87.5**	**8**	**85.45**	**11**
17	**Salix gooddingii**	**93.33**	**6**	***72.73***	***11***
19	**RWF**	**84**	**5**	**82.5**	**8**
20	**Alnus rhombifolia**	**86.67**	**6**	**83.33**	**6**
21	**Fraxinus latifolia**	***72***	***5***	73.33	3
24	**VRF**	***60***	***5***	N/A	0
23	Salix lucida	N/A	0	80	1
5	**Ailanthus altissima - provisional**	**97.14**	**7**	**100**	**6**
6	**Eucalyptus (globulus, camaldulensis)**	**100**	**6**	**91.43**	**7**
9	**Robinia pseudoacacia**	**85.71**	**7**	**96.67**	**6**
7	**Ornamental trees**	**100**	**8**	**84**	**10**
11	IMF	85	4	80	4
79	**Salix lasiolepis**	**85**	**8**	**96.67**	**6**
78	**Salix exigua**	**93.33**	**6**	**82.22**	**9**
74	**Cephalanthus occidentalis**	***73.33***	***6***	100	3
80	**Sambucus nigra**	**100**	**6**	**97.14**	**7**
81	**Vitis californica - provisional**	**100**	**7**	**91.11**	**9**
82	**RWS**	***66.67***	***6***	60	**2**
65	**Arundo donax**	***74.29***	***7***	100	4
66	**Rubus armeniacus**	**100**	**7**	**100**	**7**
69	RIS	70	2	53.33	3
46	**Baccharis pilularis**	**88.57**	**7**	**80**	**9**
51	**Heterotheca oregona**	**97.5**	**8**	**100**	**7**
83	**Allenrolfea occidentalis**	**100**	**8**	**100**	**8**
84	**Atriplex lentiformis**	**100**	**8**	**88.89**	**9**
86	Frankenia salina	N/A	0	80	3
88	**Suaeda moquinii**	**100**	**5**	**100**	**5**

123	**Distichlis spicata**	**83.33**	**6**	65	4
145	**SVP**	**100**	**7**	**100**	**7**
146	**AGP**	**88.57**	**7**	**91.43**	**7**
132	VPB	60	4	100	1
131	VPG	75	4	100	3
94	CFG	50	2	N/A	0
90	Centaurea (solstitialis, mexicana)	N/A	0	20	1
92	CAI	100	2	90	4
133	Artemisia douglasiana - provisional	80	3	80	4
140	**WTM**	***60***	***5***	N/A	0
129	Juncus effusus	N/A	0	60	1
111	Persicaria lapathifolia - Xanthium strumarium	N/A	0	*56.67*	*6*
112	**NRW**	*73.33*	*6*	*76.67*	*6*
110	**Managed annual and perennial wetland vegetation**	**94.29**	**7**	**93.33**	**6**
106	**Schoenoplectus (acutus, californicus)**	**87.5**	**8**	**89.09**	**11**
107	**Typha (angustifolia, domingensis, latifolia)**	**80**	**7**	**80**	**6**
108	**FEM**	**85.71**	**7**	100	3
125	Azolla (filiculoides, mexicana)	66.67	3	60	1
126	Lemna minor and Relatives	93.33	3	90	4
128	TFF	66.67	3	80	1
114	**Ludwigia (hexapetala, peploides)**	**90**	**6**	**87.5**	**8**
115	Myriophyllum spp.-Egeria densa Provisional	N/A	0	70	2
116	**NTF**	*76.67*	*6*	86.67	3
142	BGS	N/A	0	80	1
144	WAT	N/A	0	N/A	0

OVERALL ACCURACY of Producer's Accuracy (%)	**OVERALL ACCURACY of Producer's count**
87.067	**303**

Discussion of low scores

Low scores are those that do not have an Accuracy Assessment score of 80% or greater. All or a select portion of the polygons in the low-scoring Alliances and Groups are revisited post Accuracy Assessment to make necessary corrections, working outward from the known field-assessed point. This is what increases the overall confidence for the map user, but is difficult to quantify since this is not a normal tracking procedure in the mapping process, but could be added in future mapping efforts. Low scores are often the result of getting a few stand types wrong when there is a small sample size of Accuracy Assessments for a particular Alliance or Group. Large sample sizes increase the cost of the project but also increase the overall accuracy.

***Fraxinus latifolia* and Vancouvarian Riparian Forest (VRF)** - *Fraxinus latifolia* is an Alliance under the VRF Group along with *Alnus rhombifolia* and *Salix lucida*. These communities (with the exception of *S. lucida*) are in thin riparian strips which are often thinner than the 10-meter

minimum width mapping rule and are often mixed with species of the Riparian Woodland Forest Group. For this reason, the communities are hard to map and often key to RWF Alliances or the Group level. Most of these polygons were double-checked post AA and the user can have much higher confidence in this Alliance than the AA score indicates.

***Cephalanthus occidentalis* –** This is a fairly uncommon shrub, difficult to discern in the mapping area. It is often mixed with and has a similar mapping signature to other riparian shrubs such as *Rubus armeniacus* (non-native), *Rosa californica*, *Sambucus nigra*, and *Vitis californica*. All of these polygons were double-checked post AA and the user can have much higher confidence in this Alliance than the AA score indicates.

Southwestern North American Riparian Wash/Scrub Group (RWS) - Two of these surveys were determined to be *Baccharis pilularis,* which is not in the RWS Group, which significantly lowered the overall score for this Group. *Baccharis* is often mixed with RWS shrubs and can easily be interpreted as a riparian shrub. *Baccharis* is often planted in restoration sites where there is a mix of RWS species also planted. The correct mapping unit can change depending on the specific proportions of *Baccharis* to other restoration shrubs.

***Arundo donax* -** This Alliance has a very interpretable signature and the photointerpreters leaned too heavily towards calling it the invasive *Arundo* Alliance when there was enough nativity to be determined a native Alliance. All of these polygons were double-checked post AA and the user can have much higher confidence in this Alliance than the AA score indicates.

California Warm Temperate Marsh/Seep Group (WTM) - There is less of this Group in the CVFPP area than originally interpreted in 2009 and 2016. It is often mixed with or dominated by California Introduced Annual or Perennial Herbaceous Group (CAI) or Naturalized Warm-Temperate Riparian/Wetland Group (NRW) species. All of these polygons were double-checked post AA and the user can have much higher confidence in this Group than the AA score indicates.

Naturalized Warm-Temperate Riparian/Wetland Group (NRW) - This is a wet and weedy Group that often is mixed with and sometimes dominated by CAI and WTM species. The mapping signature for this Group is variable and can be challenging to pull out correctly.
Naturalized Temperate Pacific Freshwater Vegetation Group (NTF) - This Group is a floating aquatic vegetation Group that can be misinterpreted as the Temperate Freshwater and Floating Mat Group (TFF) or the NRW Group, wthich can have a similar signature at times.

Change Detection from 2009 to 2016 for CVFPP

Change detection is a modern concept where two maps covering the same area but based on different imagery years are compared using ArcGIS tools. The output tells us what has changed and, with further inquiry, one can determine specific changes from one mapping unit to another. For example, a wetland area mapped as Managed Marsh in 2009 had small willow trees that were not tall enough or dense enough to be considered a tree stand. By 2016, these willow trees had matured enough over 7 years to be classified as a willow stand. This example occurred in the Butte Sink area west of the Sutter Buttes.

Changes in a remap effort can occur due to several factors, some due to physical change and some due to non-physical change. Examples of factors that represent physical change are: stand maturation or decadence, fire, erosion, deposition, anthropogenic disturbances such as scraping/clearing, urban development, agricultural development, and restoration. Non-physical changes include: improvement in imagery quality, incorrect original mapping, imagery shifts, improvement of older linework, and change in level mapped (classification). Imagery quality continues to improve with time, which allows the photointerpreter to better determine which species are present and in what amounts to determine its best classification. A photointerpreter could also disagree with the previous mapper's decisions and may change the classification in the remapping effort. A more subtle map change, which does not affect the acreages significantly, is when the photointerpreter improves old linework to make it better fit the classification type visually. Also, when the NAIP imagery is ortho-rectified, in some years it does not perfectly align with the year it is being compared to and linework needs to be shifted/redrawn. Lastly, a photointerpreter may have remapped an Alliance at the Group level due to lack of confidence at the Alliance level, and vice versa the interpreter may have mapped an Alliance that was previously mapped at Group level due to better confidence at that level. **All of these factors should be taken into consideration when reviewing or citing this report.**

Change detection was performed for the Central Valley Flood Protection Plan area, comparing the years 2009 to 2016, totaling 2,645,999 acres. Each map was clipped to the designated CVFPP area boundary and then each mapping unit was analyzed for change in acreages between the imagery years. The results of this analysis can be found in Table 4. Riparian acres totaled 281,033 in 2009 and 303,823 in 2016, showing an increase of 22,790 acres (8%). Non-riparian acres were 291,582 in 2009 and 264,568 in 2016, showing a decrease of 27,013 acres (9%). Agriculture covered 1,753,706 acres in 2009 and 1,757,906 acres in 2016, showing an increase of 4,200 acres (<1%). Urban areas covered 241,002 acres in 2009 and 244,155 acres in 2016, showing an increase of 3,153 acres (1%). A crosswalk used to compare mapping units from 2009 to 2016 can be found in Table 5.

The Future of Change Detection

The most recent change detection effort quantifies how our vegetation map has changed from 2009 to 2016. The Department of Water Resources has additionally asked the GIC to document why areas of change occurred. In order to update the Central Valley Flood Protection Plan and Conservation Strategy, DWR is interested in tracking the true physical changes to vegetation in the landscape. To accomplish this, each polygon would need to be re-evaluated and given a code representing a change type determined by the photointerpreter. This can only be performed during the next mapping effort due to the extensive time and effort required to complete this task. By adding this to the next mapping effort we will be able to determine the cause/reasons why any acreage change occurs, as the polygons are mapped. The GIC retroactively tried to determine why some of the largest changes occurred for this remap effort and they are discussed below, along with charts for every Group separated out by riparian, non-riparian, and non-vegetated.

Summary of Change from 2009 to 2016: Riparian Groups

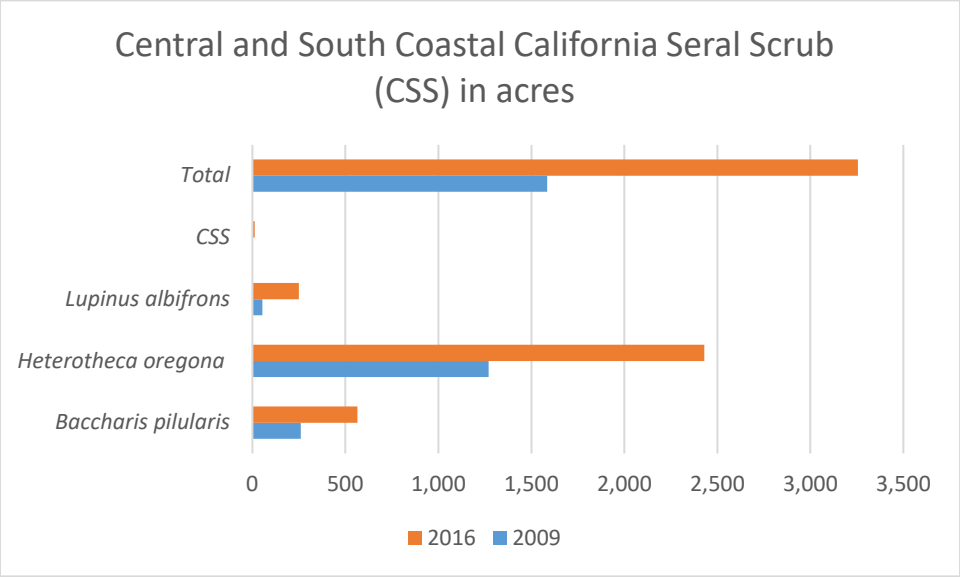

Figure 5. Central and South Coastal California Seral Scrub (CSS)

The changes in acreages for *Lupinus albifrons* and *Heterotheca oregona* are due to two factors: better imagery to show the detail necessary to pick out these small sub-shrubs, and deposition which created more gravel bars which they inhabit. This increase in *Baccharis pilularis* is due to maturation and restoration. Overall this group had an increase of 1,672 acres.

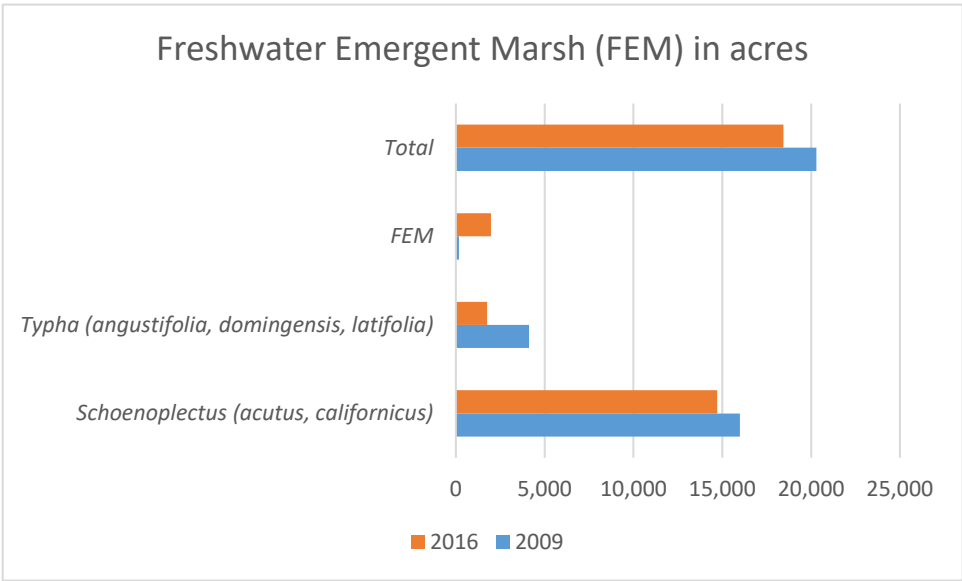

Figure 6. Freshwater Emergent Marsh (FEM)

Schoenoplectus (acutus, californicus) showed a loss of 1,289 acres and *Typha* showed a loss of 2,353 acres. 1,797 acres were gained in the FEM Group level category, which shows that the photointerpreters reclassified much of the *Schoenoplectus* and *Typha* from the Alliance to the Group level, potentially due to mixed stands or unclear imagery. The remainder of the loss of *Typha* and *Schoenoplectus* was most likely the result of plowing in managed marsh areas, where the acres were reclassified as a managed marsh or the more general Naturalized Warm-Temperate Riparian/Wetland (NRW) category. The total acres lost in this Group were 1,845.

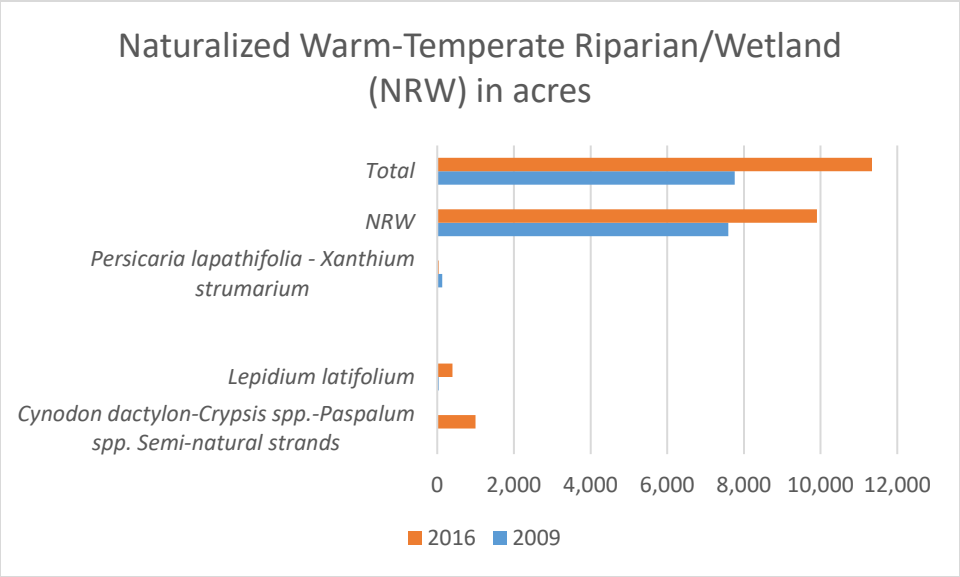

Figure 7. Naturalized Warm-Temperate Riparian/Wetland (NRW)

Cynodon dactylon-Crypsis spp.-Paspalum spp. Semi-natural strands showed an increase of 1,001 acres. Photointerpreters were not required to map to this level, however the Accuracy Assessment confirmed the acreages. These stands are normally mapped as the more general NRW Group or as Managed Annual and Perennial Wetland vegetation. *Lepidium latifolium* increased by 356 acres, which is most likely a combination of physical change and being able to detect the signature with better imagery in 2016. These two Alliances commonly reside within managed marsh areas in the southern portion of the Great Valley Eco-region. A total of 8,471 acres were gained in the NRW Group and these acres most likely came from the Alkali Grassland - Playa/Pool Matrix (AGP), Sparsely Vegetated Playa/Pool (SVP), Freshwater Emergent Marsh (FEM), and California Introduced Annual and Perennial Herbaceous (CAI) Groups.

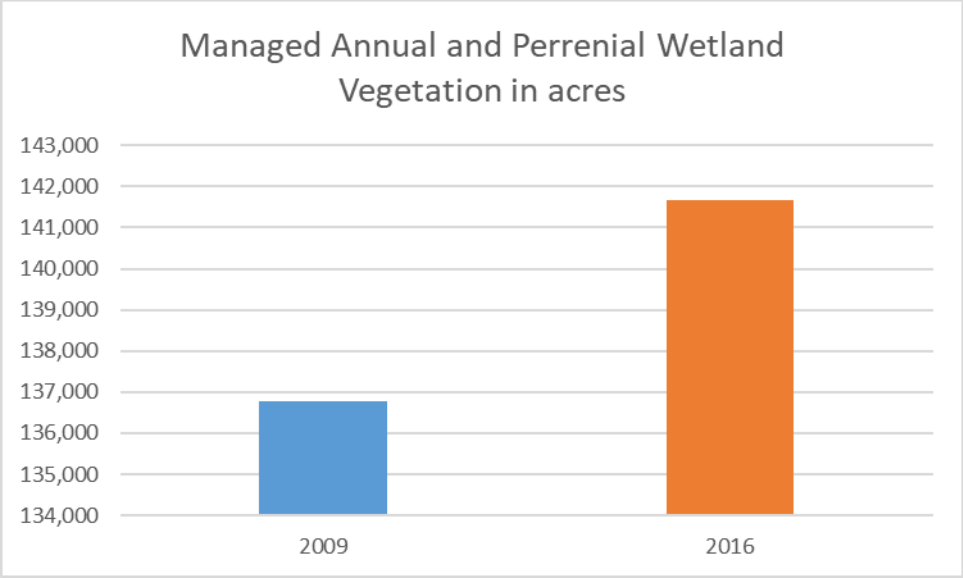

Figure 8. Managed Annual and Perennial Wetland

This is a mapping unit within the NRW group which needed its own chart due to the large acreages skewing the smaller values within the Group. Managed Annual and Perennial Wetland vegetation (such as duck clubs or national/state wildlife refuges) showed an increase of 4,892

acres. Much of this change was due to the reclassification of Alkali Grassland - Playa/Pool Matrix (AGP) and Sparsely Vegetated Playa/Pool (SVP) as Managed Annual and Perennial Wetland vegetation.

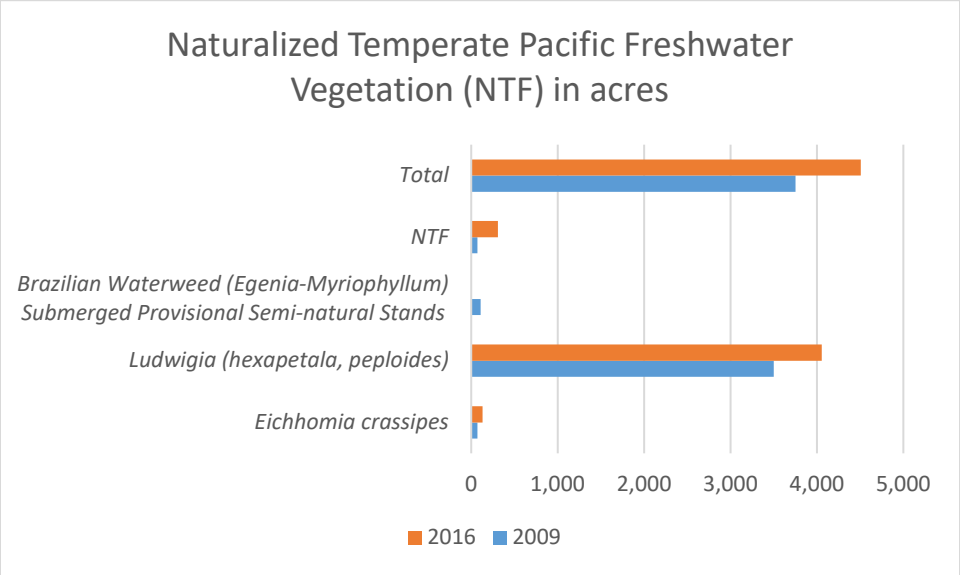

Figure 9. Naturalized Temperate Pacific Freshwater Vegetation (NTF)

Brazilian Waterweed (*Egenia-Myriophyllum*) Submerged Provisional Semi-natural Stands showed a loss of 99 acres. This signature is difficult to pick out and was most likely changed to the more general NTF Group level. The NTF Group had an overall increase of 753 acres; most of these added acres were in the *Ludwigia* Alliance. This addition of aquatic invasive species was physical change and not due to better imagery in 2016.

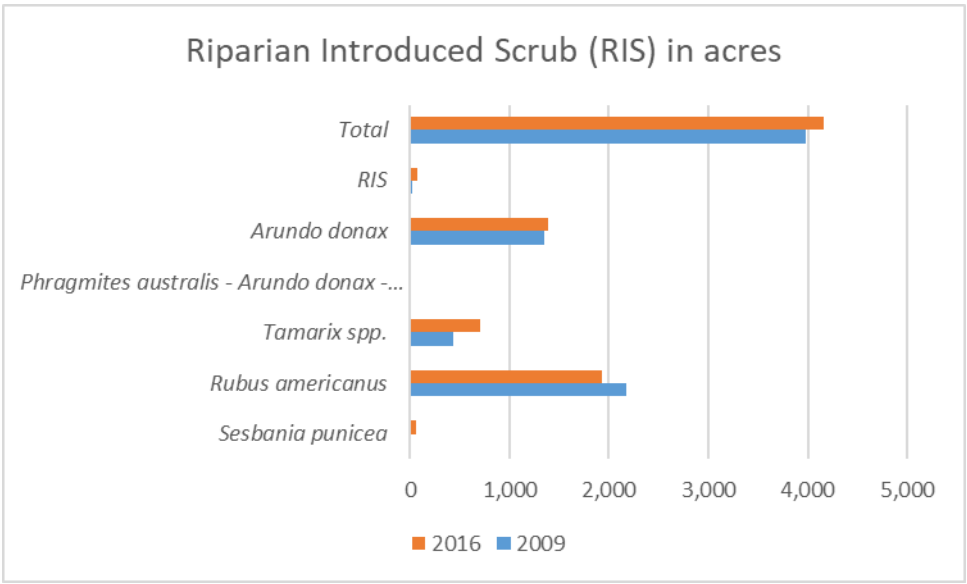

Figure 10. Riparian Introduced Scrub (RIS)

This Group had an overall addition of 175 acres, which is most likely a combination of physical change and being able to better see the signatures with better imagery. Please note that *Arundo donax* is in both its own mapping unit and in the more recent *Phragmites australis - Arundo donax - Alopecurus pratensis Semi-natural Stands Alliance.* This was done so that we could keep *Arundo*

donax separate as it was in 2009, so we could compare acres to 2016 with out *Phragmites australis* skewing data. Only one polygon was mapped of *Phragmites australis* under the new combined alliance in 2016.

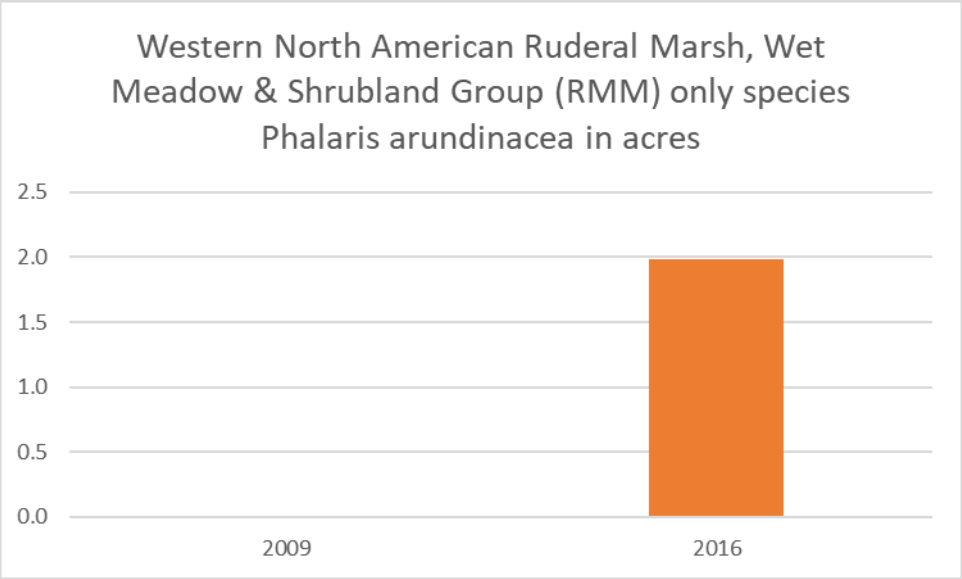

Figure 11. Western North American Ruderal Marsh, Wet Meadow & Shrubland Group (RMM) *Phalaris arundinacea* grows in narrow strips along riverbanks and showed an increase of 2 acres, which was due to observances in the field.

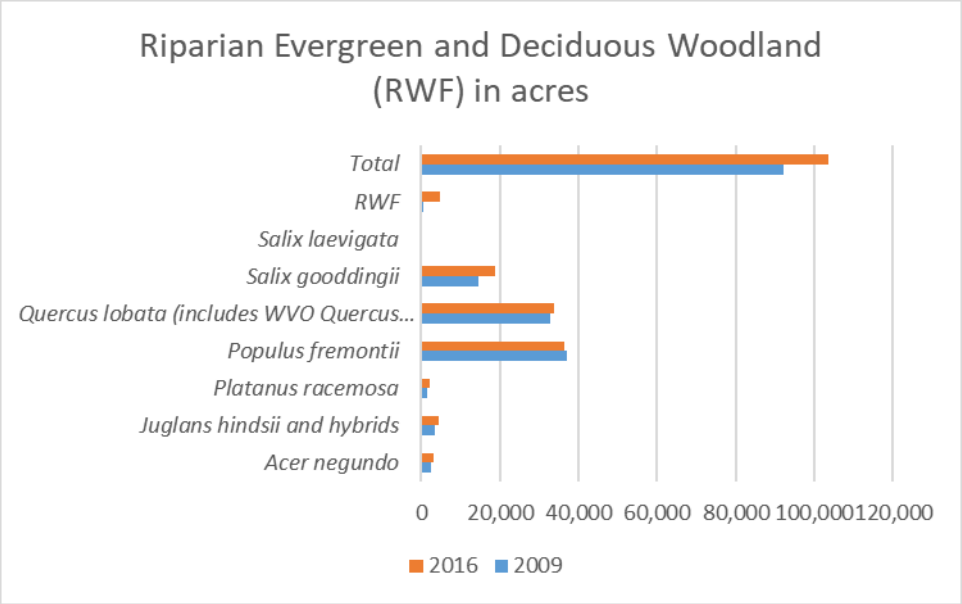

Figure 12. Riparian Evergreen and Deciduous Woodland (RWF)

Populus fremontii was the only Alliance in the Group to have a loss, which was 673 acres. This can be attributed to photointerpreters cutting out other RWF-type inclusions within *Populus* polygons. The photointerpreters could better classify the large *Populus* polygons with better imagery in 2016. *Salix gooddingii* had the most notable gain of 4,283 acres. It is important to note that the majority of this acreage was gained in managed marsh areas, not in restoration or riparian environments. This increase was a combination of the photointerpreters being able to better pick out the signature with better imagery and physical change due to maturation. The most notable

change in *Salix gooddingii* occurred in the Butte Sink area west of the Sutter Buttes. *Juglans hindsii* and hybrids increased by 1,285 acres. This species is expanding its range and dominance in the Central Valley riparian areas. Overall, the RWF Group added 11,365 acres; at least 1,000 of these acres came from restoring agricultural land to native habitat, much of which occurred in the Bear River levee setback area.

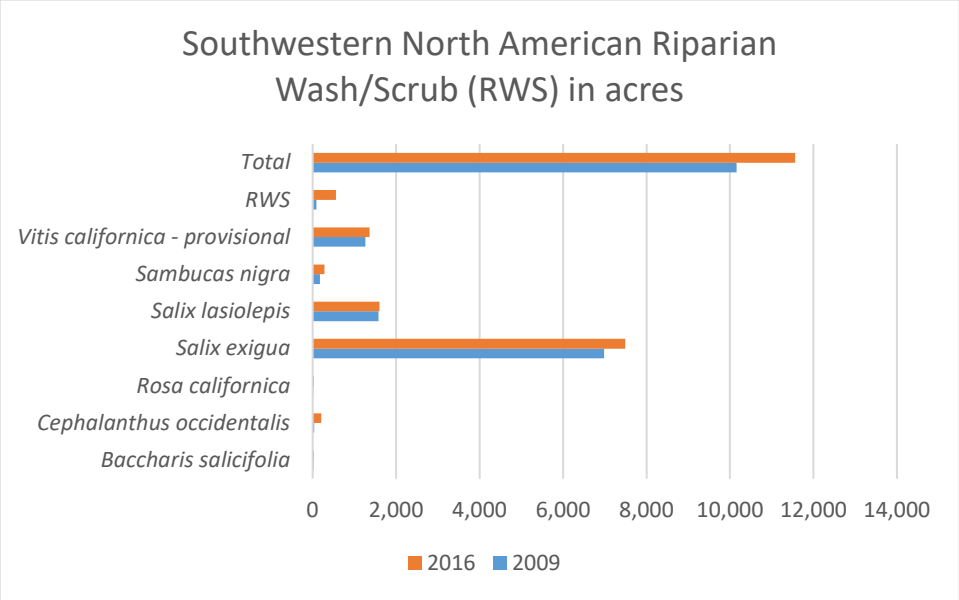

Figure 13. Southwestern North American Riparian Wash/Scrub (RWS)

This Group increased by 1,398 acres from 2009 to 2016. The increase in riparian shrubs along with *Acer negundo* (RWF, above), is most likely a combination natural ecological succession and restoration projects.

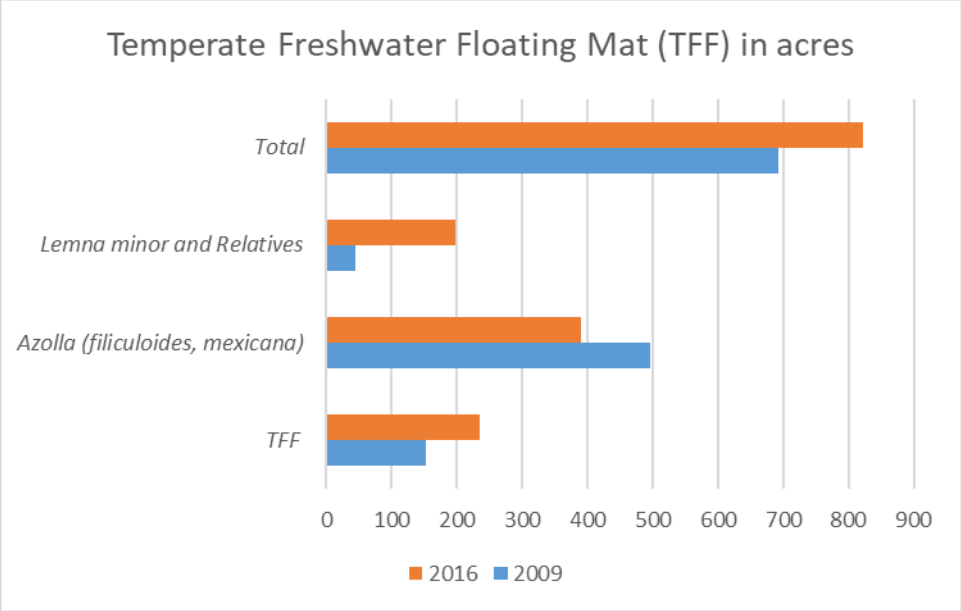

Figure 14. Temperate Freshwater Floating Mat (TFF)

This Group increased by 130 acres from 2009 to 2016, which can be attributed to physical change.

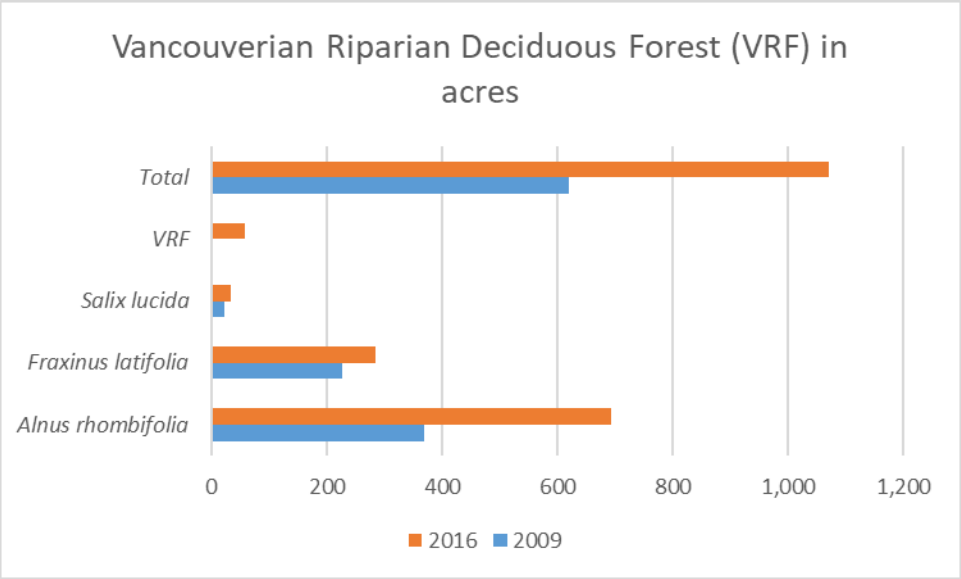

Figure 15. Vancouverian Riparian Deciduous Forest (VRF)
This Group increased by 450 acres and can mostly be attributed to manually identifying and mapping stands while floating down the Sacramento River.

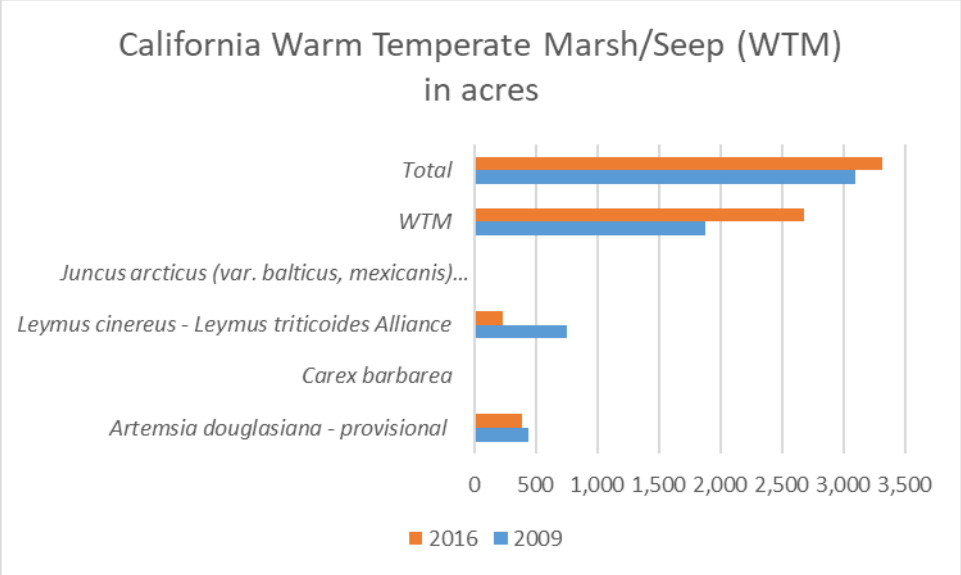

Figure 16. California Warm Temperate Marsh/Seep (WTM)
This Group gained 217 acres from 2009 to 2016, which was most likely due to physical change.

Summary of Change from 2009 to 2016: Non-Riparian Groups

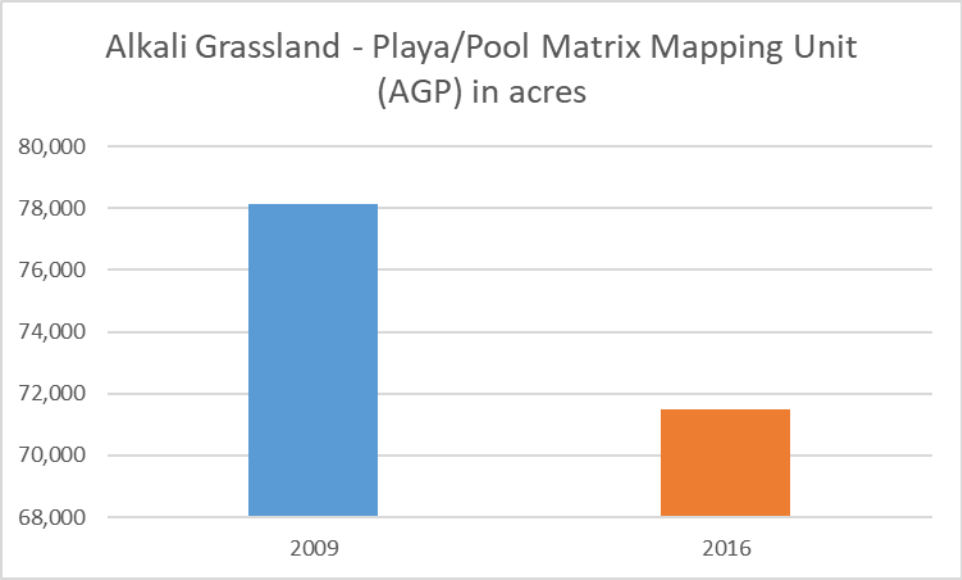

Figure 17. Alkali Grassland - Playa/Pool Matrix (AGP)

This Group had a loss of 6,634 acres, which was a combination of being converted to agriculture in the southern Central Valley and being reclassified as NRW. In the southern Central Valley, AGP areas reside within managed marsh areas, which are in the NRW Group. When areas such as AGP are seasonally flooded or rapidly changing under management, they are better classified as managed marsh.

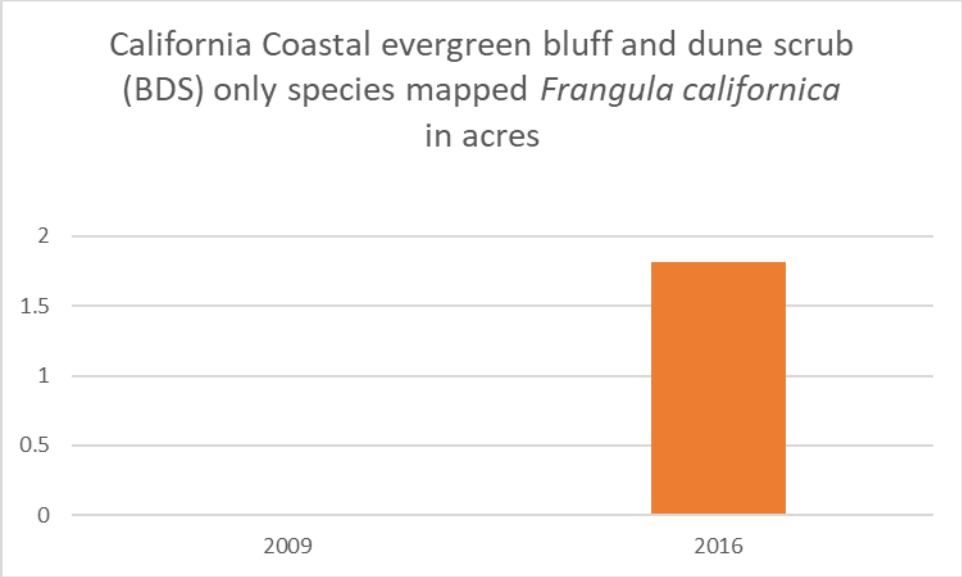

Figure 18. California Coastal evergreen bluff and dune scrub (BDS)

Frangula californica increased by 1.8 acres from 2009 to 2016 and is most likely due to ground-truthing or better image quality.

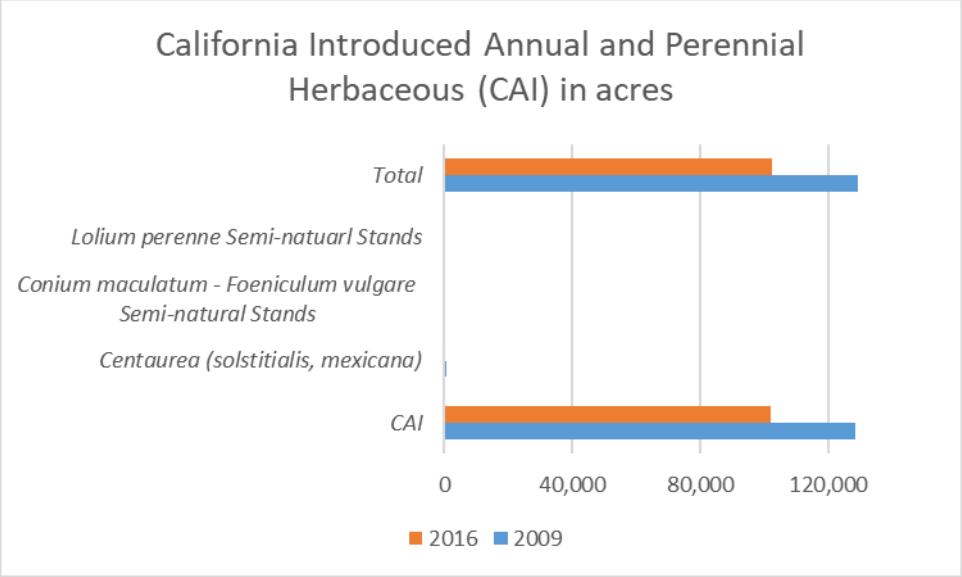

Figure 19. California Introduced Annual and Perennial Herbaceous (CAI)

This Group recorded a loss of 26,721 acres, which sounds like a lot, but is easily explained. "California's grasslands and flower fields vegetation types are among the most difficult to analyze and study. The greatest challenge comes from the variation in species composition and abundance from early to late season and between years. Researchers and consultants have tended to underestimate the significance of native herbaceous plants because they are frequently at their highest cover either very early or very late in the season and may have very low cover during the spring and summer, when non-native grasses dominate and when fieldwork is often performed. Additionally, in some years, a given area may be characterized by an abundance of non-native forbs and grasses, while in other years native herbs may dominate. This inter-seasonal and inter-annual variance of cover between the diagnostic species and the less diagnostic species leads us to conclude that rules for an herbaceous vegetation type's identification should be more broadly inclusive for nativity, with relative cover as low as 10% natives determining a native stand (CDFW Natural Communities)." It is very difficult to discern this 10% threshold of nativity via aerial imagery, and all CAI polygons were revaluated and potentially reclassified as California Annual Forbs and Grasses (CFG) native stands.

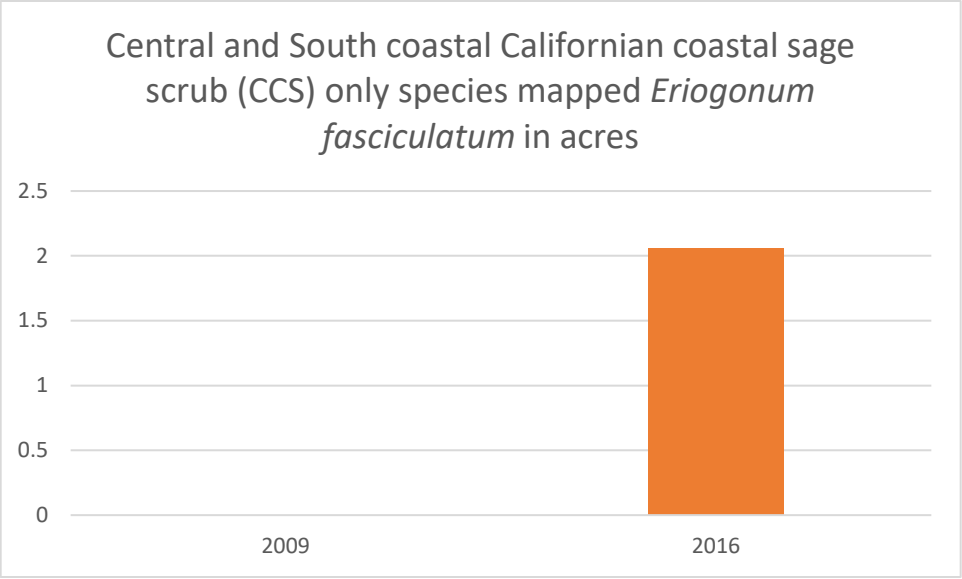

Figure 20. Central and South coastal Californian coastal sage scrub (CCS) *Eriogonum fasciculatum* increased by 2.06 acres from 2009 to 2016 and is most likely due to ground-truthing or better imagery quality.

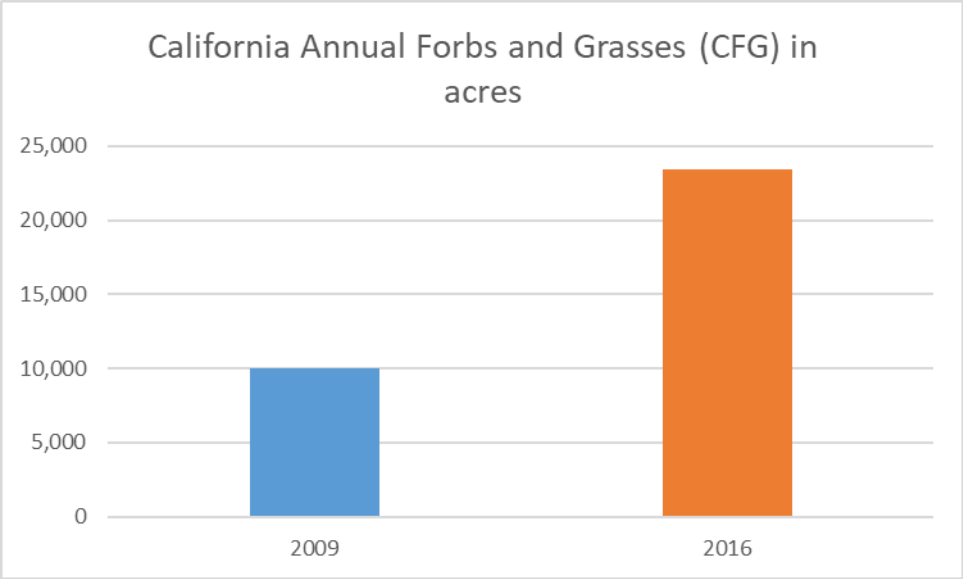

Figure 21. California Annual Forbs and Grasses (CFG)
This Group had an increase of 13,433 acres and, as discussed above, the majority of these acres came from the reclassification of CAI as native stands.

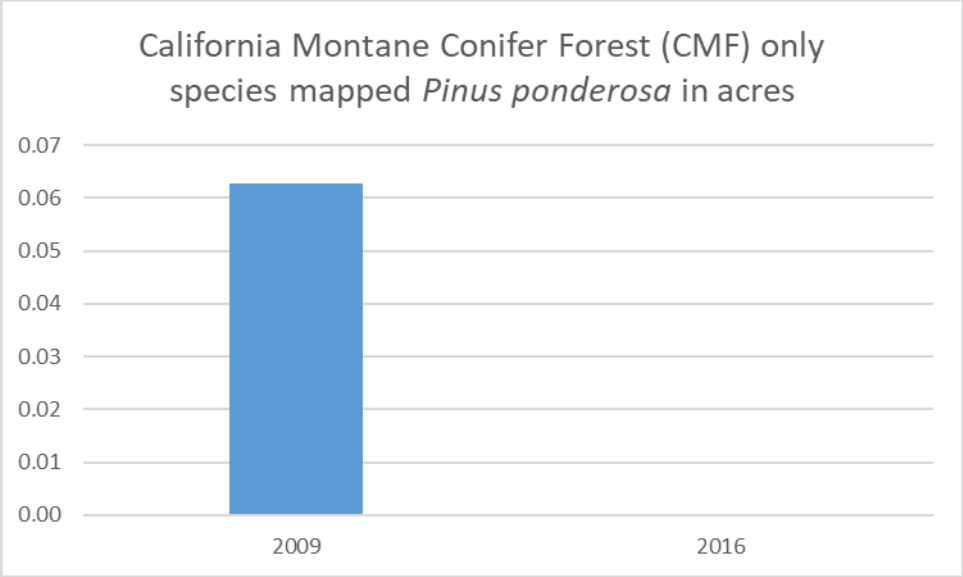

Figure 22. California Montane Conifer Forest (CMF)
Pinus ponderosa had .06 acres mapped in 2009, which was on the edge of the boundary and was sub-MMU, so was merged into an adjacent polygon in 2016.

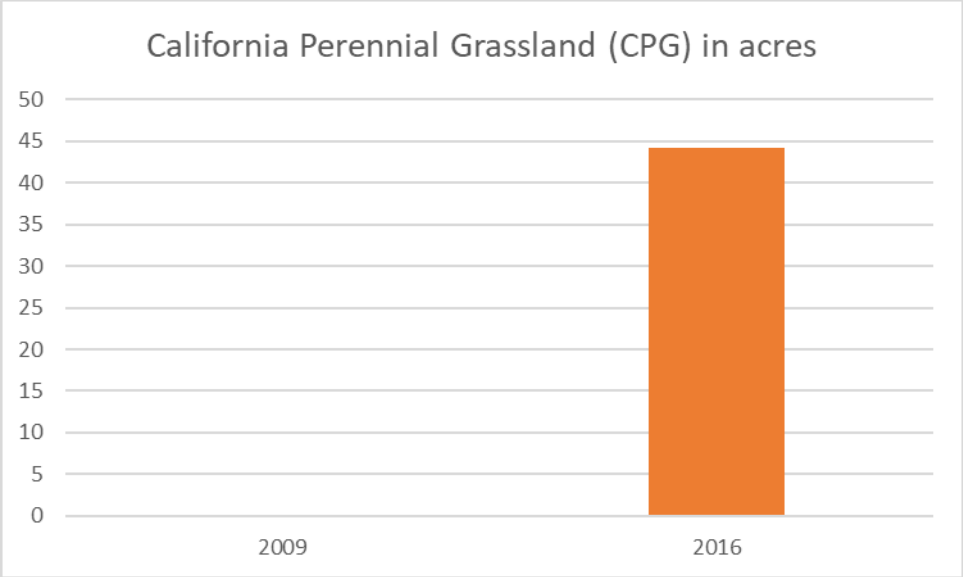

Figure 23. California Perennial Grassland (CPG)
This group increased by 44 acres from 2009 to 2016. This can be attributed to ground-truthing and better imagery quality.

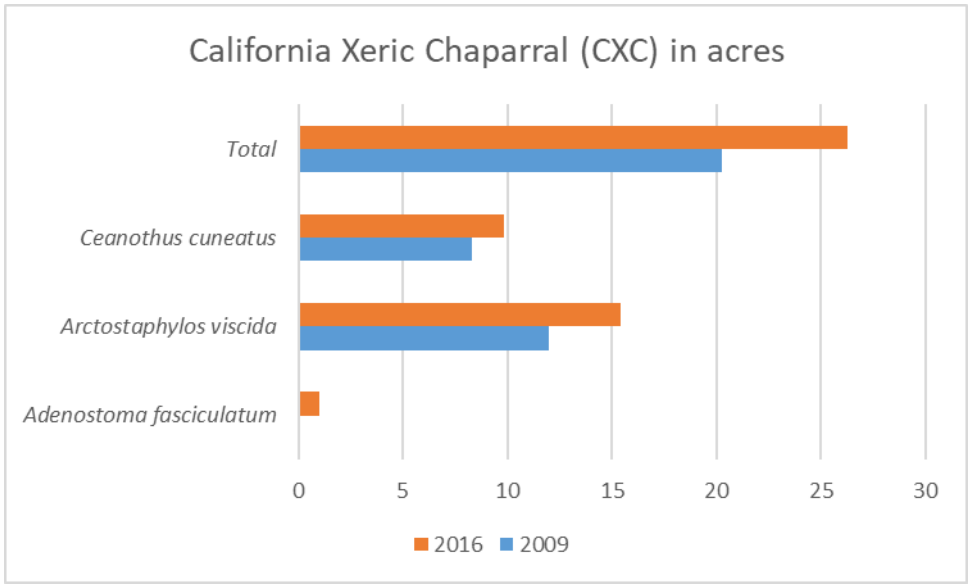

Figure 24. California Xeric Chaparral (CXC)
This group increased by 6 acres, which can be attributed to the maturation of stands.

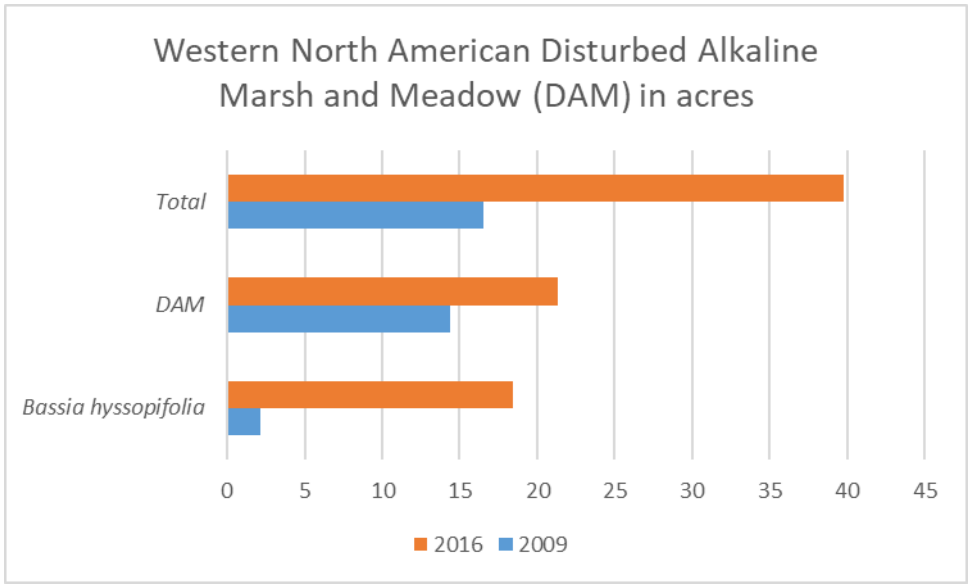

Figure 25. Western North American Disturbed Alkaline Marsh and Meadow (DAM)
This group increased by 23 acres from 2009 to 2016 and can be attributed to ground-truthing and better imagery quality.

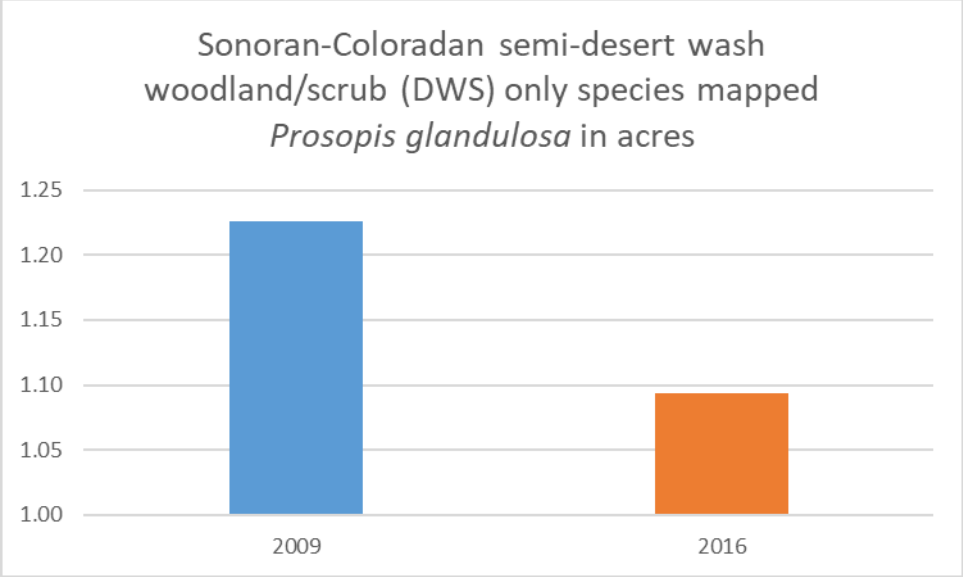

Figure 26. Sonoran-Coloradan semi-desert wash woodland/scrub (DWS) *Prosopis glandulosa* had a slight change in acreage of .13 acres, which can be attributed to slight linework improvement from 2009 to 2016.

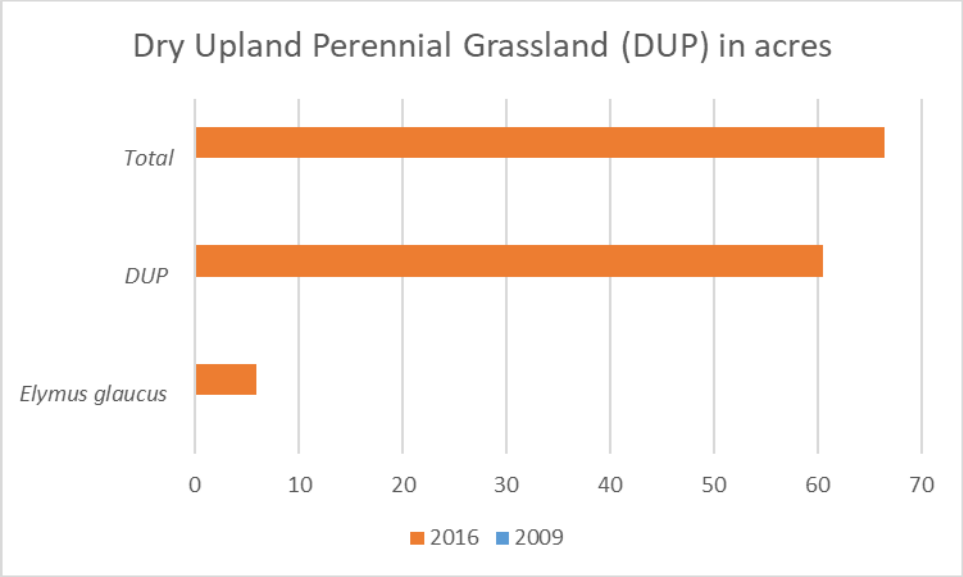

Figure 27. Dry Upland Perennial Grassland (DUP) This group had zero acres mapped in 2009 and 66 acres in 2016, which can be attributed to ground-truthing and better imagery quality.

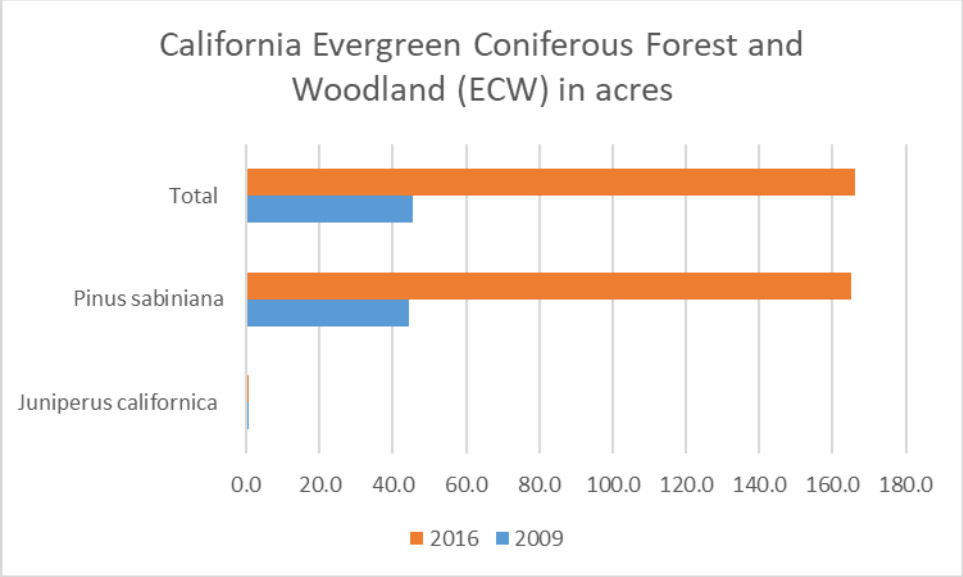

Figure 28. California Evergreen Coniferous Forest and Woodland (ECW)

This Group added 120 acres in the *Pinus sabiniana* Alliance and can be attributed to being misclassified in 2009 and correctly identified in 2016. When using the infrared imagery layer, *Pinus sabiniana* can look like *Populus fremontii*.

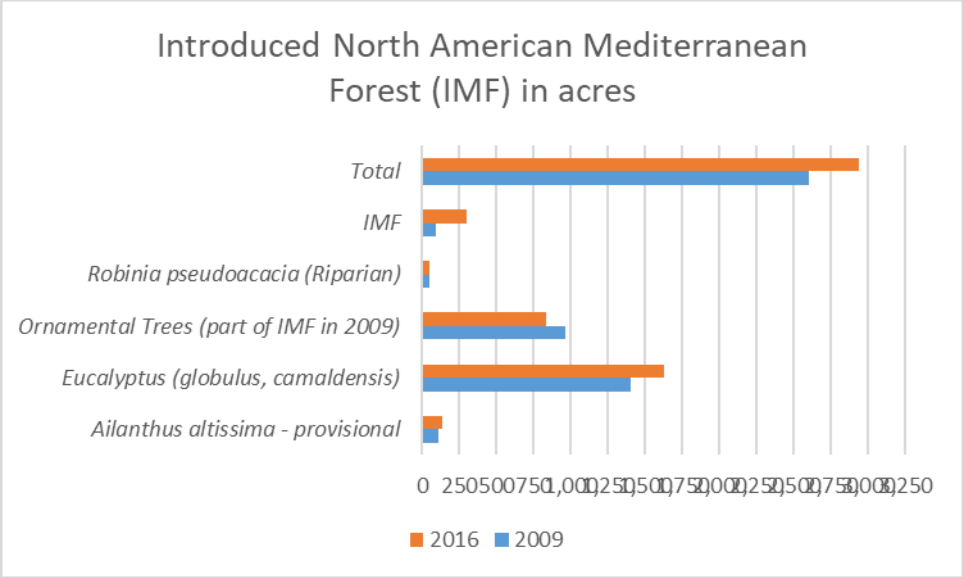

Figure 29. Introduced North American Mediterranean Forest (IMF)

This group increased by 330 acres from 2009 to 2016 and was mainly driven by the spreading of *Eucalyptus sp.*

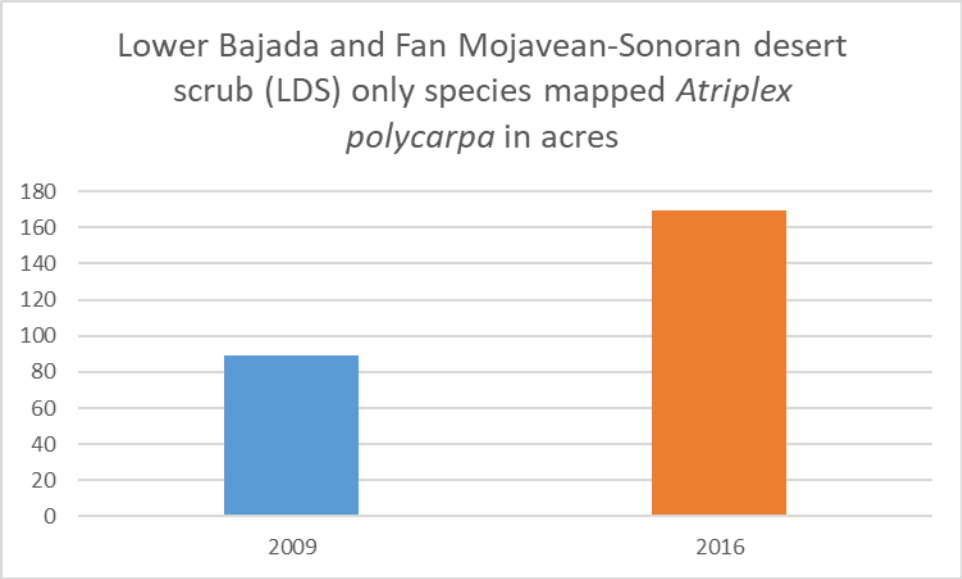

Figure 30. Lower Bajada and Fan Mojavean-Sonoran desert scrub (LDS)
This Group's only species mapped - *Atriplex polycarpa* - increased by 80 acres from 2009 to 2016. This can be attributed to ground-truthing and better imagery quality.

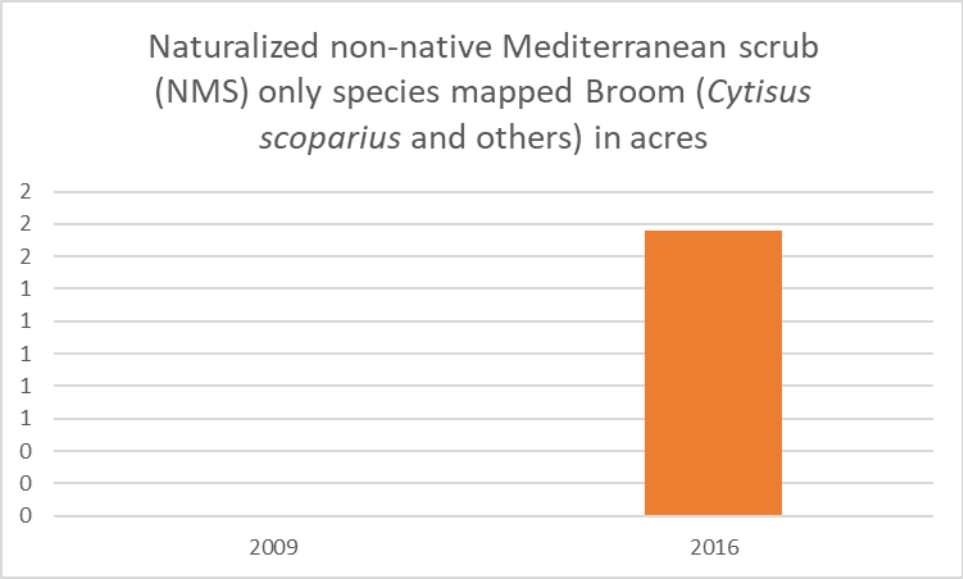

Figure 31. Naturalized non-native Mediterranean scrub (NMS)
This Group's only species mapped - *Cytisus scoparius* and other brooms – increased by 1.8 acres from 2009 to 2016, which can be attributed to ground-truthing in the Redding area.

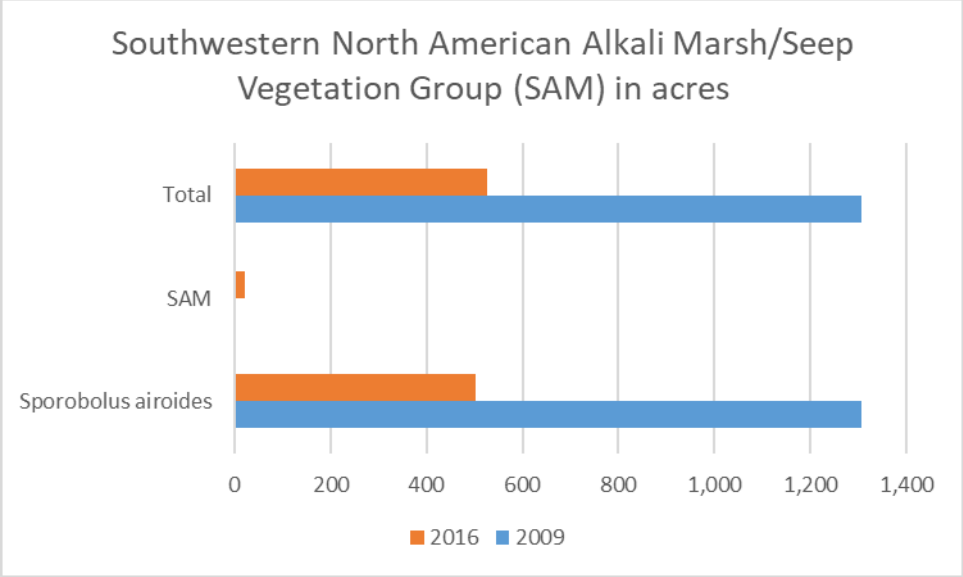

Figure 32. Southwestern North American Alkali Marsh/Seep Vegetation (SAM)

This Group had a loss of 781 acres from 2009 to 2016. *Sporablolis airoides* mostly occurs within managed marshes which change rapidly with management and seasonality. Most of the loss of these acres were reclassified as NRW or managed marsh.

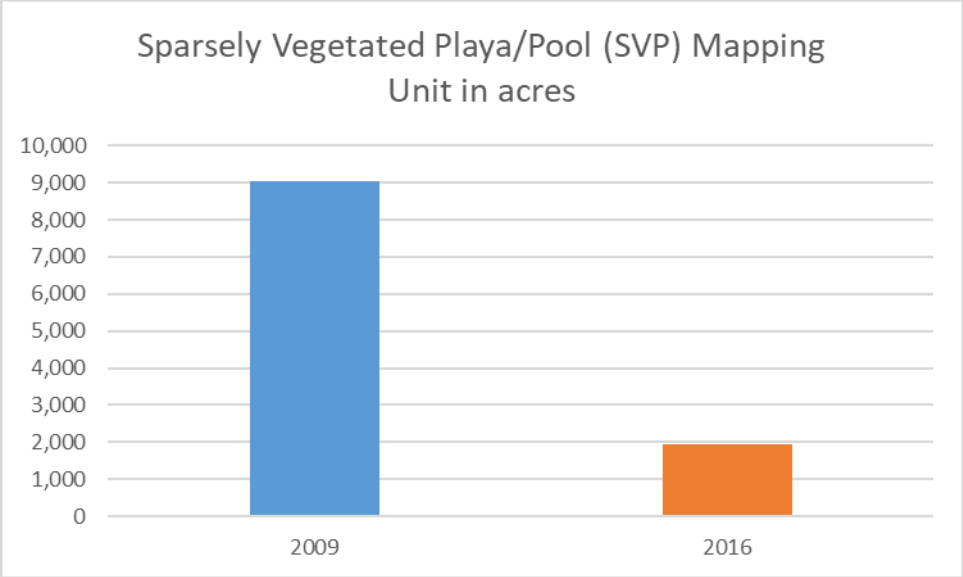

Figure 33. Sparsely Vegetated Playa/Pool (SVP)

This mapping unit had a loss of 7,066 acres. This loss can be attributed to the reclassification of the Mendota Wildlife Area, which was misclassified in 2009 as SVP instead of being NRW Managed Marsh or other alliances within NRW. As discussed previously, in the southern central valley SVP and AGP areas reside within managed marsh areas that are under the NRW Group. When areas such as SVP are seasonally flooded or rapidly changing under management, they are better classified as managed marsh. Additionally, with better imagery in 2016 photointerpreters were able to cut out Southwestern North American Salt Basin and High Marsh (SSB) Alliances such as *Suaeda moquinii* from the SVP areas.

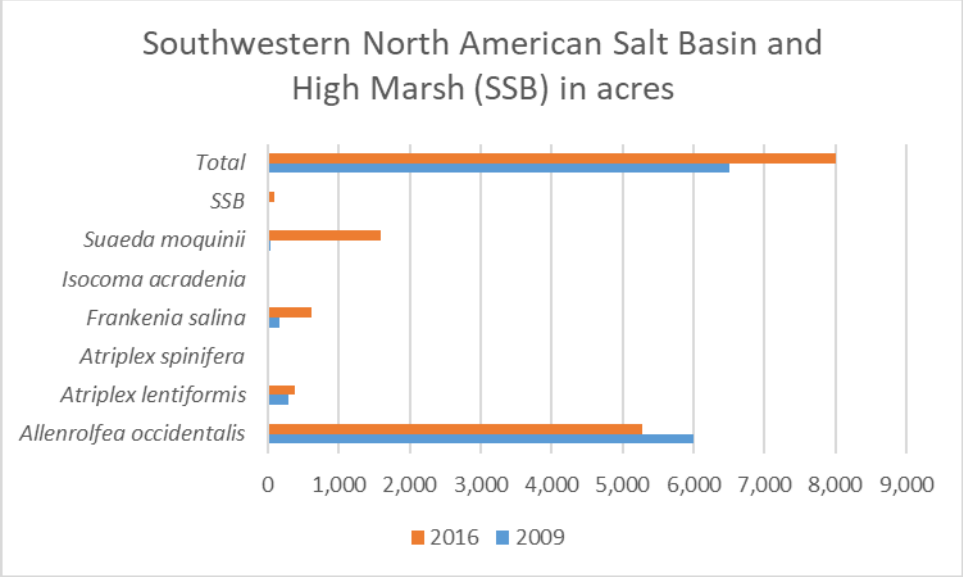

Figure 34. Southwestern North American Salt Basin and High Marsh (SSB)

This Group had an increase of 1,505 acres and, as discussed in the SVP summary, several of the acres came from being able to cut them out from SVP areas with better imagery.

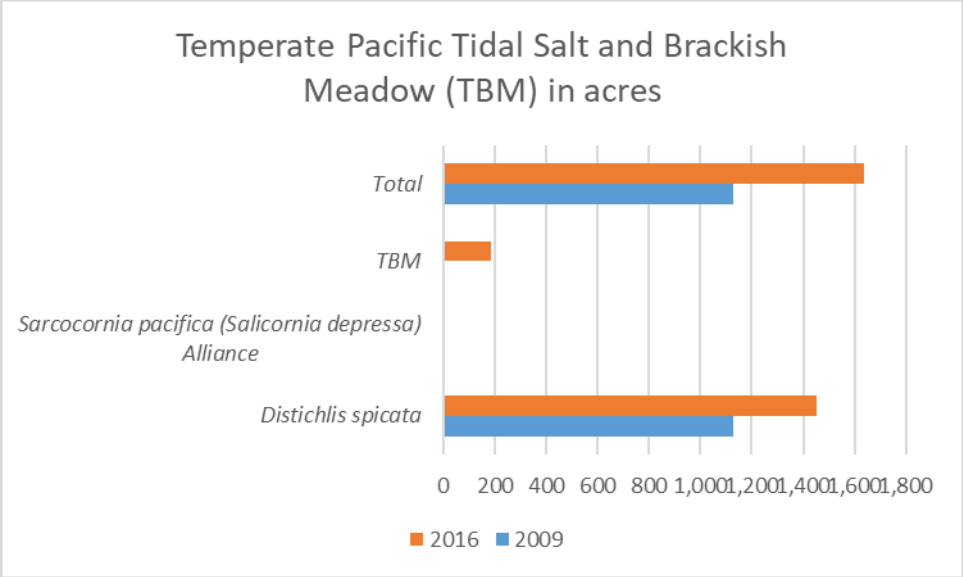

Figure 35. Temperate Pacific Tidal Salt and Brackish Meadow (TBM)

This Group had an increase of 510 acres. Most of this increase was in the *Distichlis spicata* Alliance, which most likely was cut out of SVP areas with better imagery quality in 2016.

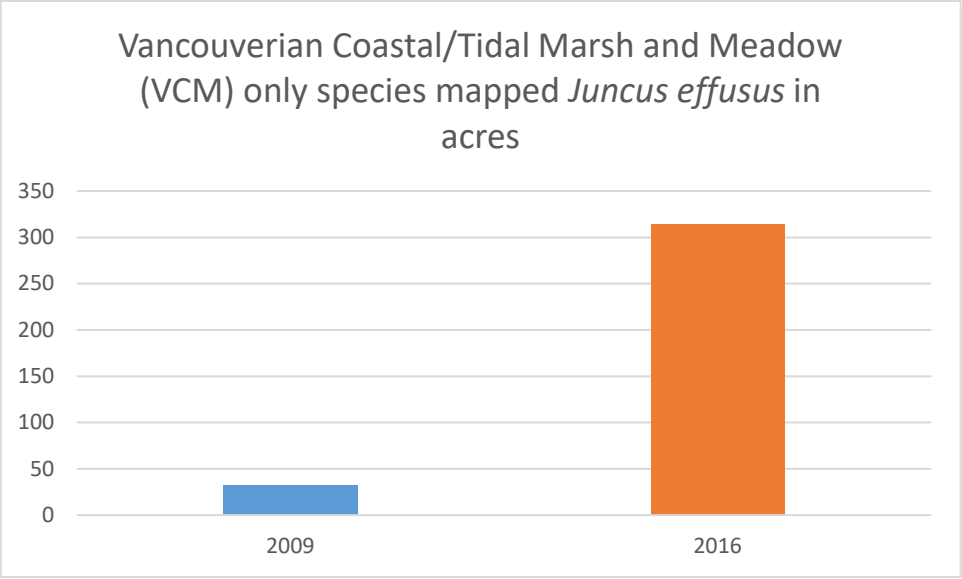

Figure 36. Vancouverian Coastal/Tidal Marsh and Meadow (VCM)
This Group's only species mapped - *Juncus effusus* - increased by 281 acres from 2009 to 2016. This can be attributed to ground-truthing and better imagery quality.

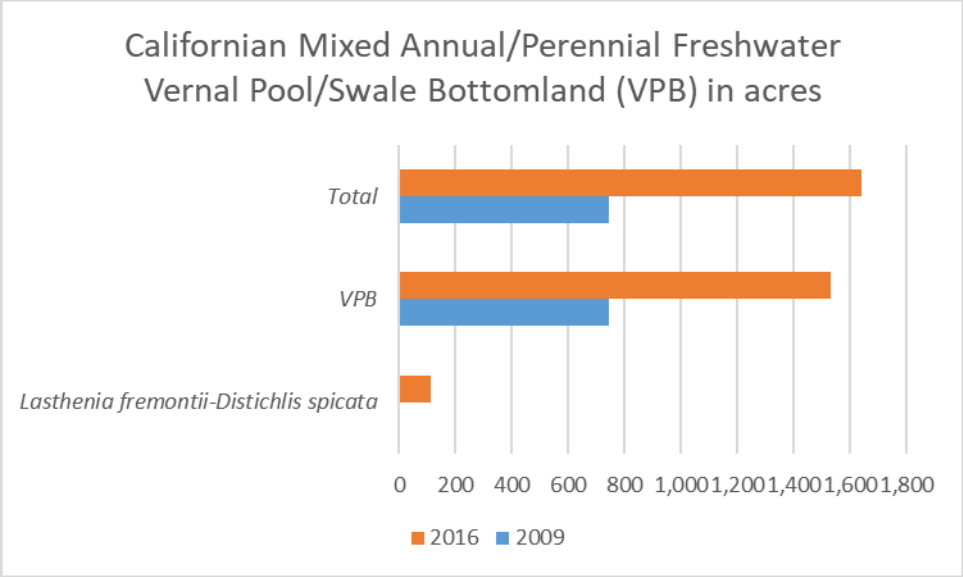

Figure 37. Californian Mixed Annual/Perennial Freshwater Vernal Pool/Swale Bottomland (VPB)
This mapping unit increased by 899 acres and it should be noted that this is non-physical change. This increase in acres came from being able to more easily discern vernal pools with better imagery quality; the vernal pools were cut out of California Vernal Pool and Grassland Matrix (VPG) areas.

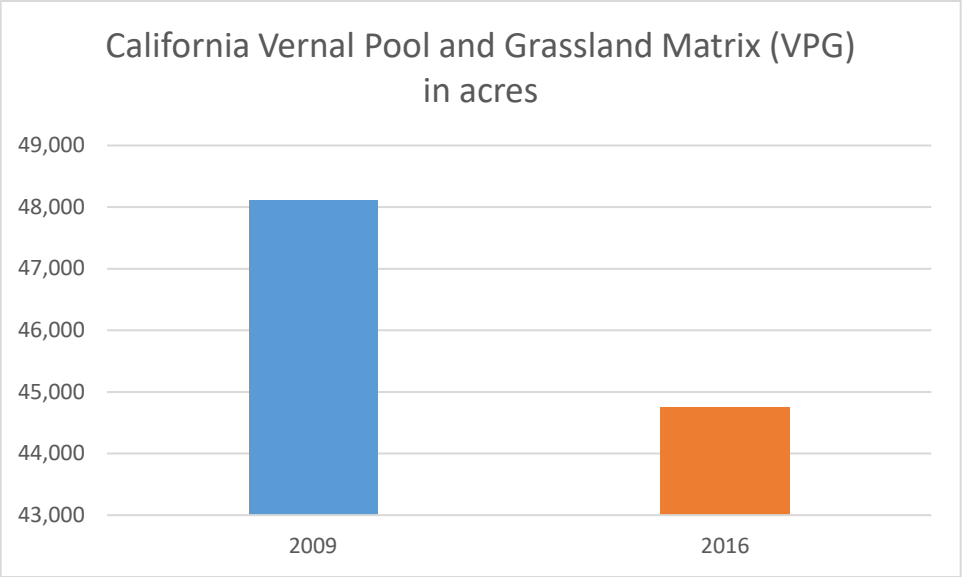

Figure 38. California Vernal Pool and Grassland Matrix (VPG)

This mapping unit had a loss of 3,360 where approximately 900 of these acres were cut out and reclassified as VPB, and the majority of the remaining 2,461 acres were lost to urban development. This acreage transition from vernal pool grassland to urban is among the greatest and most concerning changes noted in this report.

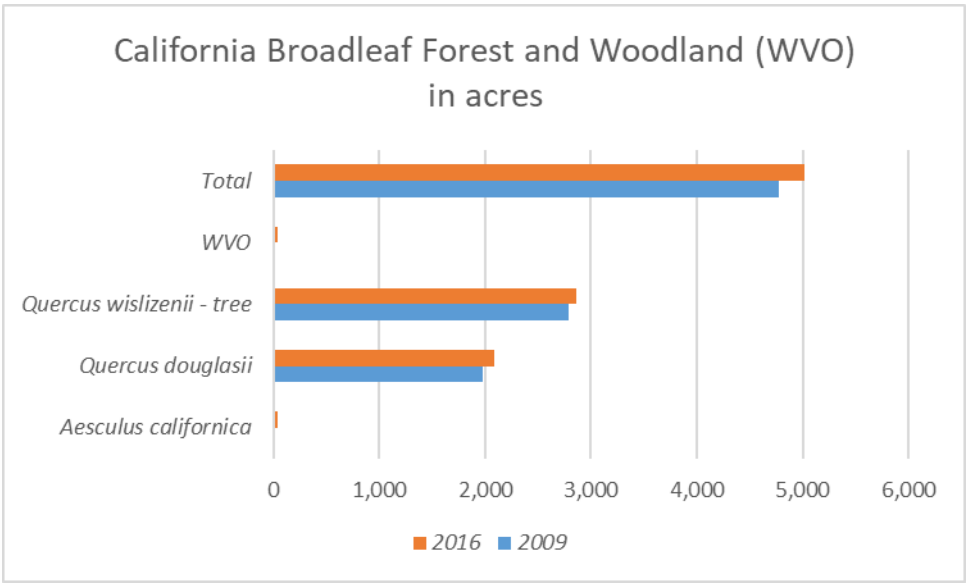

Figure 39. California Broadleaf Forest and Woodland (WVO)

This Group had an increase of 236 acres, which can be attributed to ecological succession and possibly some restoration efforts.

Summary of Change from 2009 to 2016: Non-natural Vegetation Mapping Units

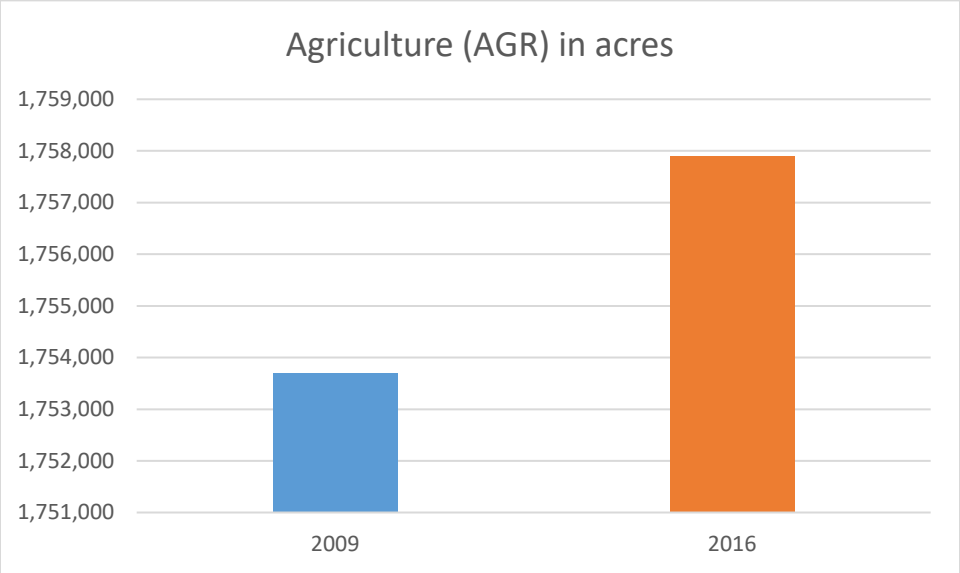

Figure 40. Agriculture (AGR)

Agriculture increased by 4,199 acres from 2009 to 2016. Much of this increase can be attributed to the conversion of vernal pool and alkali vernal pool and grassland habitats to agriculture. At least a portion of this increase is due to reclassifying fallow fields that were thought to be CAI in 2009, but were actively farmed between 2011 and 2016. Land is classified as agriculture if it has been actively farmed within 5 years of the imagery used.

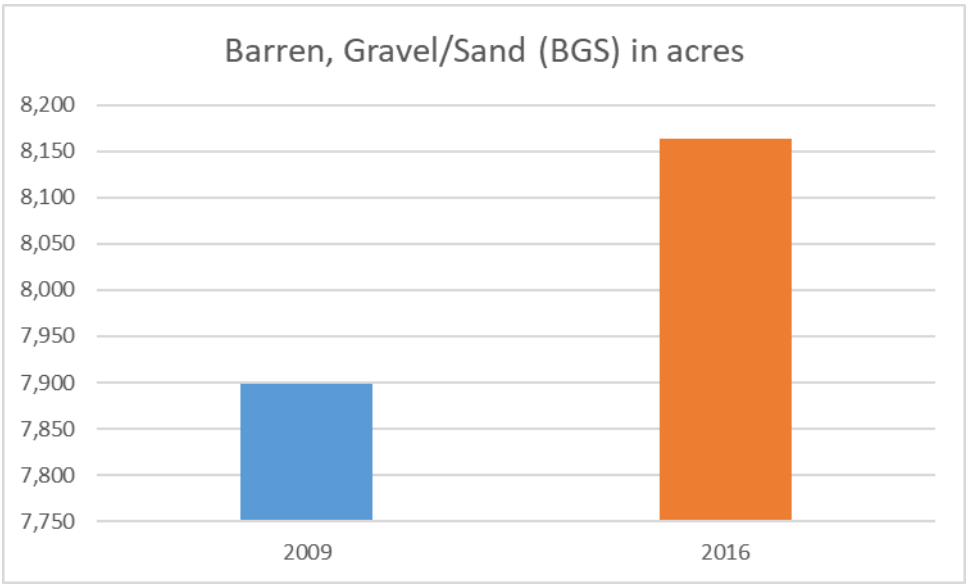

Figure 41. Bare - Gravel/Sand (BGS)

This mapping unit increased by 264 acres, which is due to a combination of river meandering and deposition as well as lower reservoir water levels in the 2016 imagery.

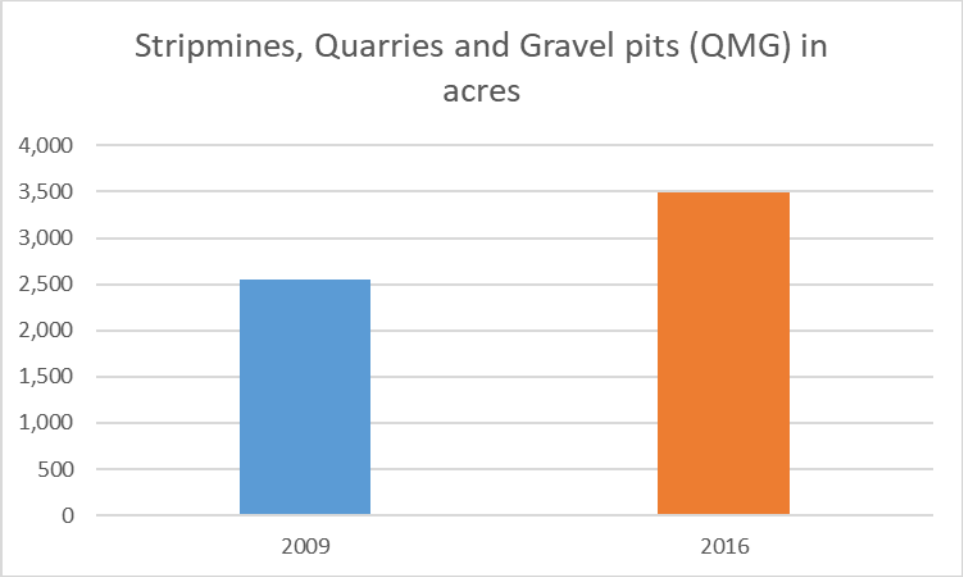

Figure 42. Strip-mines, Quarries and Gravel pits (QMG)
This was not investigated but should be considered physical change.

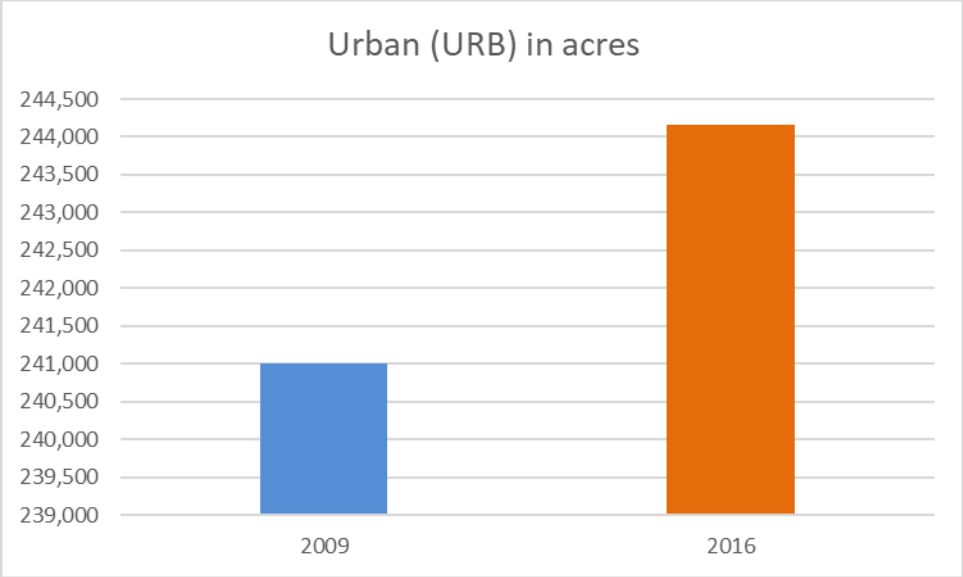

Figure 43. Urban (URB)
Urban areas grew by 3,153 acres from 2009 to 2016. Much of this new urban land was converted from vernal pool habitat and other grasslands.

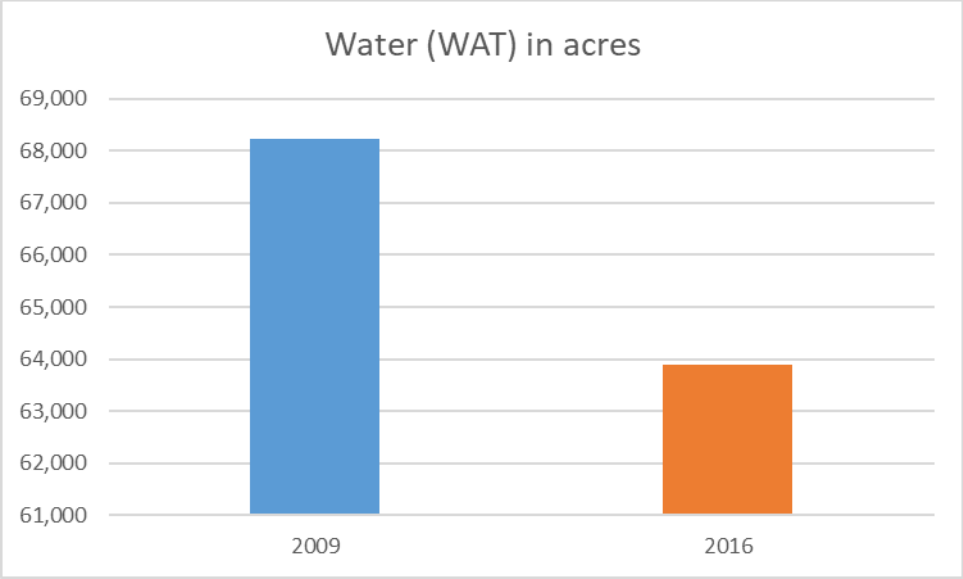

Figure 44. Water (WAT)

Water had a loss of 4,345 acres. This change was mainly due to the Don Pedro Reservoir and Lake McClure in the Sierra Nevada foothills having far less water in 2016. This acreage change shows the physical change in the surface area of the lakes, and not the actual change in acre-feet of water storage.

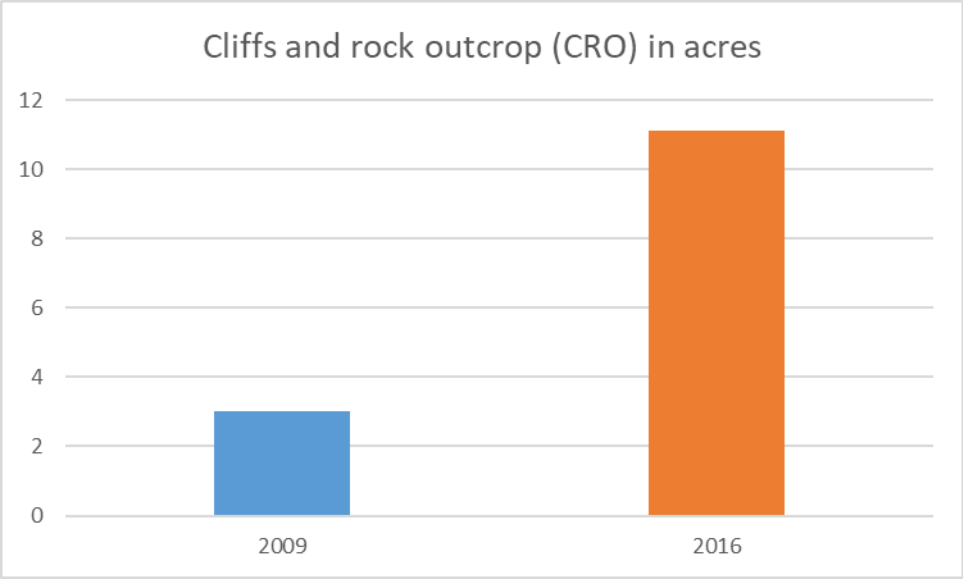

Figure 45. Cliffs and Rock Outcrop (CRO)

This group had an increase of 8.1 acres, which can be attributed to better imagery quality which allowed the photointerpreters to better identify these rocky areas.

Table 4. Results from Change Detection 2009 to 2016 (continues to page 46)

Each mapping unit was compared from 2009 to 2016 for riparian, non-riparian, and non-vegetation changes. Acres lost are in red and acres gained are in black.

Group	Alliance	Common Name	2009 Acres	2009 Total Group Acres	2016 Acres	2016 Total Group Acres	Alliance Acre Change	Group Acre Change
Riparian Vegetation								
Central and South Coastal California Seral Scrub (CSS)								
CSS	*Baccharis pilularis*	Coyote Brush	260.62		564.40		**303.78**	
CSS	*Heterotheca oregona*	Oregon False Goldenaster	1,270.49		2,429.14		**1,158.66**	
CSS	*Lupinus albifrons*	Silver lupine	53.63		250.00		**196.37**	
CSS	CSS	Central and South Coastal California Seral Scrub	0.00		12.82		**12.82**	
		Total Acres		**1,584.73**		**3,256.36**		**1,671.62**
Freshwater Emergent Marsh (FEM)								
FEM	FEM	Freshwater Emergent Marsh	177.57		1,974.84		**1,797.27**	
FEM	*Schoenoplectus (acutus, californicus)*	Bulrush	15,993.03		14,703.53		**-1,289.50**	
FEM	*Typha (angustifolia, domingensis, latifolia)*	Cattail	4,120.40		1,767.22		**-2,353.18**	
		Total Acres		**20,291.01**		**18,445.59**		**-1,845.42**
Naturalized Warm-Temperate Riparian/Wetland (NRW)								
NRW	*Cynodon dactylon-Crypsis spp.-Paspalum spp.* Semi-natural strands (part of NRW in 2009)	Scrutch grass	0.00		1,001.64		**1,001.64**	
NRW	*Lepidium latifolium*	Tall Whitetop	39.02		395.96		**356.94**	
NRW	Managed annual and perrenial wetland vegetation	Duck Clubs etc.	136,778.94		141,671.17		**4,892.23**	
NRW	*Persicaria lapathifolia - Xanthium strumarium*	Knotweed, Cocklebur	126.08		41.63		**-84.46**	
NRW	NRW	Naturalized Warm-Temperate Riparian/Wetland	7,595.42		9,900.84		**2,305.43**	
		Total Acres		**144,539.46**		**153,011.24**		**8,471.78**
Naturalized Temperate Pacific Freshwater Vegetation (NTF)								
NTF	*Eichhomia crassipes*	Common water hyacinth	72.70		130.87		**58.17**	
NTF	*Ludwigia (hexapetala, peploides)*	Floating Primrose	3,500.10		4,057.26		**557.16**	
NTF	Brazilian Waterweed (*Egenia-Myriophyllum*) Submerged Provisional Semi-natural Stands	Permantely Flooded Herbaceous Alliance	109.04		9.93		**-99.11**	
NTF	NTF	Naturalized Temperate Pacific Freshwater Vegetation	71.65		309.24		**237.59**	
		Total Acres		**3,753.49**		**4,507.31**		**753.82**
Riparian Introduced Scrub (RIS)								
RIS	*Sesbania punicea*	Rattlebox	2.32		66.97		**64.64**	
RIS	*Rubus americanus*	Himalayan Blackberry	2,178.25		1,922.93		**-255.32**	
RIS	*Tamarix spp.*	Saltcedar	437.88		700.71		**262.83**	
RIS	*Phragmites australis - Arundo donax - Alopecurus pratensis Semi natural Stands*		0.00		4.75		**4.75**	
RIS	*Arundo donax*	Giant Cane	1,347.56		1,387.58		**40.02**	
RIS	RIS	Riparian Introduced Scrub	16.90		75.07		**58.17**	
		Total Acres		**3,982.92**		**4,158.00**		**175.08**

Western North American Ruderal Marsh, Wet Meadow & Shrubland Group (RMM)								
RMM	*Phalaris arundinacea*	Reed Canary Grass	0.00		1.99			
		Total Acres		**0.00**		**1.99**		**1.99**
Riparian Evergreen and Deciduous Woodland (RWF)								
RWF	*Acer negundo*	Box Elder	2,322.46		3,021.92		**699.46**	
RWF	*Juglans hindsii and hydribs*	Black Walnut	3,299.01		4,584.25		**1,285.24**	
RWF	*Platanus racemosa*	Sycamore	1,527.90		2,229.25		**701.35**	
RWF	*Populus fremontii*	Freemont Cottonwood	36,926.79		36,252.83		**-673.95**	
RWF	*Quercus lobata* (includes WVO *Quercus lobata* from 2016)	Valley Oak	32,884.64		33,694.04		**809.40**	
RWF	*Salix gooddingii*	Goodding's Willow	14,625.47		18,909.03		**4,283.56**	
RWF	*Salix laevigata*	Red Willow	152.19		249.90		**97.71**	
RWF	RWF	Riparian Evergreen and Deciduous Woodland	567.43		4,729.70		**4,162.28**	
		Total Acres		**92,305.88**		**103,670.93**		**11,365.05**
Southwestern North American Riparian Wash/Scrub (RWS)								
RWS	*Baccharis salicifolia*	Mule Fat	18.69		27.22		**8.53**	
RWS	*Cephalanthus occidentalis*	Buttonwillow	38.50		206.50		**168.00**	
RWS	*Rosa californica*	California Wild Rose	12.25		26.11		**13.87**	
RWS	*Salix exigua*	Narrowleaf Willow	6,983.54		7,493.39		**509.84**	
RWS	*Salix lasiolepis*	Arroroy Willow	1,580.34		1,597.62		**17.27**	
RWS	*Sambucas nigra*	Blue Elderberry	171.57		280.22		**108.65**	
RWS	*Vitis californica* - provisional	California Wild Grape	1,262.26		1,366.16		**103.89**	
RWS	RWS	Southwestern North American Riparian Wash/Scrub	92.39		560.71		**468.32**	
		Total Acres		**10,159.56**		**11,557.93**		**1,398.37**
Temperate Freshwater Floating Mat (TFF)								
TFF	TFF	Temperate Freshwater Floating Mat	152.38		234.62		**82.24**	
TFF	*Azolla (filiculoides, mexicana)*	Mosquito Fern	495.65		389.26		**-106.39**	
TFF	*Lemna minor* and Relatives	Common Duckweed	43.92		198.28		**154.36**	
		Total Acres		**691.96**		**822.16**		**130.21**
Vancouverian Riparian Deciduous Forest (VRF)								
VRF	*Alnus rhombifolia*	White Alder	369.22		692.44		**323.22**	
VRF	*Fraxinus latifolia*	Oregon Ash	226.87		284.31		**57.44**	
VRF	*Salix lucida*	Pacific Willow	24.19		34.80		**10.61**	
VRF	VRF	Vancouverian Riparian Deciduous Forest	0.00		58.89		**58.89**	
		Total Acres		**620.28**		**1,070.44**		**450.16**
California Warm Temperate Marsh/Seep (WTM)								
WTM	*Artemsia douglasiana* - provisional (part of WTM in 2009)	Mugwort	445.67		387.38		**-58.29**	
WTM	*Carex barbarea* (part of WTM in 2009)	Santa Barbara sedge			1.46		**1.46**	
WTM	*Leymus cinereus - Leymus triticoides*	Creeping Wildrye	755.22		236.02		**-519.20**	
WTM	*Juncus arcticus (var. balticus, mexicanis) and Polygonum lapathifolium – Xanthium strumarium*	Artic rush	18.92		16.03		**-2.88**	
WTM	WTM	California Warm Temperate Marsh/Seep	1,883.64		2,679.88		**796.24**	
		Total Acres		**3,103.45**		**3,320.77**		**217.33**
		Total Riparian Vegetation Acres		**281,032.73**		**303,822.72**		
		Total Riparian Vegetation Change Acres						**22,789.99**

Non-Riparian Vegetation Change								
Alkali Grassland - Playa/Pool Matirx (AGP)								
AGP	AGP	Alkali Grassland - Playa/Pool Matirx	78,124.00		71,489.24		-6,634.75	
				78,124.00		71,489.24		-6,634.75
California Coastal evergreen bluff and dune scrub (BDS)								
BDS	*Frangula californica*	Coffeeberry			1.81		1.81	
		Total Acres		**0.00**		**1.81**		**1.81**
California Introduced Annual and Perennial Herbaceous (CAI)								
CAI	CAI (CAP crosswalked from 2009)	California Introduced Annual and Perennial Herbaceous	128,527.55		102,144.99		-26,382.56	
CAI	*Centaurea (solstitialis, mexicana)*	Yellow Starthistle	523.47		148.44		-375.03	
CAI	*Conium maculatum - Foeniculum vulgare* Semi-natural Stands (part of CAI in 2009)	Hemlock	0.00		8.92		**8.92**	
CAI	*Lolium perenne* Semi-natuarl Stands (part of CAI in 2009)		0.00		27.55		**27.55**	
		Total Acres		**129,051.02**		**102,329.90**		**-26,721.12**
Central and South coastal Californian coastal sage scrub (CCS)								
CCS	*Eriogonum fasciculatum*	California Buckwheat	0.00		2.06		**2.06**	
		Total Acres		**0.00**		**2.06**		**2.06**
California Annual Forbs and Grasses (CFG)								
CFG	CFG	California Annual Forbs and Grasses	10,007.19		23,440.76		**13,433.57**	
		Total Acres		**10,007.19**		**23,440.76**		**13,433.57**
California Montane Conifer Forest (CMF)								
CMF	*Pinus ponderosa*	Ponderosa Pine	0.06		0.00		-0.06	
				0.06		**0.00**		**-0.06**
California Perennial Grassland (CPG)								
CPG	CPG	California Perennial Grassland	0.00		44.13		**44.13**	
		Total Acres		**0.00**		**44.13**		**44.13**
Cliffs and rock outcrop (CRO)								
CRO	CRO	Cliffs and rock outcrop	3.02		11.10		**8.08**	
				3.02		**11.10**		**8.08**
California Xeric Chaparral (CXC)								
CXC	*Adenostoma fasciculatum*	Chamise	0.00		1.00		**1.00**	
CXC	*Arctostaphylos viscida*	Whiteleaf Manzanita	11.96		15.42		**3.46**	
CXC	*Ceanothus cuneatus*	Buckbrush	8.29		9.85		**1.56**	
		Total Acres		**20.25**		**26.27**		**6.02**
Western North American Disturbed Alkaline Marsh and Meadow (DAM)								
DAM	Bassia hyssopifolia	Five-horn smotherweed	2.15		18.47		**16.32**	
DAM	DAM	Western North American Disturbed Alkaline Marsh and Meadow	14.40		21.30		**6.90**	
		Total Acres		**16.54**		**39.77**		**23.22**
Sonoran-Coloradan semi-desert wash woodland/scrub (DWS)								
DWS	*Prosopis glandulosa*	Honey Mesquite	1.23		1.09		-0.13	
		Total Acres		**1.23**		**1.09**		**-0.13**
Dry Upland Perennial Grassland (DUP)								
DUP	*Elymus glaucus*	Blue wildrye	0.00		5.91		**5.91**	
DUP	DUP	Dry Upland Perennial Grassland	0.00		60.53		**60.53**	
		Total Acres		**0.00**		**66.44**		**66.44**
California Evergreen Coniferous Forest and Woodland (ECW)								
ECW	*Juniperus californica*	Juniper	0.88		0.88		0.00	
ECW	*Pinus sabiniana*	Foothill Pine	44.49		165.15		120.66	
		Total Acres		**45.37**		**166.03**		**120.66**
Introduced North American Mediterranean Forest (IMF)								
IMF	*Ailanthus altissima* - provisional	Tree of Heavan	108.49		131.44		**22.95**	
IMF	*Eucalyptus (globulus, camaldensis)*	Bluegum, Redgum	1,399.74		1,622.84		**223.11**	
IMF	Ornamental Trees (part of IMF in 2009)	Ornamental Trees	957.97		828.82		-129.14	
IMF	*Robinia pseudoacacia*	Black locust	45.47		51.49		**6.02**	
IMF	IMF	Introduced North American Mediterranean Forest	90.31		297.84		**207.53**	
		Total Acres		**2,601.98**		**2,932.44**		**330.46**
Lower Bajada and Fan Mojavean-Sonoran desert scrub (LDS)								
LDS	*Atriplex polycarpa*	Many fuited saltbush	89.09		169.39		**80.30**	
		Total Acres		**89.09**		**169.39**		**80.30**

Naturalized non-native Mediterranean scrub (NMS)								
NMS	Broom (*Cytisus scoparius* and others)	Broom	0.00		1.76		**1.76**	
		Total Acres		**0.00**		**1.76**		**1.76**
Southwestern North American Alkali Marsh/Seep Vegetation (SAM)								
SAM	*Sporobolus airoides*	Alkali sacaton	1,307.08		503.05		**-804.03**	
SAM	SAM	Southwestern North American Alkali Marsh/Seep Vegetation	0.00		22.23		**22.23**	
		Total Acres		**1,307.08**		**525.28**		**-781.80**
Southwestern North American Salt Basin and High Marsh (SSB)								
SSB	*Allenrolfea occidentalis*	Iodine bush	5,996.06		5,285.97		**-710.09**	
SSB	*Atriplex lentiformis*	Big saltbrush	297.83		374.92		**77.08**	
SSB	*Atriplex spinifera*	Spiny salbrush	0.00		20.61		**20.61**	
SSB	*Frankenia salina*	Alkali heath	165.18		611.08		**445.90**	
SSB	*Isocoma acradenia*	Alkali goldenbush	0.00		25.19		**25.19**	
SSB	*Suaeda moquinii*	Bush seepweed	46.38		1,597.48		**1,551.10**	
SSB	SSB	Southwestern North American Salt Basin and High Marsh	0.00		96.04		**96.04**	
		Total Acres		**6,505.45**		**8,011.28**		**1,505.83**
Sparsely Vegetated Playa/Pool (SVP)								
SVP	SVP	Sparsely Vegetated Playa/Pool	9,024.06		1,957.44		**-7,066.62**	
		Total Acres		**9,024.06**		**1,957.44**		**-7,066.62**
Temperate Pacific Tidal Salt and Brackish Meadow (TBM)								
TBM	*Distichlis spicata*	Desert saltgrass	1,127.64		1,454.24		**326.60**	
TBM	*Sarcocornia pacifica (Salicornia depressa)*	Virginia glasswort	0.00		1.87		**1.87**	
TBM	TBM	Temperate Pacific Tidal Salt and Brackish Meadow	0.00		181.95		**181.95**	
		Total Acres		**1,127.64**		**1,638.05**		**510.42**
Vancouverian Coastal/Tidal Marsh and Meadow (VCM)								
VCM	Juncus effusus	Soft rush	32.17		313.51		**281.34**	
		Total Acres		**32.17**		**313.51**		**281.34**
Californian Mixed Annual/Perennial Freshwater Vernal Pool/Swale Bottomland (VPB)								
VPB	*Lasthenia fremonti-Distichlis spicata* (part of VPB in 2009)		0.00		111.35		**111.35**	
VPB	VPB	Californian Mixed Annual/Perennial Freshwater Vernal Pool/Swale Bottomland	741.93		1,529.74		**787.80**	
		Total Acres		**741.93**		**1,641.08**		**899.15**
California Vernal Pool and Grassland Matrix (VPG)								
VPG	VPG	California Vernal Pool and Grassland Matrix	48,102.71		44,742.54		**-3,360.17**	
		Total Acres		**48,102.71**		**44,742.54**		**-3,360.17**
California Broadleaf Forest and Woodland (WVO)								
WVO	*Aesculus californica*	California buckeye or California horse-chestnut	13.92		33.97		**20.05**	
WVO	*Quercus douglasii*	Blue Oak	1,978.92		2,088.02		**109.10**	
WVO	*Quercus wislizenii - tree*	Interior Live Oak	2,787.94		2,857.59		**69.65**	
WVO	WVO	California Broadleaf Forest and Woodland			37.41		**37.41**	
		Total Acres		**4,780.78**		**5,016.99**		**236.20**
		Total Non-Riparian Vegettion Acres		**291,581.57**		**264,568.37**		
		Total Non-Riparian Vegetation Change Acres						**-27,013.21**

Non-Vegetation Change								
Agriculture (AGR)								
AGR	AGR	Agriculture	1,753,706.22		1,757,906.19			**4,199.97**
Bare - Gravel/Sand								
BGS	BGS	Bare - Gravel/Sand	7,898.96		8,163.23			**264.27**
Stripmines, quarries and gravel pits								
QMG	QMG	Stripmines, quarries and gravel pits	2,546.39		3,497.55			**951.16**
Urban (URB)								
URB	URB	Urban	241,002.37		244,155.40			**3,153.03**
Water (WAT)								
WAT	WAT	Water	68,230.98		63,885.75			**-4,345.23**
		Total Non-Vegetation Acres		**2,073,384.92**		**2,077,608.13**		
		Total Non-Vegetation Change Acres						**4,223.22**
		Total Mapped Acres		**2,645,999.22**		**2,645,999.22**		

Table 5. Crosswalk used in change detection to compare mapping units from 2009 to 2016

MAPCLASS_2009	**Change 2009 to 2016**
Acer negundo	
Adenostoma fasciculatum Not mapped 2009	
Aesculus californica	
AGP	AGP -Alkali Grassland - Playa/Pool Matrix
AGR	AGR - Agriculture
Ailanthus altissima - provisional	*Ailanthus altissima* Semi-natural Stands
Allenrolfea occidentalis	
Alnus rhombifolia	
Arctostaphylos viscida	
Artemisia douglasiana - provisional	*Artemisia douglasiana*
Arundo donax	
Atriplex lentiformis	
Atriplex polycarpa	
Atriplex spinifera Not mapped 2009	
Azolla (filiculoides, mexicana)	
Baccharis pilularis	
Baccharis salicifolia	
Bassia hyssopifolia	
BGS	BGS - Barren gravel and sand
Broom (*Cytisus scoparius* and Others) Not mapped 2009	
CAI	CAI - California Introduced Annual and Perennial Herbaceous
CAP	
Carex barbarae Not mapped 2009	
Ceanothus cuneatus	
Centaurea (solstitialis, melitensis)	*Centaurea (solstitialis, mexicana)*
Cephalanthus occidentalis	
CFG	CFG - California Annual Forbs and Grasses
Conium maculatum - Foeniculum vulgare Semi-natural Stands Not mapped 2009	
CPG - California Perennial Grassland Not mapped 2009	
CRO	CRO - North American warm desert bedrock cliff and outcrop
CSS - Central and south coastal California seral scrub Not mapped 2009	
Cynodon dactylon - Crypsis spp. - Paspalum spp. Not mapped 2009	
DAM	DAM - Western North American Disturbed Alkaline Marsh and Meadow

Distichlis spicata	
DUP - Western Dry Upland Perennial Grassland Not mapped 2009	
Eichhornia crassipes	*Eichhornia crassipes* Semi-natural Stands
Elymus glaucus Not mapped 2009	
Eriogonum fasciculatum Not mapped 2009	
Elymus triticoides	*Leymus cinereus - Leymus triticoides*
Eucalyptus (globulus, camaldulensis)	*Eucalyptus (globulus, camaldulensis)* Semi-natural Stands
FEM	FEM - Freshwater Emergent Marsh
Frangula californica Not mapped 2009	
Frankenia salina	
Fraxinus latifolia	
Heterotheca oregona	
IMF	IMF - Introduced North American Mediterranean Forest
Isocoma acradenia Not mapped 2009	
Juglans hindsii and hybrids	
Juncus arcticus (var. balticus, mexicanis)	
Juncus effusus	
Juniperus californica	
Lasthenia fremontii - Distichlis spicata Not mapped 2009	
Lemna (minor) and Relatives	*Lemna minor* and Relatives
Lepidium latifolium	
Lolium perenne Not mapped 2009	
Ludwigia (hexapetala, peploides)	
Lupinus albifrons	
Managed annual and perrenial wetland vegetation	
Myriophyllum spp. - permanently flooded herbaceous alliance	
NRW	NRW - Naturalized Warm-Temperate Riparian/Wetland
NTF	NTF - Naturalized Temperate Pacific Freshwater Vegetation
Ornamental trees	
Persicaria lapathifolia - Xanthium strumarium	
Phalaris arundinacea Not mapped 2009	
Phragmites *australis* not mapped in 2009	
Pinus ponderosa	
Pinus sabiniana	
Platanus racemosa	
Populus fremontii	

Prosopis glandulosa	
QMG	QMG - Stripmines, Quarries and Gravel pits
Quercus douglasii	
Quercus lobata (RWF)	*Quercus lobata* (RWF)
Quercus lobata (WVO)	*Quercus lobata* (RWF)
Quercus wislizeni (tree)	
RIS	RIS - Riparian Introduced Scrub
Robinia pseudoacacia	*Robinia pseudoacacia* Semi-natural Stands
Rosa californica	
Rubus armeniacus	
RWF	RWF - Riparian Evergreen and Deciduous Woodland
RWS	RWS - Southwestern North American Riparian Wash/Scrub
Salix exigua	
Salix gooddingii	
Salix laevigata	
Salix lasiolepis	
Salix lucida	
SAM - Southwestern North American Alkali Marsh/Seep Vegetation Not mapped 2009	
Sambucus nigra	
Sarcocornia pacifica (Salicornia depressa) Not mapped 2009	
Schoenoplectus (acutus, californicus)	
Sesbania punicea	
Sporobolus airoides	
SSB - Southwestern North American Salt Basin and High Marsh Not mapped 2009	
Suaeda moquinii	
SVP	SVP - Sparsely Vegetated Playa/Pool
Tamarix spp.	*Tamarix spp.* Semi-natural Stands
TBM - Temperate Pacific tidal salt and brackish meadow Not mapped 2009	
TFF	TFF - Temperate Freshwater Floating Mat
Typha (angustifolia, domingensis, latifolia)	
URB	URB - Urban
Vitis californica - provisional	Vitis californica
VPB	VPB - Californian Mixed Annual/Perennial Freshwater Vernal Pool / Swale Bottomland
VPG	VPG - California Vernal Pool and Grassland Matrix
VRF	VRF -Vancouverian Riparian Deciduous Forest
WAT	WAT - Water

WTM	WTM - California Warm Temperate Marsh/Seep
WVO Not mapped in 2009	

MapClass 2016	**Change 2016 to**
Acer negundo	
Adenostoma fasciculatum	
Aesculus californica	
AGP -Alkali Grassland - Playa/Pool Matrix	
AGR - Agriculture	
Ailanthus altissima Semi-natural Stands	
Allenrolfea occidentalis	
Alnus rhombifolia	
Arctostaphylos viscida	
Artemisia douglasiana	
Arundo donax	
Atriplex lentiformis	
Atriplex polycarpa	
Atriplex spinifera	
Azolla (filiculoides, mexicana)	
Baccharis pilularis	
Baccharis salicifolia	
Bassia hyssopifolia	
BGS - Barren gravel and sand	
Broom (*Cytisus scoparius* and Others)	
CAI - California Introduced Annual and Perennial Herbaceous	
CAP Not mapped 2016	
Carex barbarae	
Ceanothus cuneatus	
Centaurea (solstitialis, mexicana)	
Cephalanthus occidentalis	
CFG - California Annual Forbs and Grasses	
Conium maculatum - Foeniculum vulgare Semi-natural Stands	
CPG - California Perennial Grassland	
CRO - North American warm desert bedrock cliff and outcrop	
CSS - Central and south coastal California seral scrub	
Cynodon dactylon - Crypsis spp. - Paspalum spp.	
DAM - Western North American Disturbed Alkaline Marsh and Meadow	
Distichlis spicata	
DUP - Western Dry Upland Perennial Grassland	
Eichhornia crassipes Semi-natural Stands	

Elymus glaucus	
Eriogonum fasciculatum	
Leymus cinereus - Leymus triticoides	
Eucalyptus (globulus, camaldulensis) Semi-natural Stands	
FEM - Freshwater Emergent Marsh	
Frangula californica	
Frankenia salina	
Fraxinus latifolia	
Heterotheca oregona	
IMF - Introduced North American Mediterranean Forest	
Isocoma acradenia	
Juglans hindsii and hybrids	
Juncus arcticus (var. balticus, mexicanus)	
Juncus effusus	
Juniperus californica	
Lasthenia fremontii - Distichlis spicata	
Lemna minor and Relatives	
Lepidium latifolium	
Leymus cinereus - Leymus triticoides	
Lolium perenne	
Ludwigia (hexapetala, peploides)	
Lupinus albifrons	
Managed annual and perennial wetland vegetation	
Myriophyllum spp. - permanently flooded herbaceous alliance	
NRW - Naturalized Warm-Temperate Riparian/Wetland	
NTF - Naturalized Temperate Pacific Freshwater Vegetation	
Ornamental trees	
Persicaria lapathifolia - Xanthium strumarium	
Phalaris arundinacea	
Phragmites australis - Arundo donax - Alopecurus pratensis Semi-natural Stands	
Pinus ponderosa Not mapped 2016	
Pinus sabiniana	
Platanus racemosa	
Populus fremontii	
Prosopis glandulosa	
QMG - Stripmines, Quarries and Gravel pits	
Quercus douglasii	
Quercus lobata (riparian)	*Quercus lobata* (RWF)
Quercus lobata (upland)	*Quercus lobata* (RWF)
Quercus wislizeni - tree	

RIS - Riparian Introduced Scrub	
Robinia pseudoacacia Semi-natural Stands	
Rosa californica	
Rubus armeniacus	
RWF - Riparian Evergreen and Deciduous Woodland	
RWS - Southwestern North American Riparian Wash/Scrub	
Salix exigua	
Salix gooddingii	
Salix laevigata	
Salix lasiolepis	
Salix lucida	
SAM - Southwestern North American Alkali Marsh/Seep Vegetation	
Sambucus nigra	
Sarcocornia pacifica (Salicornia depressa)	
Schoenoplectus (acutus, californicus)	
Sesbania punicea	
Sporobolus airoides	
SSB - Southwestern North American Salt Basin and High Marsh	
Suaeda moquinii	
SVP - Sparsely Vegetated Playa/Pool	
Tamarix spp. Semi-natural Stands	
TBM - Temperate Pacific tidal salt and brackish meadow	
TFF - Temperate Freshwater Floating Mat	
Typha (angustifolia, domingensis, latifolia)	
URB - Urban	
Vitis californica	
VPB - Californian Mixed Annual/Perennial Freshwater Vernal Pool / Swale Bottomland	
VPG - California Vernal Pool and Grassland Matrix	
VRF -Vancouverian Riparian Deciduous Forest	
WAT - Water	
WTM - California Warm Temperate Marsh/Seep	
WVO - California Broadleaf Forest and Woodland	

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Appendix A. Accuracy Assessment Form 2020

Accuracy Assessment – CVFPA 2020 (3/23/2020)

Surveyor:	**Other Surveyors:**	**Date:**
Location Name:		
Waypoint ID: **Polygon UID:**	**GPS Name** _____ **Projected? Yes / No / Base** If Yes, enter: **Bearing** (°): _____ **Distance (m):** _____ **Inclination** (°): _____ If Yes, enter: **Base Waypoint ID**: _____ Record either UTMs or Decimal Degrees **Base** UTMs / **Projected** UTMs (circle one) GPS error: **ft / m / PDOP** _____ **UTME** ___ ___ ___ ___ ___ ___ **UTMN** ___ ___ ___ ___ ___ ___ ___ Decimal degrees: **LAT** __ __ . __ __ __ __ __ __ **LONG** __ __ __ . __ __ __ __ __ __	
Camera name:	**Photo #s:**	

Strata	Species	% cover	C	Strata	Species	% cover	C

Notes:

Map Unit Name:	Secondary:

Confidence in map unit ID: L M H Explain:

Describe above:	Linework problems ☐	More than 1 vegetation type in this polygon ☐	Vegetation change since imagery taken ☐

Conifer Cover: _____ Hardwood Cover: _____ Total Tree Cover: _____ Shrub Cover: _____

Herb Cover Class	<2%	2–9%	10–39%	40-59%	>59%	>40% woody cover
Tree Height	<1m	1-5m	5-20m	20-50m	>50m	NA
Tree DBH	<1"	1-6"	>6-11"	>11-24"	>24"	
Invasives (absolute cover)	none: <5%	low: 5-25%	moderate: 25-50%	high: >50%		
Restoration	NO	YES				

Rough % of polygon viewed from point _____ Total % viewed _____

Appendix B. Accuracy Assessment Protocol CVFPP Area 2020

This protocol describes accuracy assessment (AA) data collection procedures. The primary purpose of the AA fieldwork is to supply data to test the accuracy of a specific vegetation map. The information collected can also contribute additional data for the classification of vegetation communities. The primary sampling units are the vegetation polygons delineated by photointerpreters in the creation of the vegetation map.
If an entire AA polygon cannot be fully investigated due to terrain or other reasons, as much of the polygon as can be evaluated should be assessed.
Note that a delineated polygon may differ from the conventional definition of a stand of vegetation. It may lump more than one stand type into a single mapping unit or Alliance. A stand is the basic physical unit of vegetation in a landscape. It has no set size. Some stands of vegetation are very small while some may be several square kilometers in size. A stand is defined by two main unifying characteristics:

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

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

Selecting a location to sample within a polygon (for subsamples only):

Because many polygons are large, it may be difficult to summarize the species composition, cover, and structure of an entire stand. We are also usually trying to capture the most information as efficiently as possible. Thus, we may be forced to select a representative portion to sample.
When taking a subsample, the main point to remember is to select an area that, in as many ways possible, is representative of that polygon. This means that you are not randomly selecting a plot; on the contrary, you are actively using your own best judgment to find a representative example of the polygon.
Selecting an assessment site requires that you see enough of the polygon you are sampling to feel comfortable in choosing a representative plot location. If possible, take a brief walk through the polygon and figure out where the boundary lines are drawn. Look for variations in species composition and in stand structure. In the process, decide whether the polygon includes more than one mappable vegetation type or if the stand boundaries do not seem to match up with the polygon delineation. If more than one vegetation type is present, fill out an AA form for each mappable vegetation type. Small variations in vegetation that are repeated throughout the polygon should be included in your subsample. Once you assess the variation within the polygon, attempt to find an area that captures the stand's species composition and structural condition to sample.

How to enter fields on the form:

Surveyors: Use initials for each person assisting on the assessment. If someone is present who is not a normal member of the field personnel, their full name should be used. The person recording the data on the form should circle their initials.
Date: Enter the date the AA point was sampled. Use the standard U.S. format of "month-day year" or use letters to write out the month.
Waypoint ID: Record the waypoint number assigned by the Juno when marking and storing a waypoint for the sample location.
Note that the GPS point should be taken away from the edge of the polygon, and near the center of the subsample (if one is used).
Polygon UID: Record the unique identifier (UID) assigned to each polygon, included in the Juno data and on paper maps.
GPS name: Record the name/number assigned to each GPS unit or Juno. This can be the serial number if another number is not assigned.
Projected? Yes / No/ Base/ Digitized Circle "Yes" to denote that the GPS waypoint was taken within the boundary of the polygon being assessed (it should be taken well within the boundary, to insure that the point will fall within the stand when mapped, accounting for GPS error). Circle "No" if the waypoint was taken at a distance from the stand (such as with a binocular view of the stand). Circle "Base" if the point is projected and enter the Base waypoint ID and UTMS. If entering the projected UTMs, circle "projected UTMs." If the point is digitized with the Juno, circle "Digitized" and also enter base ID to record where you are standing. If No, record:
Distance (m): the distance in meters to the center of the polygon view from the GPS point using a rangefinder.
Bearing (degrees): the compass bearing from the GPS point to the center of the polygon view.
UTM coordinates: Record the Northing (UTMN) and easting (UTME) location coordinates using the Universal Transverse Mercator (UTM) grid as recorded by the Juno. Circle whether the UTMs are for a base or projected point.
PDOP: Record the PDOP from the Juno. It is typical for commercial GPS units to be accurate with a pdop value of 1 to 5. The lower the error number, the more accurate the GPS reading.
Species list and coverage
List up to 12 species that are dominant or that are characteristically consistent throughout the stand. These species may or may not be abundant, but they should be constant representatives in the survey. When different layers of vegetation occur in the stand, make sure to list species from each stratum. As a general guide, make sure to list at least 1-2 of the most abundant species per stratum.

Provide the stratum where:
T = Overstory tree. A woody perennial plant that has a single trunk.
S = Shrub A perennial, woody plant that is multi-branched and doesn't die back to the ground every year.
H = Herb An annual or perennial that dies down to ground level every year.
N = Non-vascular Includes mosses, liverworts, hornworts, and algae.
Be consistent and don't break up a single species into two separate strata. Here is a list of a few species that can be ambiguous:

> ***Quercus wislizeni*** = If it is regenerating after a fire or disturbance call it an understory tree (U). Otherwise call it a Tree (T).
> ***Sambucus nigra*** = Shrub (S)

***Phoradendron* spp.** = Shrub (S)

If a species collection is made, it should be indicated in the fourth column with a "C" (for collected). If the species is later keyed out, the data sheet needs to be updated with the proper species name. If the specimen is then thrown out, the "C" in the collection column should be erased. If the specimen is kept but is still not confidently identified, add a "U" to the "C" in the collection column (CU = collected and unconfirmed). In this case the unconfirmed species epithet should be put in parentheses [*e.g., Hordeum (murinum)*]. If the specimen is kept and is confidently identified, add a "C" to the existing "C" in the collection column (CC = Collected and confirmed). Use Jepson Manual nomenclature.

All species percent covers may total over 100% because of overlap.

Notes: Describe the stand age or seral stage, disturbance history, nature and extent of land use, and other site environmental and vegetation factors. Examples of disturbance history: fire, landslides, avalanching, drought, flood, animal burrowing, or pest outbreak. Also, try to estimate year or frequency of disturbance. Examples of land use: grazing or mining. Examples of other site factors: exposed rocks, soil with fine-textured sediments, high litter or duff build-up, multi-storied vegetation structure, or other stand dynamics. Include any recommendations for line-work revision. Record notes on the discernibility of the vegetation based on phenology or other factors, problems with interpretation of the classification, homogeneity of the vegetation, and or any unusual sightings of rare plants or animals.

Alliance Name: Assign the best-fitting name for the vegetation within the polygon, using the key.

Map Unit (Group code and name): Enter the map unit and Group code here**.**

Camera/Photos: Write in the identifier for the camera used. Write the JPG/frame number, and direction of photos (note the roll number if using film). *Take four photos in the main cardinal directions (N, E, S, W) clockwise from the north, from the GPS location.* Make sure to take additional photos of the general composition of the stand if the cardinal photos do not do an adequate job (also noting the general direction the photos were taken, e.g., NE).

Tree Height: Circle the height range of the modal tree height, or NA if there are no trees.

Tree Size: Circle the dbh range as appropriate. When marking the main size class, make sure to estimate the mean diameter of all trees over the entire stand, and weight the mean if there are some larger tree dbh's. Stands in the "multi-layered" class need also to contain at least 10% cover of size class >24" dbh trees growing over a distinct layer with at least 10% combined cover of trees in size classes 6-11" and 11-24".

Overall cover of vegetation

Provide an estimate of cover for the following categories below (based on functional life forms) to the nearest 1%. Your percent cover estimates should take into consideration the porosity of the canopy. Litter/duff should not be included in these estimates.

Hardwood Cover: The total aerial cover (canopy closure) of all live hardwood tree species that are present (overstory, emergent, or understory), disregarding overlap of individual trees.

Conifer Cover: The total aerial cover (canopy closure) of all live conifer tree species that are present (overstory, emergent, or understory), disregarding overlap of individual trees.

Total Tree Cover: The total aerial cover (canopy closure) of all live conifer and hardwood tree species that are present (overstory, emergent, or understory), disregarding overlap of individual trees.

Shrub Cover: The total aerial cover (canopy closure) of all live shrub species disregarding overlap of individual shrubs and the canopy above the shrub layer.

Herb Cover: Circle the appropriate cover class representing the total aerial cover (canopy closure) of all herbaceous species, disregarding overlap of individual herbs and the herbs hidden from view by woody plants, in the cover classes.
Total Cover: Enter the total aerial cover of all vascular vegetation. This is an estimate of the absolute vegetation cover, disregarding overlap of the various tree, shrub, and/or herbaceous layers and species. It is possible that this will be a higher number than the sum of the three layers, since the total cover includes some of the herb and shrub layer that may be indistinct in an aerial view, but actually would be seen through the pores of the upper canopy.
Isolated Tree: Circle yes if the vegetation is not a tree type but contains isolated trees that make up less than 5% cover.
Clearing Disturbance: Circle the class representing how much of the polygon has been cleared for roads, trails, disking or scraping.
Invasive Plants: Circle the class representing the absolute cover of invasive plants within the polygon.
Restoration: Circle "No" if it the polygon shows no sign of being a restoration site; circle "yes" otherwise.
Estimated area of identifiable vegetation viewed: Enter the radius in meters of the area around your GPS point that you were able to assess within the polygon, or enter a rough estimate of the percent of the polygon that you were able to assess from your point AND additional area that you were able to view while driving or walking around or through the polygon.
Linework okay: Check the box if the photointerpreters did a good job of drawing a boundary line that surrounds a distinct vegetation type. Examples for which you would *not* check the box include situations where there is more than one type of mappable vegetation within the polygon, when a portion of the boundary includes part of an adjacent stand, or when the stand continues beyond the polygon boundary. If not checked, provide comments in the Notes section to explain.
Only one vegetation type in this polygon: Check if there is only one vegetation type within the polygon. If the polygon includes more than one mappable type, provide the additional types in the Notes section. If these other types are smaller than the MMU, and therefore would not be expected to be mapped, note that as well.
Vegetation change since imagery taken: Check the box if the vegetation in the polygon has changed since the aerial imagery used as the base of the vegetation map was taken. If yes, provide notes in the Notes section on how the vegetation has changed (for example: burned, developed, visible dominance change over time).

Terms and Concepts Used Throughout the Key

Terms regarding species abundance/cover/constancy:

Dominance by layer: Tree, shrub, and herbaceous layers are considered physiognomically distinct. A vegetation type is considered to belong to a certain physiognomic Group if it is dominated by one layer. Layers are prioritized in order of height when naming the type.
Dominant: Dominance refers to the preponderance of vegetation cover in a stand of uniform composition and site history. It may refer to cover of an individual species (as in "dominated by valley oak"), or it may refer to dominance by a physiognomic Group, as in "dominated by shrubs." Dominance refers to the relative cover of one species or physiognomic Group as compared to another species or physiognomic Group.
Co-dominant: Co-dominance refers to two or more species in a stand that share dominance and have between 30 and 60 percent relative cover each.

Diagnostic (species): any species or Group of species whose relative constancy or abundance differentiates one vegetation type from another. A species of high fidelity to a particular type and one whose presence serves as a criterion of recognition of that type (Jennings et al. 2009).

Terms regarding vegetation types:

Alliance: A vegetation classification unit containing one or more associations, and defined by a characteristic range of species composition, habitat conditions, physiognomy, and diagnostic species, typically at least one of which is found in the uppermost or dominant stratum of the vegetation (Jenningset al., 2009).

Association: A vegetation classification unit defined on the basis of a characteristic range of species composition, diagnostic species occurrence, habitat conditions, and physiognomy (Jennings et al., 2009).

Sub-Alliance: An informal subdivision of an Alliance usually developed when an Alliance contains various associations but incomplete floristic data exist for analyzing and defining specific associations.

Phase: An informal subdivision of an association (within a subset of the samples used to define the association) that often describes and emphasizes the dominance of certain non-diagnostic species, or sometimes denotes the absence of certain typical but not diagnostic species of the association.

Mapping Unit: An informal classification unit for mapping of Groups of types that may be planted stands of vegetation, agricultural and/or urban.

Semi-natural Stands: A vegetation classification unit defined by the strong dominance of naturalized (non-native) plants, and they often grow in non-agricultural settings with insignificant cover of native plants. These stands can be valuable habitat for wildlife species (e.g., Eucalyptus stands as nesting and perching sites for raptors, *Bromus (hordeaceus, diandrus)–Brachypodium distachyon* stands as burrowing and feeding sites for small mammals and hunting grounds for birds and larger mammals).

While these types are differentiated from the natural Alliance stands, little effort has been taken to differentiate many associations/stand types of this classification unit. Ultimately, with areas of semi-natural stands identified, future management efforts could be undertaken to enhance native diversity and abundance in these stands to restore them to more native states.

Other terms:

Phenology (peak): The study of periodic species life cycle events, which are influenced by seasonal and inter-annual variations. Peak phenology for annual plant types in Mediterranean California is typically early to mid spring, whereby some annual types may be difficult to properly identify the Alliances in late spring and summer in most years.

Appendix C: Vegetation Classification from Buck-Diaz, J., S. Batiuk and J. Evens. 2012

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

Group I: Woodlands and forests characterized by needle or scale-leaved conifer trees, including various species of pine (Pinus) or juniper (Juniperus). The conifers may only occur intermittently in the overstory and may be associated with shrubs.

I.A. The overstory is dominated by *Pinus* trees alone…

IA.1. Foothill or ghost pine (*Pinus sabiniana*) is the dominant tree in the overstory, and it is generally>10% absolute cover. When foothill pine is co-dominant with *Quercus lobata, Q. kelloggii, Q, wislizeni,* or *Q. douglasii,* key to the respective oak Alliance (not to *P. sabiniana*)……

***Pinus sabiniana* Woodland/Forest Alliance**

IA1.a. *Pinus sabiniana* occurs over an herbaceous and shrub understory with hoary coffeeberry (*Frangula californica* ssp. *tomentella*) at 2% or greater absolute cover…

***Pinus sabiniana* / *Frangula californica* ssp. *tomentella* Woodland Association (Provisional)**

IA1.b. *Pinus sabiniana* occurs over an herbaceous and shrub understory with wedgeleaf ceanothus (*Ceanothus cuneatus*), toyon (*Heteromeles arbutifolia*), and other chaparral species…

***Pinus sabiniana* / *Ceanothus cuneatus – Heteromeles arbutifolia* Woodland Association**

IA1.c. *Pinus sabiniana* occurs over a primarily herbaceous understory with a variety of non-native and native herbs. Shrubs if present are typically disturbance-following species including *Lotus scoparius* and *Lupinus albifrons*…

***Pinus sabiniana* / Grass–Herb Woodland Association**

IA.2. Ponderosa pine (*Pinus ponderosa*) is dominant in the tree canopy with >50% relative cover…

***Pinus ponderosa* Woodland/Forest Alliance**

IA2.a. Shrubs make up the intermittent cover in the understory, with whiteleaf manzanita (*Arctostaphylos viscida*) dominant…

***Pinus ponderosa* / *Arctostaphylos viscida* Woodland Association (Provisional)**

I.B. The overstory is dominated by California juniper (*Juniperus californica*). Oaks or other trees, if present, are low in cover…

***Juniperus californica* Woodland Alliance**

IB.1. *Juniperus californica* is dominant and the understory contains a mixture of herbs…

Group II. Woodlands and forests characterized mainly by broad-leaved evergreen and deciduous tree species such as oaks (Quercus), willows (Salix), etc.

II.A. One or more *Quercus* spp. species are the primary overstory canopy tree, or oaks share dominance with conifers…

IIA.1. Valley oak (*Quercus lobata*) is the dominant species in the tree overstory, or other oaks or riparian species may be co-dominant…

***Quercus lobata* Woodland/Forest Alliance**

IIA1.a. *Quercus lobata* is usually dominant in the overstory. Himalaya berry (*Rubus armeniacus*) usually has 20% or more cover as a (co-)dominant shrub in the understory. Some stands may also have high cover of understory herbs including *Bromus diandrus* and *Carex barbarae,* Found primarily in riparian settings…

***Quercus lobata* / *Rubus armeniacus* Woodland Association**

IIA1.b. *Quercus lobata* is usually dominant in the overstory. California rose (*Rosa californica*) and/or California blackberry (*Rubus ursinus*) are present and (co-)dominant shrubs in the understory. Other shrubs/lianas may be present including *Rubus armeniacus* and California grape (*Vitis californica*). Found along streambanks, levees, sloughs, alluvial bottomlands and swales…

***Quercus lobata* / *Rubus ursinus – Rosa californica* Woodland Association**

IIA1.c. *Quercus lobata* is usually dominant in the overstory. Arroyo willow (*S. lasiolepis*) and/or other willows (e.g., *S. exigua*) are present and (co-)dominant shrubs in the understory…

***Quercus lobata – Salix lasiolepis* Woodland Association**

IIA1.d. *Quercus lobata* is usually dominant in the overstory. White-root sedge (*Carex barbarae*) and/or creeping rye grass (*Leymus triticoides*) are present in the understory and (co-)dominant with other herbs including *Bromus diandrus, Carex praegracilis,* and *Cynodon dactylon.* Rose and blackberry, if present, have relatively low cover compared to the indicator riparian graminoids.
Found primarily in riparian settings including river banks and seasonal streams…

***Quercus lobata* / *Carex barbarae* Woodland Association**

IIA1.e. *Quercus lobata* is the sole dominant over a grassy or herbaceous understory (especially *Bromus diandrus, Lactuca serriola,* and *Hordeum murinum*). Shrubs may sometimes be present and intermittent. Usually associated with small creeks, stream terraces, bottomlands and other low-lying features within the Valley and Sierra foothills…

***Quercus lobata* / Herbaceous Semi-Riparian Woodland Association**

IIA1.f. *Quercus lobata* is usually dominant, while white alder (*Alnus rhombifolia*) is present and averages >5% absolute cover. *Rubus armeniacus* and *Vitis californica* are often present and are variable in cover. Found strictly in riparian settings in the Valley and Sierra foothills…

***Quercus lobata – Alnus rhombifolia* Woodland Association**

IIA1.g. *Quercus lobata* and Oregon ash (*Fraxinus latifolia*) generally co-dominate, although the latter may have low cover. *Alnus rhombifolia* is largely absent. *Vitis californica* characteristically present (with average 10% cover), but sometimes may be absent. Found strictly in riparian settings…

***Quercus lobata – Fraxinus latifolia / Vitis californica* Woodland Association**

IIA1.h. *Quercus lobata* is usually dominant to co-dominant with interior live oak (*Quercus wislizeni*) in the overstory. Poison oak (*Toxicodendron diversilobum*) is usually present and variable in cover, while *Rubus armeniacus* is sometimes present with low cover. Other trees may be present, including California buckeye (*Aesculus californica*), foothill pine (*Pinus sabiniana*) and California sycamore (*Platanus racemosa*). Found within and adjacent to riparian settings…

***Quercus lobata – Quercus wislizeni* Woodland Association**

IIA1.i. *Quercus lobata* is dominant to co-dominant with coast live oak (*Quercus agrifolia*) in the overstory. Various understory riparian and upland herbs may occur in the understory…

***Quercus lobata – Quercus agrifolia /* Grass Woodland Association**

IIA1.j. *Platanus racemosa* occurs in association with *Quercus lobata*. *Rubus armeniacus* and *Vitis californica* are usually present (at >5% absolute cover). Found strictly in riparian settings…

***Platanus racemosa – Quercus lobata* Woodland Association of the *Platanus racemosa* Woodland/Forest Alliance**

IIA.2. Blue oak (*Quercus douglasii*) is the dominant oak species at >50% relative cover in the overstory. Other trees, such as foothill pine (*Pinus sabiniana*), California buckeye (*Aesculus californica*), or other oaks, may be present, but *Quercus douglasii* generally has greater cover…

***Quercus douglasii* Woodland/Forest Alliance**

IIA2.a. *Aesculus californica* is present and conspicuous in the overstory at >2% cover with *Quercus douglasii*. Other tree species may be present, but at relatively lower cover. The understory is usually well-developed with herbs…

***Quercus douglasii – Aesculus californicus* / Grass Woodland Association**

IIA2.b. Other oaks as well as *Quercus douglasii* occur in the overstory. *Aesculus californica* is absent or inconspicuous…

IIA2b.i. Interior live oak (*Quercus wislizeni*) is present and conspicuous in the overstory at >2% cover, with *Quercus douglasii* having >50% relative cover. *Pinus sabiniana* may be present. The understory is open to dense with herbs…

***Quercus douglasii – Quercus wislizeni* Woodland Association**

IIA2.c. Other broad-leaf tree species are not conspicuous with *Quercus douglasii*. Instead, *Pinus sabiniana* is present and conspicuous in the overstory at >2% cover. Shrubs are present in the understory, including chaparral species and poison oak…

IIA2c.i. Common manzanita (*Arctostaphylos manzanita*) is characteristically present in the understory at >2% cover, and the herb layer is usually intermittent to dense…

***Quercus douglasii* / *Arctostaphylos manzanita* / Herbaceous Woodland Association**

IIA2.c.ii. *Pinus sabiniana* is present at >2% cover, and shrubs if present are low in cover including toyon (*Heteromeles arbutifolia*) and other manzanita species. The herbaceous layer is usually intermittent to dense in cover…

***Quercus douglasii – Pinus sabiniana* Woodland Association**

IIA2.d. *Quercus douglasii* is the primary dominant tree in the overstory. The understory may be shrubby or grassy…

IIA2d.i. *Arctostaphylos manzanita* is characteristically present in the understory at >2% cover, and the herb layer is usually intermittent to dense…

***Quercus douglasii* / *Arctostaphylos manzanita* / Herbaceous Woodland Association**

IIA2d.ii. Annual grasses, forbs, and bulbs dominate the understory, and shrubs are low in cover. The most common species include non-natives such as *Bromus hordeaceus*, *Trifolium hirtum*, *Torilis arvensis*, *Avena barbata*, and *Lolium perenne*. However, annual species vary significantly both seasonally and annually, and further research likely could identify a variety of finer-scale associations…

***Quercus douglasii* / Grass Woodland Sub-Alliance**

IIA2d.ii.x. Annual native forbs including *Navarretia pubescens*, *Centaurium muehlenbergii*, *Clarkia purpurea*, and *Selaginella hansenii* occur with non-native grasses such as *Avena barbata*, *Bromus hordeaceus*, and*Trifolium hirtum* in the understory.
Found on volcanic substrates in the Lassen Foothills…

Quercus douglasii* / *Selaginella hansenii – Navarretia pubescens* Woodland Association (Provisional)

IIA2d.ii.xx. Non-native annual grasses such as *Brachypodium distachyon* occur as the dominant or co-dominant with other non-natives in the understory. Found on recently burned soils in the Central Foothills…

***Quercus douglasii / Brachypodium distachyon* Woodland Association**

IIA.3. Interior live oak (*Quercus wislizeni*) is dominant or co-dominant at >30% relative cover, with other tree species in the overstory…

***Quercus wislizeni* Woodland/Forest Alliance**

IIA3.a. *Quercus wislizeni* occurs as a riparian (or semi-riparian) forest or tall shrubland with riparian indicators such as red willow (*Salix laevigata*), Oregon ash (*Fraxinus latifolia*), coffeeberry (*Rhamnus=Frangula californica*), mugwort (*Artemisia douglasiana*), Himalaya blackberry (*Rubus armeniacus*), and others…

***Quercus wislizeni – Salix laevigata* / *Frangula californica* Woodland Association**

IIA3.b. *Aesculus californica* occurs as a conspicuous member of the canopy with *Quercus wislizeni*, and *Pinus sabiniana* is variable in cover if present…

IIA3b.i. *Quercus wislizeni* and *Aesculus californica* occur with *Q. douglasii*, which is conspicuous with at least 5% cover in the overstory…

***Quercus wislizenii – Quercus douglasii – Aesculus californica* Woodland Association**

IIA3b.ii. *Quercus wislizeni* and *Aesculus californica* occur without *Q. douglasii*, or *Q. douglasii* is low in cover (<5%) in the overstory…

***Quercus wislizenii – Aesculus californica* Woodland Association**

IIA3.c. *Quercus douglasii* is either sub-dominant or co-dominant with *Q. wislizeni*. No other tree species is conspicuous in the overstory…

***Quercus wislizeni – Quercus douglasii* / Herbaceous Woodland Association**

IIA3d. *Pinus sabiniana* is usually at least 5% cover with *Quercus wislizeni* dominant in tree layer, and *Quercus douglasii* is less than 5% cover. The understory has no significant cover of toyon (*Heteromeles arbutifolia*), but may have other shrubs significant in cover…

IIA3d.i. *Arctostaphylos manzanita* is present with at least 5% cover in a mixed shrub layer, and *Quercus wislizeni* is in the tree or tall shrub layer…

***Quercus wislizeni – Pinus sabiniana* / *Arctostaphylos manzanita* Woodland Association**

IIA3d.ii. Whiteleaf manzanita (*Arctostaphylos viscida*) is present with at least 5% cover in a mixed shrub layer, and *Quercus wislizeni* is in the tree or tall shrub layer…

***Quercus wislizeni – Pinus sabiniana* / *Arctostaphylos viscida* Woodland Association**

IIA3d.iii. Manzanita spp. are absent, though other shrubs may be present and variable in cover in the understory…

***Quercus wislizeni – Pinus sabiniana* / Annual grass – herb Woodland Association**

IIA3.e. *Quercus wislizeni* is the primary species in the overstory, occurring as a tree or a tall shrub with *Arctostaphylos viscida*. Both species typically have at least 5% absolute cover. May include *Heteromeles arbutifolia* and other shrubs. Typically of upper slopes and relatively exposed, upland settings…

***Quercus wislizeni* / *Arctostaphylos viscida* Woodland Association**

IIA3.f. *Quercus wislizeni* occurs as a tree or tall shrub with *Heteromeles arbutifolia* as the major shrub associate (at least 5% cover). May include up to 5% cover of *Arctostaphylos viscida*, but if so, *Heteromeles arbutifolia* has at least two times the

cover of manzanita. *Toxicodendron diversilobum* may be significant. Typically of mesic settings (concavities and northerly-facing slopes)…

***Quercus wislizenii* / *Heteromeles arbutifolia* Woodland Association**

IIA.4. Canyon live oak (*Quercus chrysolepis*) is dominant in the overstory (>60% relative cover), and sometimes conifers such as *Pinus sabiniana* are emergent at low cover. No significant indicator species are identified in the understory, though shrubs may be sparse to intermittent in cover, usually occurring on ridgetops and northerly slopes…

***Quercus chrysolepis* Woodland Association of the *Quercus chrysolepis* Woodland/Forest Alliance**

IIA.5. Coast live oak (*Quercus agrifolia*) is the dominant species in the overstory, and other trees if present are lower in cover. Stands in the valley are rare and represented by plots with *Equisetum hyemale*, *Carex barbarae,* and other herbs…

(no association defined)
***Quercus agrifolia* Woodland/Forest Alliance**

IIA.6. An oak of hybrid origin (*Quercus* x*morehus*) occurs as a dominant, or is co-dominant with *Quercus wislizeni* or other oaks in the overstory…

(no association defined)
***Quercus kelloggii* Woodland/Forest Alliance**

II.B. California buckeye (*Aesculus californica*) is dominant (>60% relative cover) as a tree or tall shrub in the overstory. If *Aesculus californica* is co-dominant with an oak species, see the *Quercus douglasii* and *Q. wislizeni* Alliances…

***Aesculus californica* Woodland/Forest Alliance**

IIB.1. *Aesculus californica* is dominant as a tree or shrub; oaks may be present but not abundant. *Toxicodendron diversilobum*, herbs, and moss characteristically occur in the understory. Usually on very rocky, upland substrates…

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

II.C. Stands dominated by Hinds's Walnut (*Juglans hindsii*), tree-of-heaven (*Ailanthus altissima*), eucalyptus (*Eucalyptus* spp.), black locust (*Robinia pseudoacacia*), European olive (*Olea europaea*), or other non-native trees in riparian zones…

IIC.1. Hinds's Walnut (*Juglans hindsii*) is dominant in the overstory. Most stands in the Valley and Sierra Foothills are planted or of hybrid origin…

***Juglans hindsii* and hybrids Special Stands and Semi-Natural Woodland Stands**

IIC1.a. *Juglans hindsii* is dominant in the overstory with *Quercus lobata* and *Vitis californica* present at low cover. The understory is characterized by herbs including *Bromus diandrus*…

***Juglans hindsii* / Herbaceous Woodland Association (Provisional)**

IIC.2. *Platanus racemosa* co-dominates the overstory with Hinds's walnut (*Juglans hindsii*)…

(no association defined)

***Platanus racemosa* Woodland/Forest Alliance**

IIC.3. Red river gum (*Eucalyptus camaldulensis*), Blue gum (*E. globulus*), or other eucalyptus strongly dominant in the overstory…

***Eucalyptus* (*globulus, camaldulensis*) Woodland Stand Type**
***Eucalyptus* (*globulus, camaldulensis*) Semi-Natural Woodland Stands**

IIC.4. Tree-of-heaven (*Ailanthus altissima*) strongly dominant in the overstory…

***Ailanthus altissima* Woodland Stand Type (Provisional)**
***Ailanthus altissima* Semi-Natural Woodland Stands (Provisional)**

IIC.5. Black locust (*Robinia pseudoacacia*) strongly dominant in the overstory…

***Robinia pseudoacacia* Woodland Stand Type (Provisional)**
of the *Robinia pseudoacacia* Semi-Natural Woodland Stands (Provisional)

IIC.6. Other non-native trees occur in the overstory as planted stands, including cypress (*Cupressus* sp.), olive (*Olea europaea*), and mulberry (*Morus alba*)…

Ornamental Trees Woodland/Forest Mapping Unit

II.D. Stands dominated or characterized by other typical riparian winter deciduous trees or tall shrubs that are native in the following genera: *Acer*, *Alnus, Fraxinus, Platanus, Populus*, or *Salix*…

IID.1. Box-elder (*Acer negundo*) is typically dominant or co-dominant with other riparian species in the overstory…

***Acer negundo* Woodland/Forest Alliance**

IID1.a. *Acer negundo* co-dominant to dominant with black willow (*Salix gooddingii*) and/or Fremont cottonwood (*Populus fremontii*)…

***Acer negundo – Salix gooddingii* Woodland Association**

IID1.b. *Acer negundo* dominates the tree layer and others trees are absent or low in cover. Shrubs are variable in the understory…

***Acer negundo* Woodland Association**

IID.2. Fremont cottonwood (*Populus fremontii*) has ≥ 5% cover in overstory, usually as a dominant or co-dominant in the overstory with other trees (especially willows)…

***Populus fremontii* Woodland/Forest Alliance**

IID2.a. *Populus fremontii* is the dominant tree in the overstory. Other riparian trees may be present at lower cover, including *Quercus lobata*. *Vitis californica* is present along with other shrubs, including Himalaya or California blackberry (*Rubus* spp.) at ≥10% absolute cover in the understory…

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

IID2.b. *Populus fremontii* is the dominant tree in the overstory. Other riparian trees may be present at low cover. Mulefat (*Baccharis salicifolia*) present at has ≥5% absolute cover, and herbs are variable in the understory including various wetland species…

***Populus fremontii* / *Baccharis salicifolia* Woodland Association**

IID2.c. *Populus fremontii* is the dominant tree in the overstory. Other riparian trees may be present at low cover, including *Quercus lobata*. Shrubs, if present, are usually low in cover (<10%); herbs are variable in cover in the understory and may include *Bromus diandrus*, *Artemisia douglasiana*, *Leymus triticoides*, and *Galium aparine.* This association was previously defined by Vaghti (2003) as *Populus fremontii* Sacramento River, *Populus fremontii / Artemisia douglasiana,* and *Populus fremontii / Galium aparine* Associations which have been merged together into this association…

***Populus fremontii* Great Valley Woodland Association**

IID2.d. *Populus fremontii* occurs in an association with red willow (*Salix laevigata*), where red willow usually has ≥5% absolute cover. Other riparian trees may be present and sometimes co- dominant, including *Quercus lobata*, white alder (*Alnus rhombifolia*), and/or Oregon ash (*Fraxinus latifolia*)…

***Populus fremontii – Salix laevigata* Woodland Association**

IID2.e. *Populus fremontii* occurs in an association with arroyo willow (*Salix lasiolepis*), where arroyo willow has ≥5% absolute cover. Other riparian trees may be present at low cover, including *Quercus lobata* and/or *Fraxinus latifolia*…

***Populus fremontii – Salix lasiolepis* Woodland Association**

IID2.f. *Populus fremontii* occurs in an association with sandbar willow (*Salix exigua*), where sandbar willow has ≥5% absolute cover. Other riparian trees may be present at low cover, including *Quercus lobata*, black willow (*S. gooddingii*), and/or *Fraxinus latifolia*…

***Populus fremontii* / *Salix exigua* Woodland Association**

IID2.g. *Populus fremontii* is a dominant to co-dominant tree with box elder (*Acer negundo*) in the tree canopy. Other riparian trees may be present at low cover including *Salix gooddingii* and *Juglans hindsii,* and shrubs are variable in cover including *Vitis californica,* Himalaya and California blackberry (*Rubus* spp.)…

***Populus fremontii – Acer negundo* Woodland Association**

IID2.h. *Populus fremontii* is co-dominant with *Salix gooddingii* in the tree canopy. Other riparian trees may be present including *Quercus lobata*, box elder (*Acer negundo*), arroyo willow (*S. lasiolepis*) and red willow (*S. laevigata*), and they may also be co-dominant. This association was previously defined as the *Salix gooddingii–Populus fremontii* Association by Hickson and Keeler- Wolf (2007)...

***Populus fremontii – Salix gooddingii* Woodland Association**

IID.3. California sycamore (*Platanus racemosa*) has >5% absolute cover in the overstory as the dominant or co-dominant tree. Other species may intermix in the overstory, including Fremont cottonwood (*Populus fremontii*), Hinds's walnut (*Juglans hindsii*), oaks (*Quercus* spp.), and/or Oregon ash (*Fraxinus latifolia*)…

***Platanus racemosa* Woodland/Forest Alliance**

IID3.a. *Platanus racemosa* is the sole dominant tree. Annual grasses and forbs are present, including *Amsinckia menziesii* and *Bromus diandrus,* and are variable in cover…

***Platanus racemosa* (/ Annual Grass) Woodland Association**

IID3.b. *Platanus racemosa* occurs in association with *Quercus lobata*. *Vitis californica* and *Rubus armeniacus* are usually present at >5% absolute cover.

***Platanus racemosa – Quercus lobata* Woodland Association**

IID3.c. *Platanus racemosa* occurs in association with *Populus fremontii*. Arroyo willow (*Salix lasiolepis*) and/or other willows are also present and variable in cover…

***Platanus racemosa – Populus fremontii / Salix lasiolepis* Woodland Association**

IID.3.d. *Platanus racemosa* co-dominants with *Juglans hindsii*…

(no association defined)

***Platanus racemosa* Woodland/Forest Alliance**

IID.4. White alder (*Alnus rhombifolia*) is dominant or co-dominant with other riparian species in the overstory…

***Alnus rhombifolia* Woodland/Forest Alliance**

IID4.a. *Platanus racemosa* is usually present with red willow (*Salix laevigata*), and both trees usually have >5% absolute cover in a mix with white alder…

***Alnus rhombifolia – Salix laevigata – Platanus racemosa* Woodland Association**

IID4.b. *Alnus rhombifolia* is typically the dominant tree. Sandbar willow (*Salix exigua*) is usually present in the shrub layer along with California wild rose (*Rosa californica*) at 1% or greater. Red- osier dogwood (*Cornus sericea*), if present, has relatively low cover…

***Alnus rhombifolia / Salix exigua* – (*Rosa californica*) Woodland Association**

IID4.c. *Alnus rhombifolia* is typically the dominant tree with an understory of *Cornus sericea.* Arroyo willow (*Salix lasiolepis*) may also dominate the shrub layer…

***Alnus rhombifolia / Cornus sericea* Woodland Association**

IID4.d. *Alnus rhombifolia* is typically the dominant tree. *Salix exigua, Rosa californica,* and *Cornus sericea* are not significant in the understory, though other shrubs or herbs may be present and variable in cover…

***Alnus rhombifolia* Association**

IID.5. Black willow (*Salix gooddingii*) is the dominant tree in the overstory or co-dominant with Fremont cottonwood (*Populus fremontii*), Oregon ash (*Fraxinus latifolia*) or valley oak (*Quercus lobata*)…

***Salix gooddingii* Woodland/Forest Alliance**

IID5.a. *Salix gooddingii* is the sole dominant in the tree canopy. Himalaya blackberry (*Rubus armeniacus*), button-willow (*Cephalanthus occidentalis*), or other shrubs and/or herbs may have high cover in the understory…

***Salix gooddingii* Woodland Association**

IID5.b. *Salix gooddingii* is the sole dominant in the tree canopy. Sandbar willow (*Salix exigua*) is present as a co-dominant or dominant shrub in the understory…

***Salix gooddingii / Salix exigua* Woodland Association (Provisional)**

IID5.c. *Salix gooddingii* is dominant or co-dominant with *Quercus lobata* in the tree canopy. Stands rarely have additional trees as a co-dominant. The understory is characterized by *Cynodon dactylon, Lolium perenne, Polygonum* spp., *Xanthium* spp., or other wetland species…

***Salix gooddingii – Quercus lobata* / Wetland Herb Woodland Association (Provisional)**

IID5.d. *Salix gooddingii* is dominant or co-dominant with *Fraxinus latifolia* in the tree canopy, and both trees have >5% cover. The understory is variable with herbs such as *Cynodon dactylon* and shrubs including *Salix exigua*…

***Salix gooddingii – Fraxinus latifolia* Woodland Association (Provisional)**

IID5.e. *Salix gooddingii* is typically co-dominant with *Populus fremontii* in the tree canopy, and both trees are usually 5% or more cover. Other riparian trees may be present including *Quercus lobata* and arroyo willow (*Salix lasiolepis*). This association was previously defined as the *Salix gooddingii–Populus fremontii* Association by Keeler-Wolf and Hickson (2007)...

***Populus fremontii – Salix gooddingii* Woodland Association of the *Populus fremontii* Woodland/Forest Alliance**

Class B. Shrubland Vegetation

Group I. Shrublands dominated by sclerophyllous temperate shrubs (with leaves hardened by a waxy cuticle). They are dominated by typical chaparral shrub genera, including chamise (Adenostoma fasciculatum), manzanita (Arctostaphylos), yerba santa (Eriodictyon californicum), scrub oaks (Quercus), etc…

I.A. Hoary coffeeberry (*Frangula californica* ssp. *tomentella=Rhamnus tomentella*) is dominant in the shrub canopy, and other shrubs may be present at relatively low cover. Found on alluvial and rocky substrates, including riparian areas…

***Frangula californica* ssp. *tomentella* Shrubland Association**
of the *Frangula californica* Shrubland Alliance

I.B. Toyon (*Heteromeles arbutifolia*) is dominant the shrub canopy, other shrubs may be present at relatively low cover. Found primarily on serpentinite substrate, toyon recovers quickly from sprouting and tends to dominate on south-facing slopes for long periods following fires…

***Heteromeles arbutifolia* Serpentine Shrubland Association (Provisional)**
of the *Heteromeles arbutifolia* Shrubland Alliance

I.C. California yerba santa (*Eriodictyon californicum*) dominates the shrub canopy with open to intermittent cover over annual grasses and forbs. Other shrubs may intermix at relatively low cover. Found often in recently disturbed sites including those recently burned, and tolerates serpentinite substrates…

***Eriodictyon californicum* / Herbaceous Shrubland Association**
of the *Eriodictyon californicum* Shrubland Alliance

I.D. Interior live oak (*Quercus wislizeni*) is dominant or co-dominant in the shrub and/or tree canopy…

***Quercus wislizeni* Alliance (Also see Class A, Group IIA.3.**
for key to tree Associations)

I.E. Scrub oak (*Quercus berberidifolia*) is dominant or co-dominant with other shrubs in the canopy including *Cercocarpus montanus*, *Ceanothus* spp., and *Fraxinus dipetala*. This vegetation type is localized in the southern portion of the Sutter Buttes. Data was not analyzed for this type within the Great Valley but it is described in the neighboring foothills of the Sierra Nevada; see Klein et al. (2007) for full description…

Quercus berberidifolia* Shrubland Alliance

I.E. The overstory is dominated by wedgeleaf ceanothus (*Ceanothus cuneatus*) alone or in shared dominance with other chaparral species such as chamise (*Adenostoma fasciculatum*), coffeeberry (*Rhamnus* spp.), and common manzanita (*Arctostaphylos manzanita*)…

***Ceanothus cuneatus* Shrubland Alliance**

IE.1. *Ceanothus cuneatus* is dominant forming an open to intermittent shrub canopy. Other chaparral shrubs may occur occasionally with low cover. Native herbs are characteristically

present in an open to intermittent understory including *Plantago erecta* and *Vulpia microstachys*. Found primarily on serpentinite substrates…

***Ceanothus cuneatus* / *Plantago erecta* Shrubland Association**

IE.2. *Ceanothus cuneatus* is dominant forming an open to continuous shrub canopy. Other chaparral shrubs may occur occasionally with low cover. The understory is comprised mostly of non-native grasses and forbs. Found primarily on igneous, especially volcanic, substrates…

***Ceanothus cuneatus* Shrubland Association**

IE.3. *Ceanothus cuneatus* and *Adenostoma fasciculatum* are co-dominant in an intermittent to continuous shrub canopy; other chaparral species may intermix at low cover. The herb layer is sparse with *Aira caryophyllea* and other herbs comprising an open understory…

***Ceanothus cuneatus – Adenostoma fasciculatum* Shrubland Association**

I.F. The overstory is characterized by common manzanita (*Arctostaphylos manzanita*), Ione manzanita (*Arctostaphylos myrtifolia*), and/or Whiteleaf manzanita (*Arctostaphylos viscida*); intermixing with a variety of associated shrubs in the canopy…

IF.1. *Arctostaphylos myrtifolia* typically dominates or co-dominates with *A. viscida* in an intermittent to continuous canopy…

***Arctostaphylos myrtifolia* Shrubland Association**
of the *Arctostaphylos myrtifolia* Shrubland Alliance

IF.2. *Arctostaphylos viscida* forms an intermittent to continuous canopy intermixing with a variety of associated shrubs in the canopy…

***Arctostaphylos viscida* Shrubland Alliance**

IF2.a. *Arctostaphylos viscida* forms an intermittent to continuous canopy as the sole dominant shrub. Chamise is absent or relatively low in cover, and other chaparral shrubs such as toyon (*Heteromeles arbutifolia*) may occur at low cover…

***Arctostaphylos viscida* Shrubland Association**

IF2.b. *Arctostaphylos viscida* is a co-dominant or sub-dominant shrub with chamise (*Adenostoma fasciculatum*). *Heteromeles arbutifolia* is often present and may be similar in cover to the manzanita. Found primarily on sedimentary, volcanic, metamorphic and serpentinite substrates (not found on gabbro substrate)…

***Arctostaphylos viscida – Adenostoma fasciculatum* Shrubland Association**

IF.3. *Arctostaphylos manzanita* typically dominates or co-dominates with other shrubs in an intermittent to continuous canopy…

***Arctostaphylos manzanita* Shrubland Association**
of the *Arctostaphylos manzanita* Shrubland Alliance

I.G. The overstory is dominated by chamise (*Adenostoma fasciculatum*) and other chaparral species if present, are relatively low in cover, including manzanita, wedgeleaf ceanothus (*Ceanothus cuneatus*), and/or California yerba santa (*Eriodictyon californicum*). Found typically on sedimentary and igneous substrates, and occasionally on ultramafic substrate…

I.H. *Arctostaphylos viscida* is a co-dominant or sub-dominant shrub with *Adenostoma fasciculatum*. Toyon (*Heteromeles arbutifolia*) is often present and may be similar in cover to the manzanita. Found primarily on sedimentary, volcanic, metamorphic and serpentinite substrates…

***Arctostaphylos viscida – Adenostoma fasciculatum* Shrubland Association**
of the *Arctostaphylos viscida* Shrubland Alliance

Group II. Shrublands dominated by scale-like or broad-leaved species. These are generally considered to be part of desert transition, riparian, or other more soft - leaved shrub habitats; including Coyote brush (Baccharis pilularis), dogwood (Cornus sericea), blackberry (Rubus spp.), willows (Salix spp.), and poison oak (Toxicodendron diversilobum), etc...

II.A. Upland and mesic stands dominated by shrubs that have broad, deciduous leaves, including poison oak (*Toxicodendron diversilobum*), monkeyflower (*Mimulus aurantiacus*), gooseberry (*Ribes* spp.), and elderberry (*Sambucus nigra*)…

IIA.1. Poison oak (*Toxicodendron diversilobum*) dominates the shrub overstory. Other shrubs such as wedgeleaf ceanothus (*Ceanothus cuneatus*) may intermix at low cover, and the herbaceous layer is usually well-developed with annual grasses and forbs; extensive stands often indicate recent and moderately severe browsing and fire history…

***Toxicodendron diversilobum* / Herbaceous Shrubland**
Association of the *Toxicodendron diversilobum*
Shrubland Alliance

IIA.2. Coyote brush (*Baccharis pilularis*) is the dominant in the shrub overstory, forming an open to intermittent canopy. Willows may be present and lower in cover, and the herbaceous understory is often well-developed. Found in moist, grazed meadows and disturbed riparian areas…

***Baccharis pilularis* Shrubland Association**
of the *Baccharis pilularis* Shrubland Alliance

IIA.3. Bush monkey flower (*Mimulus aurantiacus*) is the dominant shrub in the overstory, while shrubby oak (*Quercus wislizeni*) and *Toxicodendron diversilobum* may be present at lower cover…

***Mimulus aurantiacus* Shrubland Association**
of the *Mimulus aurantiacus* Shrubland Alliance

IIA.4. Elderberry (*Sambucus nigra*) dominates the shrub layer. Other shrubs may be present at lower cover, and herbs are usually present and variable in cover in the understory. Occurs in sandy and gravelly riparian and semi-riparian areas…

***Sambucus nigra* Shrubland Association**
of the *Sambucus nigra* Shrubland Alliance

IIA.5. Oak gooseberry (*Ribes quercetorum*) dominates the shrub layer. Found on mesic, rocky slopes and concavities; most stands occur in the inner South Coast ranges…

***Ribes quercetorum* Shrubland Association**
of the *Ribes quercetorum* Shrubland Alliance

IIA.6. Choke cherry (*Prunus virginiana*) dominates in the shrub layer. Found in moist draws and dry ravines; primarily in the coast ranges adjacent to the central valley sometimes on serpentinite…

***Prunus virginiana* Shrubland Association (Provisional)**
of the *Prunus virginiana* Shrubland Alliance

IIA.7. California buckwheat (*Eriogonum fasciculatum*) dominates the shrub layer. Found typically on south-facing slopes and ridges; primarily in the South Coast Ranges and northward to the Kern R drainage of the S Sierra Foothills…

***Eriogonum fasciculatum* Shrubland Association**
of the *Eriogonum fasciculatum* Shrubland Alliance

IIA.8. Wright's buckwheat (*Eriogonum wrightii*) dominates the shrub layer as a dwarf shrub. Found on slopes and flats…

***Eriogonum wrightii* Shrubland Association (Provisional)**
of the *Eriogonum wrightii* Shrubland Alliance

IIA.9. Silver bush lupine (*Lupinus albifrons*) dominates the shrub layer, or sometimes co-dominates with other short-lived woody species including *Lotus scoparius* or Brickellia californica. Found in recently disturbed areas, including riparian/wash terraces, road cuts, and steep erosive slopes…

***Lupinus albifrons* Shrubland of the**
***Lupinus albifrons* Shrubland Alliance**

IIA.10. Deerweed (*Lotus scoparius*) is dominant to co-dominant with other short-lived shrubs in the shrub overstory including yerba santa (*Eriodictyon californicum*) in the shrub overstory, forming an open to intermittent canopy. Found in recently disturbed areas, often from fire and/or mining…

***Lotus scoparius* Shrubland Association**
***Lotus scoparius* Shrubland Alliance**

IIA.11. Virgin River encelia (*Encelia virginensis*) or Acton's brittlebush (*Encelia virginensis* ssp. *actoni*) is dominant in the shrub overstory, forming a sparse to open canopy. Found in disturbed areas including washes and blown sandy areas, only in southern-most portion of the study area near Tehachapi Mtns…

***Encelia virginensis* ssp. *actoni* Shrubland Association**
of the *Encelia virginensis* Shrubland Alliance

IIA.12. Interior goldenbush (*Ericameria linearifolia*), Bladderpod (*Isomeris arborea*), and/or Eastwoodia (*Eastwoodia elegans*) is dominant or co-dominant in the shrub overstory, forming a sparse to open canopy. Found typically on hillslopes…

***Ericameria linearifolia – Isomeris arborea* Shrubland Alliance**

IIA12.a. *Isomeris arborea* is dominant in the shrub overstory. Found often on steep slopes and in washes…

***Isomeris arborea* Shrubland Association**

IIA12.b. *Eastwoodiae elegans* is dominant or co-dominant in the shrub overstory, including *Atriplex polycarpa, Eriogonum* spp. Found often on steep east-to-north-facing slopes…

***Eastwoodiae elegans* Shrubland Association**

IIA.13. California joint fir (*Ephedra californica*) is dominant or co-dominant in the shrub overstory, forming a sparse to open canopy. Found in disturbed areas including washes and blown sandy areas, or on fine textured upland soils near the Carrizo Plain…

***Ephedra californica* Shrubland Alliance**

IIA13.a. *Ephedra californica* is dominant in the overstory; the herbaceous layer is usually much higher in cover than the shrub layer…

***Ephedra californica* / Annual-Perennial herb Shrubland Association**

IIA13.b. *Ephedra californica* is co-dominant with California matchweed (*Gutierrezia californica*) in the shrub layer, and various herbs including *Bromus rubens* and *Eriastrum pluriflorum* occur in the understory…

***Ephedra californica – Gutierrezia californica / Eriastrum pluriflorum* Shrubland Association**

IIA13.c. *Ephedra californica* is co-dominant with other shrubs including cheesebush (*Ambrosia salsola*) and California buckwheat (*Eriogonum fasciculatum*) in the shrub layer…

***Ephedra californica – Ambrosia salsola* Shrubland Association**

IIA.14. Mormon tea (*Ephedra viridis*) is dominant in the shrub overstory, forming a sparse to open canopy. Found on cliffs and other rocky areas…

***Ephedra viridis* Shrubland Association (Provisional) of the *Ephedra viridis* Shrubland Alliance**

IIA.15. Cheesebush (*Ambrosia salsola=Hymenoclea salsola*) is dominant or co-dominant with *Opuntia basilaris* var. *treleasei* in the shrub overstory, forming a sparse to open canopy. Found in lower rocky slopes.

***Ambrosia salsola* Shrubland Association of the *Ambrosia salsola* Shrubland Alliance**

IIA.16. California matchweed (*Gutierrezia californica*) is dominant in the shrub overstory, forming a sparse to open canopy. Found on slopes that are often north-facing and disturbed by livestock and mammals…

***Gutierrezia californica / Poa secunda* Shrubland Association of the *Gutierrezia californica* Shrubland Alliance**

IIA.17. Other native shrubs are dominant in the overstory, forming a sparse to intermittent canopy. Found adjacent to riparian areas on terraces and banks or on steep slopes that have erosional or fire disturbance. Shrubs include *Brickellia californica, Mimulus aurantiacus,* and *Eriodictyon* spp. …

Central and South Coastal California Seral Scrub Group

II.B. Shrublands characterized by riparian and upland species that can tolerate saline or alkaline soils, though not necessarily restricted to these conditions. Includes iodine bush (*Allenrolfea occidentalis*)*, Atriplex* spp.*,* frankenia (*Frankenia salina*)*,* alkali goldenbush (*Isocoma acradenia*)*,* and bush seepweed *Suaeda nigra (=S. moquinii)*…

IIB.1. Iodine bush (*Allenrolfea occidentalis*) dominates with > 2% absolute cover on seasonally saturated soils, and other alkaline-tolerant shrubs such as *Frankenia salina* and *Suaeda nigra* may be present. Annual and perennial herbs are often present and variable in cover…

***Allenrolfea occidentalis* Shrubland Alliance**

IIB1.a. *Allenrolfea occidentalis* occurs with *Suaeda nigra,* and other shrubs and herbs may be present…

***Allenrolfea occidentalis – Suaeda nigra* Shrubland Association**

IIB1.b. *Allenrolfea occidentalis* occurs without *Suaeda nigra,* and other shrubs and herbs may be present including annuals *Amsinckia* spp., *Bromus* spp., *Hordeum* spp., *Polypogon monspeliensis,* and *Vulpia* spp.…

***Allenrolfea occidentalis* Shrubland Association**

IIB1.c. *Allenrolfea occidentalis* occurs without *Suaeda nigra,* and the understory contains *Distichlis spicata* as a dominant or co-dominant herb. Other herbs may be present including *Amsinckia* spp., *Hordeum* spp. and *Bolboshoenus (=Scirpus) maritimus*…

***Allenrolfea occidentalis* / *Distichlis spicata* Shrubland Association**

IIB.2. Bush seepweed *Suaeda nigra (=S. moquinii)* dominates the shrub canopy. Herbs, including *Lepidium dictyotum, Atriplex* spp.*, Centromadia pungens, Frankenia salina, Hordeum murinum, Lasthenia glabrata,* and other alkaline-tolerant species, may be present and high in cover…

***Suaeda nigra* / *Lepidium dictyotum* Shrubland Association**
of the *Suaeda nigra* Shrubland Alliance

IIB.3. *Atriplex lentiformis* dominates with > 5% absolute cover on seasonally saturated soils, and other alkaline-tolerant shrubs such as *Frankenia salina* and *Suaeda nigra* may be present at low cover. Annual and perennial herbs are often present and variable in cover…

***Atriplex lentiformis* Shrubland Association**
of the *Atriplex lentiformis* Shrubland Alliance

IIB.4. *Atriplex spinifera* dominates with > 2% absolute cover on seasonally saturated soils, and other alkaline-tolerant shrubs such as *Isocoma acradenia* and *Suaeda nigra* may be present at low cover. Annual and perennial herbs are often present and open to continuous in cover, including *Amsinckia menziesii, Bromus* spp., *Centromadia pungens, Lasthenia* spp., and *Vulpia* spp. …

***Atriplex spinifera* / Herbaceous Shrubland Association**
of the *Atriplex spinifera* Shrubland Alliance

IIB.5. *Atriplex polycarpa* dominates with > 5% absolute cover on seasonally saturated soils, and other shrubs such as *Atriplex lentiformis* may be present at low cover. Annual and perennial herbs are typically present and open to continuous in cover…

***Atriplex polycarpa* / Annual herbaceous Shrubland Association**
of the *Atriplex polycarpa* Shrubland Alliance

IIB.6. Alkali goldenbush (*Isocoma acradenia*) is characteristic as a dominant to co-dominant perennial forb co-occurring with *Suaeda nigra*. The herbaceous layer is well-developed and also includes *Bromus* spp., *Centromadia pungens, Lasthenia glabrata, Schismus* sp. and *Vulpia myuros*. Stands occur along edges of alkali rain pools, alkali scalds and bottomlands...

***Isocoma acradenia – Suaeda nigra* Shrubland Association (Provisional) of the**

***Isocoma acradenia* Shrubland Alliance**

II.C. Stands dominated by typical desert riparian species, including cheesebush (*Ambrosia salsola*), brittlebush (*Encelia*), CA joint fir (*Ephedra californica*), desert olive (*Forestiera pubescens*), California scale broom (*Lepidospartum squamatum*), arrow weed (*Pluchea sericea*), and tamarix (*Tamarix*)…

IIC.1. Tamarisk (*Tamarix*) is the strong dominant in the shrub canopy. Other trees or shrubs may be present at low cover, including *Quercus* spp., *Salix* spp. and *Rubus* spp.…

***Tamarix* spp. Semi-Natural Shrubland Stand Type**
of the *Tamarix* spp. Semi-Natural Shrubland Stands

IIC.2. California joint fir (*Ephedra californica*) is dominant or co-dominant in the shrub overstory, forming a sparse to open canopy. Found in disturbed areas including washes and blown sandy areas…

***Ephedra californica* Shrubland Alliance**

IIC2.a. *Ephedra californica* is dominant in the overstory with herbaceous layer usually much higher in cover than the shrub layer…

***Ephedra californica – Ambrosia salsola* Shrubland Association**

IIC.3. Cheesebush (*Ambrosia=Hymenoclea salsola*) is dominant in the shrub overstory, forming a sparse to open canopy. Found in washes and lower alluvial fans.

***Ambrosia salsola* Shrubland Association**
of the *Ambrosia salsola* Shrubland Alliance

IIC.4. Acton's brittlebush (*Encelia virginensis* ssp. *actoni*) is dominant in the shrub overstory, forming a sparse to open canopy. Found in disturbed areas including washes, steep unstable gravelly slopes, and blown sandy areas…

***Encelia virginensis* ssp. *actoni* Shrubland Association**
of the *Encelia virginensis* Shrubland Alliance

IIC.5. Desert olive (*Forestiera pubescens*) is dominant in the shrub overstory, and associates with elderberry (*Sambucus nigra*) and other shrubs. Found in draws along slopes and drainages…

***Forestiera pubescens – Sambucus nigra* Shrubland Association**
***Forestiera pubescens* Shrubland Alliance**

IIC.6. California scale broom (*Lepidospartum squamatum*) characterizes an open shrub canopy along alluvial streams, washes, or fans. Other shrubs such as *Artemisia* spp. and *Baccharis salicifolia* may intermix at varying cover in the overstory…

***Lepidospartum squamatum* Shrubland Alliance**

IIC6.a. *Baccharis salicifolia* is sub-dominant to co-dominant in the shrub canopy…

***Lepidospartum squamatum* – *Baccharis salicifolia* Shrubland Association**

IIC6.b. Other shrubs, if present, are at low cover and a variety of herbs are present in the understory…

IIC.7. Arrow weed (*Pluchea sericea*) is dominant in the shrub canopy, and stands may include *Baccharis salicifolia, Sambucus nigra,* and others at lower cover. Stands typically occur around springs, seeps, irrigation ditches, streamsides, and seasonally flooded washes…

***Pluchea sericea* Shrubland Association**
***Pluchea sericea* Shrubland Alliance**

II.D. Stands dominated by other riparian and/or wetland species, including *Baccharis* spp., button-willow (*Cephalanthus occidentalis*), red-osier dogwood (*Cornus sericea*), bush lupine (*Lupinus albifrons*), California rose (*Rosa californica*), Himalaya blackberry (*Rubus armeniacus*), willow (*Salix*), elderberry (*Sambucus nigra*), tamarisk (*Tamarix*), and California wild grape (*Vitis californica*)…

IID.1. Red-osier dogwood (*Cornus sericea*) dominates the shrub layer or co-dominates with shrubby willows (i.e., *Salix lasiolepis, S. exigua*)…

***Cornus sericea* Shrubland Alliance**

IID1.a. *Cornus sericea* dominates or co-dominates the shrub overstory with sandbar willow (*Salix exigua*)…

***Cornus sericea – Salix exigua* Shrubland Association**

IID1.b. *Cornus sericea* dominates or co-dominates the shrub overstory with arroyo willow (*Salix lasiolepis*)…

***Cornus sericea – Salix lasiolepis* Shrubland Association**

IID.2. Button-willow (*Cephalanthus occidentalis*) dominates and forms an open to intermittent shrub canopy, and trees such as Oregon ash (*Fraxinus latifolia*), oak (*Quercus* spp.) or *Salix* spp. may intermix in the overstory at low cover. A variety of riparian/wetland shrubs and herbs occur in the understory. Found along streams, sloughs, and rocky draws…

***Cephalanthus occidentalis* Shrubland Association of the *Cephalanthus occidentalis* Shrubland Alliance**

IID.3. Mule-fat (*Baccharis salicifolia*) dominates an open to continuous shrub canopy, and other shrubs if present are lower in cover. Herbs may be present with variable cover in the understory. Found in riparian corridors and floodplains…

***Baccharis salicifolia* Shrubland Association of the *Baccharis salicifolia* Shrubland Alliance**

IID.4. Coyote brush (*Baccharis pilularis*) is the dominant in the shrub overstory, forming an open to intermittent canopy. Willows may be present and lower in cover, and the herbaceous understory is usually well-developed. Found in meadows and disturbed riparian areas…

***Baccharis pilularis* Shrubland Association of the *Baccharis pilularis* Shrubland Alliance**

IID.5. Silver bush lupine (*Lupinus albifrons*) dominates the shrub layer, or sometimes co-dominates with other disturbance species including *Lotus scoparius.* Found in recently disturbed areas, including riparian/wash terraces, road cuts, and steep erosive slopes…

***Lupinus albifrons* Shrubland Association**
of the *Lupinus albifrons* Shrubland Alliance

IID.6. One or more *Salix* spp. dominates the shrub layer. (Note: some shrub willows may be tall enough to be identified as trees and thus, are also included in the tree-overstory section of this key)…

IID6.a. Arroyo willow (*Salix lasiolepis*) is dominant as a shrub or low tree. Other shrubs and trees may be present at lower cover including shining willow (*S. lucida* ssp. *lasiandra*), Himalaya berry (*Rubus armeniacus*), and California blackberry (*Rubus ursinus*)…

***Salix lasiolepis* Shrubland Alliance**

IID6a.i. *Salix lasiolepis* is dominant in the canopy. *Rubus armeniacus* is typically present in the understory with a variety of wetland shrubs and herbs. *Rosa californica* and other willow species may be present at low cover…

***Salix lasiolepis / Rubus armeniacus* Shrubland Association**

IID6a.ii. *Salix lasiolepis* is dominant in the canopy. Other shrubs and herbs that are present understory include *Rosa californica* and *Rubus ursinus* at variable though lower cover…

***Salix lasiolepis* Shrubland Association**

IID6.b. Sandbar willow (*Salix exigua*) is dominant or co-dominant as a shrub. It forms an open to continuous canopy along riparian corridors…

***Salix exigua* Shrubland Alliance**

IID6b.i. *Salix exigua* is dominant and forms an open to continuous shrub canopy, over a variety of wetland shrubs and herbs such as *Rubus armeniacus* and mugwort (*Artemisia douglasiana*)…

***Salix exigua* Shrubland Association**

IID6b.ii. *Salix exigua* is the dominant or co-dominant with *Salix lasiolepis* and *Rubus armeniacus,* and *R. armeniacus* is typically greater than 5% cover. Other shrubs and herbs may also be present, such as *Cephalanthus occidentalis*, *Rubus ursinus*, and *Rosa californica*. Rarely *Rubus ursinus* has high cover instead of *R. armeniacus*…

***Salix exigua* – (*Salix lasiolepis*) – *Rubus armeniacus* Shrubland Association**

IID6b.iii. *Salix exigua* and Dusky sandbar willow (*S. melanopsis*) are co-dominant, forming an open to intermittent shrub canopy along exposed, sandy or cobbled river terraces…

***Salix exigua – Salix melanopsis* Shrubland Association**

IID6.c. Dusky sandbar willow (*S. melanopsis*) is dominant as a shrub. It forms an open to intermittent shrub canopy along exposed, sandy or cobbled river terraces…

***Salix exigua – Salix melanopsis* Shrubland Association**

IID6.d. Red willow (*Salix laevigata*) is dominant in the overstory with at least 10% cover, or co- dominant with another willow, usually Arroyo willow (*Salix lasiolepis*) which may occur as a sub- or co-dominant in the shrub or low tree layer…

***Salix laevigata* Woodland/Forest Alliance**

IID6d.i. *Salix laevigata* is dominant in the overstory and *S. lasiolepis* has at least 5% cover in the shrub layer. *Rubus armeniacus* and *Artemisia douglasiana* are usually present in the understory with a variety of other herbs and shrubs, including *Typha* spp.…

***Salix laevigata – Salix lasiolepis* Woodland Association**

IID6d.ii. *Salix laevigata* is dominant in the overstory with an absence or relatively low cover of other trees or willows. *Rubus armeniacus* may be present with variable cover in the understory, and various herbs including wetland and alkaline plants may also be present…

***Salix laevigata* Woodland Association**

IID.7. Elderberry (*Sambucus nigra*) dominates the shrub canopy. Other shrubs may be present at lower cover, and herbs are usually present and variable in cover in the understory. Occurs in sandy and gravelly riparian and semi-riparian areas, generally in small to moderate sized, patchy stands…

***Sambucus nigra* Shrubland Association**
of the *Sambucus nigra* Shrubland Alliance

IID.8. California wild grape (*Vitis californica*) is the dominant in the shrub overstory forming an open to continuous canopy, or co-dominant with *Rubus armeniacus*. Other shrubs, including California blackberry (*R. ursinus*), buttonwillow (*Cephalanthus occidentalis*), or elderberry (*Sambucus nigra*) may occur at lower cover. Stands occur adjacent to riparian tree or shrub types along streamsides, levee banks and other riparian areas, around springs, and steep rocky seeps…

***Vitis californica* Shrubland Association (Provisional)**
of the *Vitis californica* Shrubland Alliance (Provisional)

IID.9. California rose (*Rosa californica*) is dominant in the shrub overstory forming an open to continuous canopy. Other shrubs, including *Salix exigua* and *Rubus ursinus,* may occur at lower cover. Stands occur along stream banks and bottomland depressions; they are ecologically similar to stands with *Rubus armeniacus*…

***Rosa californica* Shrubland Association**
of the *Rosa californica* Shrubland Alliance

IID.10. Himalaya blackberry (*Rubus armeniacus*) is the strong dominant (>80% relative cover) in the shrub overstory forming an open to continuous canopy. Other shrubs such as *Vitis californica* and coffeeberry (*Frangula=Rhamnus* spp.) may occur at relatively low cover. Stands occur adjacent to riparian or wetland types…

***Rubus armeniacus* Semi-Natural Shrubland Association**
of the *Rubus armeniacus* Semi-Natural Shrubland Stands

IID.11. Golden current (*Ribes aureum*) is the dominant in the shrub overstory forming an open to continuous canopy. Other riparian shrubs such as *Rubus ursinus* and *Salix* spp., often occur at relatively low cover. Stands occur adjacent to streams…

***Ribes aureum* Shrubland Association (Provisional)**
of the *Rubus* (*parviflorus, spectabilis, ursinus*) Shrubland Alliance

IID.12. Other non-native shrubs are the strong dominant (>80% relative cover) in the shrub overstory forming an open to continuous canopy. Shrubs include common tree tobacco (*Nicotiana glauca*). Stands occur adjacent to riparian areas on terraces and other disturbed uplands…

Naturalized Non-native Mediterranean Scrub Group

Class C. Herbaceous Vegetation

Group I. Stands found in wetland and riparian settings (water or wet ground present throughout the growing season, or water is temporarily or seasonally present), and in alkaline lowlands (where water is present in the winter). Includes >30% absolute cover of true wetland herbs graminoid genera (such as Typha, Carex, Eleocharis, Juncus, or Schoenoplectus (=Scirpus)), wetland forb genera (such as Azolla, Eichhornia, Ludwigia, Potamogeton, Stuckenia, Myriophyllum), tall riparian grasses (e.g., Arundo donax, Cortaderia spp., Deschampsia caespitosa, Leymus spp., Phalaris spp., or Muhlenbergia rigens), alkaline-tolerant seasonally flooded perennials (such as Arthrocnemum subterminale, Crypsis schoenoides, Frankenia salina, Salicornia spp., Sesuvium verrucosum), or other seasonally flooded, perennial and annual forbs (such as Anemopsis californica, Artemisia douglasiana, Equisetum spp., Heterotheca oregona, Lepidium latifolium, Lotus purshianus, Persicaria spp., Polygonum spp., and Xanthium strumarium). Note: some stands may occur in ephemeral wetlands and can also be keyed in the ephemeral wetland category (Group II)…

I.A. Annual or perennial forb vegetation dominated by aquatic, floating or submerged plants.

IA.1. *Azolla filiculoides* and/or *A. mexicana* is dominant in stands or co-dominant with *Egeria densa, Myriophyllum* spp. or *Brasenia schreberi…*

Azolla (_filiculoides, mexicana_) Herbaceous Association (Provisional) of the _Azolla_ (_filiculoides, mexicana_) Herbaceous Alliance (Provisional)

IA.2. *Brasenia schreberi* is dominant in stands or co-dominant with non-natives including *Egeria* spp. and *Myriophyllum* spp.…

Brasenia schreberi Western Herbaceous Association (Provisional) of the _Brasenia schreberi_ Herbaceous Alliance (Provisional)

IA.3. *Ludwigia peploides* ssp*. montevidensis, L. p.* ssp*. peploides,* and/or *Ludwigia hexapetala* dominates the stands, or sometimes *Azolla* sp. or *Myriophyllum* sp. is sub-dominant to co-dominant with *Ludwigia…*

Ludwigia (_hexapetala, peploides_) Herbaceous Association of the _Ludwigia_ (_hexapetala, peploides_) Herbaceous Alliance

IA.4. *Typha latifolia* co-dominant with *Ludwigia* spp.…

Typha latifolia Herbaceous Association of the _Typha_ (_angustifolia_, _domingensis_, _latifolia_) Herbaceous Alliance

IA.5. *Stuckenia pectinata* dominates the herbaceous layer…

Stuckenia pectinata Herbaceous Association of the _Stuckenia_ (_pectinata_) – _Potamogeton_ spp. Herbaceous Alliance

IA.6. *Lemna* sp. and/or *Wolffia* spp. is dominant in stands; in sampled stands the *Lemna* was not determined to species though likely *Lemna gibba* and *L. minor*…

Lemna (_minor_) Herbaceous Association (Provisional) of the _Lemna_ (_minor_) and relatives Herbaceous Alliance (Provisional)

IA.7. *Myriophyllum* spp. and/or *Egeria densa* strongly dominate stands; native plants such as *Ceratophyllum demersum* and *Azolla filiculoides* <10% absolute and relative cover if present. Other similar stands may have *Cabomba* dominant, but have not yet been sampled and defined. This association was previously defined by Hickson and Keeler-Wolf 2007 as the *Egeria – Cabomba – Myriophyllum* spp. Association…

***Myriophyllum* spp. – *Egeria densa* Herbaceous Association (Provisional) of the *Myriophyllum* spp. Semi-Natural Herbaceous Stands (Provisional)**

IA.8. *Eichhornia crassipes* strongly dominates the stands, and native plants <10% absolute and relative cover if present…

***Eichhornia crassipes* Herbaceous Association (Provisional) of the *Eichhornia crassipes* Semi-Natural Herbaceous Stands (Provisional)**

IA.9. Other aquatic plants are dominant, including *Ceratophyllum demersum…*

***Ceratophyllum demersum* Herbaceous Association (Provisional) of the *Potamogeton* spp. – *Ceratophyllum* spp. – *Elodea* spp. Herbaceous Alliance (Provisional)**

I.B. *Typha* spp. and/or *Schoenoplectus* (=*Scirpus*) dominant in the herbaceous layer…

IB.1. A species of *Typha* is dominant in the herbaceous layer. If *Schoenoplectus* is present, it has <50% relative cover compared to the *Typha* species…

***Typha* (*angustifolia*, *domingensis*, *latifolia*) Herbaceous Alliance**

IB1.a. *Typha latifolia* is dominant, and intermixes with a variety of wetland herbs such as *Carex* spp., *Juncus* spp., *Epilobium* spp., and *Schoenoplectus* spp. …

***Typha latifolia* Herbaceous Association**

IB1.b. *Typha angustifolia* is dominant and occurs with other wetland herbs including *Azolla filiculoides*…

***Typha angustifolia* Herbaceous Association**

IB1.c. *Typha domingensis* is co-dominant to dominant, and occurs with other wetland herbs such as *Azolla* spp., *Lemna* spp., and *Schoenoplectus* spp. …

***Typha domingensis* Herbaceous Association**

IB.2. *Schoenoplectus* (=*Scirpus*) *acutus* typically dominates with the highest absolute cover in the herbaceous layer. *Typha* spp. may intermix as a sub- to co-dominant (at < 50% relative cover)…

***Schoenoplectus acutus* Herbaceous Alliance**

IB2.a *Schoenoplectus acutus* is strongly dominant in the herbaceous layer. A variety of taxa such as *Juncus* spp., *Persicaria* spp.., *Rumex* spp., and *Typha* spp. may intermix with lower cover.

This association includes stands previously defined by Hickson and Keeler-Wolf (2007) as *Schoenoplectus acutus – Typha latifolia, Schoenoplectus acutus – Typha domingensis,* and *Schoenoplectus acutus – Xanthium strumarium*…

***Schoenoplectus acutus* Herbaceous Association**

IB2.b. *Schoenoplectus acutus* is dominant or co-dominant with *Phragmites australis* and *Typha* spp. (*T. angustifolia* and/or *T. latifolia* may be present). This association includes stands previously defined by Hickson and Keeler-Wolf (2007) as *Schoenoplectus acutus* **–** *Typha latifolia* **–** *Phragmites australis*…

Schoenoplectus acutus – Phragmites australis **Herbaceous Association**

IB.3. *Schoenoplectus americanus* is dominant in stands…

Schoenoplectus americanus **Herbaceous Association of the *Schoenoplectus americanus* Herbaceous Alliance**

IB.4. *Schoenoplectus californicus* is dominant or co-dominant in stands (with at least 10% absolute cover). If *Schoenoplectus acutus* is present, it has less cover than, or is a co-dominant with, *S. californicus*…

Schoenoplectus californicus **Herbaceous Alliance**

IB4.a. *Schoenoplectus californicus* is dominant in stands. Sometimes *Eichhornia crassipes* is sub-dominant to co-dominant, and other plants in stands may include *Ludwigia peploides* and *Hydrocotyle ranunculoides.* This association (in part) was previously defined by Keeler-Wolf and Hickson (2007) as *Schoenoplectus californicus*– *Eichhornia crassipes* Association, though we are taking a more conservative approach that parallels the work of Keeler-Wolf and Vaghti (2000) in defining this type where *S. californicus* is clearly the dominant…

Schoenoplectus californicus **Herbaceous Association**

IB4.b. *Schoenoplectus acutus* is usually subdominant and sometimes co-dominant with *S. californicus. Phragmites australis* may also be present and co-dominant...

Schoenoplectus californicus – Schoenoplectus acutus **Herbaceous Association (Provisional)**

IB.5. Other *Schoenoplectus* sp. is dominant or co-dominant in stands (with at least 10% absolute cover). This includes *S. pungens*…

Arid West Freshwater Emergent Marsh Group

I.C. Vegetation dominated by native alkaline or salt-tolerant annual and/or perennials including *Allenrolfea, Arthrocnemum* (=*Salicornia*)*, Cressa*, *Distichlis*, *Frankenia salina, Sarcocornia pacifica* (=*Salicornia virginica*), *Sporobolus airoides* and others…

IC.1. *Arthrocnemum subterminale* (=*Salicornia*) is dominant in the herbaceous layer…

Arthrocnemum subterminale **Herbaceous Association (Provisional) of the *Arthrocnemum subterminale* Herbaceous Alliance**

IC.2. *Sporobolus airoides* is characteristic and often co-dominant in the herbaceous layer with other plants including *Bromus* spp., *Cressa truxillensis, Distichlis spicata, Frankenia salina, Hordeum marinum,* and *Vulpia* spp.…

Sporobolus airoides **Herbaceous Alliance**

IC2.a. *Sporobolus airoides* is co-dominant with other grasses including non-natives such as *Bromus diandrus, B. hordeaceus, Hordeum marinum and Vulpia myuros.*

Other species often present at low cover include *Frankenia salina, Distichlis spicata, Cressa truxillensis,* and *Vulpia bromoides*…

Sporobolus airoides **Herbaceous Association**

IC2.b. *Sporobolus airoides* is characteristically present to co-dominant with other grasses, including *Bromus diandrus, B. hordeaceus, Hordeum murinum, H. depressum, and Vulpia myuros,* and *Allenrolfea occidentalis* characteristically occurs at low cover (<2% absolute cover). Other non-native and native herbs are typically present at higher cover including *Trifolium gracilentum, T. depauperatum,* and *Lepidium* spp. …

Sporobolus airoides / Allenrolfea occidentalis **Herbaceous Association**

IC.3. *Allenrolfea occidentalis* dominates with > 2% absolute cover on seasonally saturated soils with *Distichlis spicata*, and other alkaline-tolerant shrubs such as *Frankenia salina* and *Suaeda nigra* may be present…

Allenrolfea occidentalis **Shrubland Alliance**

IC3.a. *Allenrolfea occidentalis* occurs with *Suaeda nigra,* and other shrubs and herbs may be present…

Allenrolfea occidentalis – Suaeda nigra **Shrubland Association**

IC3.b. *Allenrolfea occidentalis* occurs without *Suaeda nigra,* and other shrubs and herbs may be present including annuals *Amsinckia* spp., *Bromus* spp., *Hordeum* spp., *Polypogon monspeliensis,* and *Vulpia* spp.…

Allenrolfea occidentalis **Shrubland Association**

IC3.c. *Allenrolfea occidentalis* occurs without *Suaeda nigra,* and the understory contains *Distichlis spicata* as a dominant or co-dominant herb. Other herbs may be present including *Amsinckia* spp., *Hordeum* spp. and *Bolboshoenus (=Scirpus) maritimus*…

Allenrolfea occidentalis / Distichlis spicata **Shrubland Association**

IC.4. *Distichlis spicata* is dominant in the herb layer, or co-dominant with *Juncus arcticus* var. *balticus, Echinochloa crus-galli* and/or other grasses and forbs. Soils are often alkaline or saline and poorly drained…

Distichlis spicata **Herbaceous Alliance**

IC4.a. *Distichlis spicata* dominant in the herb layer, though various annual or perennial plants may be present at relatively lower cover…

Distichlis spicata **Herbaceous Association**

IC4.b. *Distichlis spicata* is co-dominant in stands with moderate to high cover of non-native annual grasses such as *Bromus hordeaceus, B. diandrus*, *Lolium perenne, Hordeum marinum* or *Vulpia myuros*…

Distichlis spicata **– Annual grasses Herbaceous Association**

IC4.c. *Juncus arcticus* var*. balticus* is sub-dominant to co-dominant with *Distichlis spicata.* In Suisun, high quality brackish tidal marsh habitats may include *Limonium californica*, *Glaux maritima*, and *Triglochin maritima*…

***Distichlis spicata – Juncus arcticus* var. *balticus* (*J. arcticus* var. *mexicanus*) Herbaceous Association**

IC.5. *Cressa truxillensis* and *Distichlis spicata* are characteristically present in alkaline sites typical vernal pool indicator plants are not present…

***Cressa truxillensis – Distichlis spicata* Herbaceous Association (Provisional) of the *Cressa truxillensis – Distichlis spicata* Herbaceous Alliance**

IC.6. *Frankenia salina* is dominant in the herb layer, or co-dominant with *Distichlis spicata* and/or annual grasses. Soils are typically alkaline or saline and poorly drained…

***Frankenia salina* Herbaceous Alliance**

IC6.a. *Frankenia salina* is dominant in the herb layer, or co-dominant with annual plants…

***Frankenia salina* Herbaceous Association**

IC6.b. *Distichlis spicata* co-dominates with *Frankenia salina* and other herbs including non-native grasses…

***Frankenia salina – Distichlis spicata* Herbaceous Association**

IC.7. *Frankenia salina* is often dominant or characteristic in the herb layer and occurs with vernal pool species including *Achyrachaena mollis*, *Myosurus minimus, Psilocarphus brevissimus,* and *Plagiobothrys* spp. This type may be related to *Downingia pulchella – Cressa truxillensis* from Barbour et al. (2007)…

***Frankenia salina – Psilocarphus brevissimus* Herbaceous Association (Provisional) of the *Lasthenia fremontii – Distichlis spicata* Herbaceous Alliance**

IC.8. *Sarcocornia pacifica* (=*Salicornia virginica*) is dominant in the herb layer, or co-dominant with *Distichlis spicata, Frankenia salina* and/or annual grasses. Soils are typically alkaline or saline and poorly drained…

***Sarcocornia pacifica* (*Salicornia depressa*) Herbaceous Alliance**

IC8.a. *Distichlis spicata* is sub-dominant to co-dominant with *Sarcocornia pacifica*...

***Sarcocornia pacifica – Distichlis spicata* Herbaceous Association**

IC8.b. *Sarcocornia pacifica* occurs with annual herbs including *Cotula coronopifolia, Crypsis schoenoides* and *Sesuvium verrucosum* which are seasonally present. This association is redefined here, and encompasses *Sarcocornia pacifica – Cotula coronopifolia, Sarcocornia pacifica – Crypsis* spp., and *Sarcocornia pacifica – Sesuvium verrucosum* from the previous reports Hickson and Keeler-Wolf (2007) and Keeler-Wolf and Vaghti (2000)…

***Sarcocornia pacifica* – Moist annual Herbaceous Association (Provisional)**

IC8.c. *Sarcocornia pacifica* is co-dominant with *Frankenia salina*…

***Sarcocornia pacifica – Frankenia salina* Herbaceous Association**

IC8.d. *Sarcocornia pacifica* is co-dominant with non-native grasses, including *Polypogon monspeliensis, Hordeum* spp*., Lolium perenne.* Type is defined from Keeler-Wolf and Vaghti (2000) from stands in Suisun Marsh…

Sarcocornia pacifica/*annual grasses Herbaceous Association

IC.9. *Sesuvium verrucosum* is dominant or co-dominant with other plants including *Juncus bufonius, Distichlis spicata, Atriplex triangularis* and others…

***Sesuvium verrucosum* Herbaceous Alliance**

IC9.a. *Distichlis spicata* is typically sub-dominant and sometimes co-dominant with *Sesuvium verrucosum*…

***Sesuvium verrucosum – Distichlis spicata* Herbaceous Association**

IC.10. *Centromadia* (*=Hemizonia*) *pungens* and *Lepidium dictyotum* are characteristically present with other forb and grass species such as *Distichlis spicata*. This type may be related to *Downingia bella – Centromadia pungens* from Barbour et al. (2007)…

***Centromadia pungens – Lepidium dictyotum* Herbaceous Association of the *Centromadia* (*pungens*) Herbaceous Alliance**

I.D. Spikerushes (*Eleocharis* spp.) dominate the herb layer…

ID.1. *Eleocharis macrostachya* has at least 2% cover, and is often dominant. Stands are usually found in wetland ponds and may contain a high combined cover of other species including *Lolium perenne*. In vernal pools and swales, stands may contain *Eryngium castrense*, but do not include other typical vernal pool species such as *Lasthenia fremontii* and *Downingia* spp.…

***Eleocharis macrostachya* Herbaceous Association of the *Eleocharis macrostachya* Herbaceous Alliance**

I.E. Rushes (*Juncus* spp.) dominate the herb layer though other species may occur with high cover such as *Carex praegracilis* and *Lepidium latifolium*…

IE.1. *Juncus effusus* dominates the herbaceous layer and intermixes with other wetland herbs…

***Juncus effusus* Herbaceous Association of the *Juncus effusus* Herbaceous Alliance**

IE.2. *Juncus arcticus* var*. balticus* and/or var*. mexicanus* are dominant or co-dominant with a variety of other wetland species. In some cases, *Carex praegracilis* may be dominant, but *J*. *arcticus* is present and usually has >5% cover…

***Juncus arcticus* (var*. balticus, mexicanus*) Herbaceous Alliance**

IE2.a. *Juncus arcticus* var*. balticus* is typically co-dominant to dominant with other wetland species, may co-occur with *J. arcticus* var. *mexicanus*…

***Juncus arcticus* var*. balticus* Herbaceous Association**

IE2.b. *Juncus arcticus* var*. mexicanus* dominates and occurs with a variety of other wetland species…

***Juncus arcticus* var*. mexicanus* Herbaceous Association**

IE2.c. *Carex praegracilis* dominates the herbaceous layer with *Juncus arcticus* var*. balticus* in swales or other moist places, often surrounded by open grasslands…

***Juncus arcticus* var*. balticus – Carex praegracilis* Herbaceous Association**

IE2.d. *Lepidium latifolium* is co-dominant to dominant with *Juncus arcticus*…
***Juncus arcticus* var*. balticus – Lepidium latifolium* Herbaceous Association (Provisional)**

IE.3. *Juncus xiphioides* dominates the herbaceous layer and occurs with a variety of obligate wetland species. Stands are in wet to moist swales and on riparian margins…
***Juncus xiphioides* Herbaceous Association (Provisional)**
of the *Juncus* (*oxymeris*, *xiphioides*) Herbaceous Alliance (Provisional)

IE.4. Other *Juncus* sp. dominates the herbaceous layer with other riparian or wetland plants…
California Warm Temperate Marsh/Seep Group

I.F. Sedges (*Carex* spp.) dominate the herbaceous layer…

IF.1. *Carex barbarae*, a species often associated with stream terraces, is the dominant species in the herbaceous layer, and intermixes with various native and non-native forbs and grasses…
***Carex barbarae* Herbaceous Association**
of the *Carex barbarae* Herbaceous Alliance

IF.2. *Carex praegracilis* dominates the herbaceous layer with *Juncus arcticus* var*. balticus* in swales or other moist places, often surrounded by open grasslands…
***Juncus arcticus* var*. balticus – Carex praegracilis* Herbaceous Association**
of the *Juncus arcticus* (var*. balticus, mexicanus*) Herbaceous Alliance

I.G. Native perennial grasses dominate or are characteristic in the herbaceous layer (including *Deschampsia caespitosa, Leymus* spp., *Hordeum brachyantherum* or *Muhlenbergia rigens*); usually found in wet areas or riparian margins. Other wetland graminoids (*Juncus* sp., *Carex* sp.) may also be present…

IG.1. *Muhlenbergia rigens* is constant and often co-dominant (with greater than 10% absolute cover). Non-native grasses and forbs usually intermix with variable cover…
***Muhlenbergia rigens* Herbaceous Association**
of the *Muhlenbergia rigens* Herbaceous Alliance

IG.2. *Hordeum brachyantherum* is characteristic in the herbaceous layer and co-occurs with annual grasses and forbs including *Hordeum marinum*, *Lolium perenne*, *Medicago polymorpha,* and *Trifolium repens*…
***Hordeum brachyantherum* Herbaceous Association**
of the *Hordeum brachyantherum* Herbaceous Alliance

IG.3. Stands have at least 10% cover of *Deschampsia caespitosa* and the rare species *Lilaeopsis masonii* is present…
***Deschampsia caespitosa – Lilaeopsis masonii* Herbaceous Association (Provisional)**
of the *Deschampsia caespitosa* Herbaceous Alliance

IG.4. *Leymus triticoides* dominates or co-dominates in the herbaceous layer with alkali-tolerant species such as *Frankenia salina* and *Distichlis spicata* and non-natives including *Bromus hordeaceus* and *Lactuca serriola…*

***Leymus triticoides* Herbaceous Alliance**

IG4.a. *Leymus triticoides* dominates the herbaceous layer and may occur with alkali-tolerant species such as *Frankenia salina* and *Distichlis spicata* and non-native *Bromus hordeaceus* and *Lactuca serriola*…

***Leymus triticoides* Herbaceous Association**

IG4.b. *Leymus triticoides* is characteristic in the herbaceous layer with non-natives including *Bromus diandrus*, *Centaurea solstitialis* and *Erodium botrys*…

***Leymus triticoides – Bromus* spp. – *Avena* spp. Herbaceous Association**

IG.5. *Leymus cinereus* dominates the herbaceous layer…

***Leymus cinereus* Herbaceous Association (Provisional)**
of the *Leymus cinereus* Herbaceous Alliance

IG.6. Other native species dominate the herbaceous layer with riparian or wetland plants…

California Warm Temperate Marsh/Seep Group

I.H. Non-native perennial grasses are dominant in the herbaceous layer (including *Arundo donax, Cortaderia* spp., *Cynodon dactylon, Phalaris* spp., and *Phragmites australis*); compared to native cover, non-native cover is typically >80% relative cover. Usually found in wet areas and riparian margins. Other wetland graminoids (*Juncus* spp., *Carex* spp.) may also be present…

IH.1. *Arundo donax* is the dominant species…

***Arundo donax* Semi-Natural Herbaceous Stands**

IH1.a. *Arundo donax* is dominant with other wetland species…

***Arundo donax* Herbaceous Association**

IH1.b. *Arundo donax* is dominant in the herbaceous layer and *Salix exigua* is present with at least 5% absolute cover…

***Arundo donax – Salix exigua* Herbaceous Association**

IH.2. *Cortaderia selloana* and/or *C. jubata* is the dominant species. *Phragmites australis* may also occur…

***Cortaderia* (*selloana, jubata*) Herbaceous Stand Type**
***Cortaderia* (*selloana, jubata*) Semi-Natural Herbaceous Stands**

IH.3. *Phragmites australis* is the dominant species; see Hickson and Keeler-Wolf (2007) for full description…

Phragmites australis* Herbaceous Stand Type
of the *Phragmites australis* Herbaceous Alliance and Semi-Natural Stands*

IH.4. *Phalaris arundinacea* is the dominant species. Other herbs and shrubs occur at low cover including *Carex* spp., *Baccharis salicifolia,* and *Salix* spp. …

***Phalaris arundinacea* Western Herbaceous Stand Type (Provisional)**
***Phalaris arundinacea* Semi-Natural Herbaceous Stands (Provisional)**

IH.5. *Phalaris aquatica* is the dominant species. Other herbs occur at lower cover including *Bromus* spp. …

***Phalaris aquatica* Herbaceous Stand Type (Provisional)**
***Phalaris aquatica* Semi-Natural Herbaceous Stands (Provisional)**

IH.6. Other non-native plants typically dominant (including *Cotula coronopifolia, Cyperus eragrostis, Panicum capillare, Paspalum* spp., *Scirpus tuberosus* (*=Bolboschoenus glaucus*) individually or collectively in stands…

***Cynodon dactylon – Crypsis* spp. – *Paspalum* spp. Moist Ruderal Semi-Natural Herbaceous Stands**

IH6.i. *Cynodon dactylon* dominant in stands, especially in heavily grazed and/or other disturbed soils in moist settings…

***Cynodon dactylon* Herbaceous Stand Type (Provisional)**

I.I. *Xanthium strumarium*, *Persicaria* spp., and/or *Polygonum* spp. are dominant or co-dominant in stands together or with other herbaceous species including *Chenopodium album, Echinochloa crus-galli,* and *Rumex* spp. …

***Persicaria* (*lapathifolia*) – *Xanthium strumarium* Herbaceous Alliance**

II.1. *Xanthium strumarium* is dominant or co-dominant with other herbs including *Cynodon dactylon, Echinochloa crus-galli, Lythrum hyssopifolium, Persicaria lapathifolia,* and/or *Rumex dentatus…*

***Xanthium strumarium* Herbaceous Association**

II.2. *Persicaria amphibia* and/or *P. lapathifolia* are dominant or co-dominant in stands. Other plants may also be co-dominant including *Echinochloa crus-galli, Lolium perenne, Ludwigia peploides, Rumex* spp. and/or *Xanthium strumarium*…

***Persicaria* (*amphibia, lapathifolia*) Herbaceous Association**

I.J. *Cressa truxillensis* and *Distichlis spicata* are characteristically present in alkaline sites and typical vernal pool indicator plants are not present…

***Cressa truxillensis – Distichlis spicata* Herbaceous Association (Provisional) of the *Cressa truxillensis – Distichlis spicata* Herbaceous Alliance**

I.K. *Lepidium latifolium* is strongly dominant species and occurs with other non-native species including *Bromus diandrus* and native species such as *Frankenia salina* and *Malvella leprosa*…

***Lepidium latifolium* Herbaceous Stand Type of the *Lepidium latifolium* Semi-Natural Herbaceous Stands**

l.L. *Crypsis schoenoides* or *C. vaginiflora* is dominant. Stands occur in lowlands that are usually managed wetlands within wildlife areas and alkaline marshes that dry by summer…

***Crypsis* (*schoenoides, vaginiflora*) Semi-Natural Herbaceous Stands (Provisional) of the *Cynodon dactylon – Crypsis* spp. – *Paspalum* spp. Moist Ruderal Semi-Natural Herbaceous Stands**

I.M. Other native or non-native plants (including *Cynodon dactylon, Crypsis schoenoides, Cyperus eragrostis, Panicum capillare, Paspalum* spp., *Bolboschoenus glaucus* (=*Scirpus tuberosus*) dominant in stands…

***Cynodon dactylon* – *Crypsis* spp. – *Paspalum* spp. Moist Ruderal Semi-Natural Herbaceou Stands**

I.N. *Helianthus annuus* dominates the herbaceous with other forbs and grassess…

***Helianthus annuus* Herbaceous Association (Provisional)**
of the *Helianthus annuus* Herbaceous Alliance (Provisional)

I.O. *Artemisia douglasiana* dominates the herbaceous layer and other forbs and grasses co-occur including *Hirschfeldia incana* and *Urtica dioica*…

***Artemisia douglasiana* Herbaceous Association (Provisional)**
of the *Artemisia douglasiana* Herbaceous Alliance (Provisional)

I.P. *Anemopsis californica* dominates the herbaceous layer with >30% relative cover…

***Anemopsis californica* Herbaceous Association (Provisional)**
of the *Anemopsis californica* Herbaceous Alliance

I.Q. *Equisetum hyemale* dominates the herbaceous layer…

***Equisetum hyemale* Herbaceous Association (Provisional)**
of the *Equisetum* (*arvense, variegatum, hyemale*) Herbaceous Alliance (Provisional)

I.R. *Lotus purshianus* dominates or co-dominates wetland stands with non-native grasses including *Bromus hordeaceus, Vulpia bromoides,* and/or *V. myuros,* and other native and non-native herbs also occur in stands…

***Lotus purshianus* Herbaceous Association**
of the *Lotus purshianus* Herbaceous Alliance

I.S. Oregon golden-aster (*Heterotheca oregona*) is dominant in the herbaceous layer with sparse to intermittent cover. Found on sandy and cobbled gravel bars in floodplains, along riparian terraces and stream banks, flats or slopes adjacent to riparian areas, and other seasonally disturbed areas…

***Heterotheca oregona* Herbaceous Association**
of the *Heterotheca* (*oregona, sessiliflora*) Herbaceous Alliance

Group II. Vegetation is dominated by herbaceous species of seasonally moist to dry areas (but not usually wet conditions throughout the growing season); vegetation types on alkaline lowlands are keyed above. This Group includes upland grasslands, mesa tops, or vernally wet to moist habitats, including swales and vernal pools. Species include native and non-native grasses (Bromus, Lolium, Nassella, Vulpia, etc.) forbs (Lasthenia, Plagiobothrys, Trifolium, etc.), and cryptogamic species. Stand identification may be contingent upon appropriate phenology. Stands should be identified in early to mid spring and will be more difficult to identify in late spring and summer in most years…

II.A. Stands are in relatively moist areas that are associated with flat to gradually sloping terrain. Landforms may include vernal pools or shallow ponds, lake margins, swales, and vernal seeps on slopes…

IIA.1. Stands are on moist edges of vernal pools, swales, and seeps, and are usually not inundated for multiple days during the pool or swale wetting phases, although they may have sheet flow across slopes. Stands include significant cover of native annual forbs and grasses, but may be dominated in cover by non-native annual grasses and forbs. Seasonality is extremely important when assessing these stands, since dominance shifts rapidly from early spring dominants (*Blennosperma*, *Limnanthes*) to mid and late season dominants (*Deschampsia danthonioides*, *Achyrachaena mollis*, *Layia fremontii*, *Trifolium variegatum*, *Leontodon taraxacoides*)…

IIA1.a. *Trifolium variegatum* or *T. gracilentum* is characteristic of stands in the early- to mid- spring, growing in swales, seeps, and moist grassy areas. Often found with the following non- native species: *Vulpia bromoides*, *Hypochaeris glabra*, *Leontodon taraxacoides*, and *Lolium perenne…*

***Trifolium variegatum* Herbaceous Alliance**

IIA1a.i. *Trifolium variegatum* is typically dominant or co-dominant with natives such as *Juncus bufonius, Lepidium* spp., *Trifolium* spp. or other herbs of vernally moist settings. If present, *Vulpia bromoides*, *Hypochaeris glabra*, and/or *Leontodon taraxacoides* are each lower in cover than the *Trifolium*…

***Trifolium variegatum* Herbaceous Association**

IIA1a.ii. *Trifolium variegatum*, *Leontodon taraxacoides* and/or *Lolium perenne* collectively have significant cover in the herbaceous layer, and *Juncus bufonius* and *Trifolium dubium* are characteristically present. *Vulpia bromoides* and *Hypochaeris glabra* are often absent or insignificant; see Klein et al. (2007) for full description…

Trifolium variegatum – Lolium perenne – Leontodon taraxacoides* Herbaceous Association

IIA1a.iii. *Trifolium variegatum*, *Vulpia bromoides*, *Hypochaeris glabra*, *Juncus bufonius,* and *Leontodon taraxacoides* collectively characterize the herbaceous layer, though occasionally 1-2 of these species may not be evident. A number of grass and broad-leaf annuals intermix. Found on relatively clay rich sites…

IIA1aiii.x. *Hypochaeris glabra* and/or *Leontodon taraxacoides* are usually co-dominant to dominant in the herbaceous layer. If present, *Trifolium variegatum* and

Juncus bufonius each tend to have <3% cover. Often found in late season or degraded settings…

(*Trifolium variegatum – Vulpia bromoides*) – *Hypochaeris glabra* – *Leontodon taraxacoides* Herbaceous Association

IIA1aiii.xx. *Trifolium variegatum* and *Juncus bufonius* characterize stands, frequently with more than 5% combined cover. Stands are found primarily in early season or moist (but not wet) settings, and *Hypochaeris glabra* and *Leontodon taraxacoides* are less significant than in previous association. This association was previously defined by Klein et al. (2007) as *Trifolium variegatum–Vulpia bromoides* (*Hypochaeris glabra–Leontodon taraxacoides*) Association…

***Trifolium variegatum – Juncus bufonius* Herbaceous Association**

IIA1a.iv. *Trifolium gracilentum* and *Hesperevax caulescens* are characteristically present at low cover with other herbs including *Leontodon taraxacoides, Lolium perenne, Taeniatherum caput-medusae,* and *Microseris douglasii…*

***Trifolium gracilentum – Hesperevax caulescens* Herbaceous Association**

IIA1.b. *Mimulus guttatus* and *Vulpia microstachys* are constant with other characteristic species including *Lotus purshianus, Mimulus moschatus,* and *Pentagramma triangularis*. Found on rocky, vernally wet serpentinite substrates…

***Mimulus guttatus – Vulpia microstachys* Serpentine Herbaceous Association of the *Mimulus guttatus* Herbaceous Alliance**

IIA1.c. *Layia fremontii* is an indicator (may be dominant to sub-dominant), forming early spring displays along edges of vernal pools, and in vernally moist flats and swales. It often occurs with *Triphysaria eriantha* subsp. *eriantha*, *Navarretia tagetina*, and *Lasthenia californica*. This is a transitional Alliance, occurring between upland and vernal pool settings (see IIA.2. Group).
Cicendia quadrangularis, *Plantago erecta*, and other more upland species, usually occur with low cover and combine with vernally moist site indicators such as *Plagiobothrys austiniae*, *Navarretia tagetina*, and *Deschampsia danthonioides*. Non-native species such as *Hypochaeris glabra*, *Bromus hordeaceus*, and *Taeniatherum caput-medusae* may be present with as much cover as the native species, especially later in the season. If *Lasthenia californica, Plantago erecta,* and/or *Vulpia microstachys* are present in more upland settings, they are less than half the cover as the indicator species of this vernally wet Alliance…

***Layia fremontii – Achyrachaena mollis* Herbaceous Alliance**

IIA1c.i. *Plagiobothrys austiniae* and *Achyrachaena mollis* are often present as sub-dominant herbs on volcanic basalt flows, volcanic mudflows in vernal pools, or moist swales. *Layia fremontii*, *Pogogyne zizyphoroides Triphysaria eriantha*, *Bromus hordeaceus*, *Hypochaeris glabra*, *Taeniatherum caput-medusae*, and *Cicendia quadrangularis* are characteristic with variable cover. May include Butte County meadowfoam (*Limnanthes floccosa*)…

***Plagiobothrys austiniae – Achyrachaena mollis* Herbaceous Association**

IIA1c.ii. *Plagiobothrys austiniae* is typically absent, while *Layia fremontii, Achyrachaena mollis, Triphysaria eriantha, Clarkia purpurea, Taeniatherum caput-*

medusae as well as vernal pool species such as *Lasthenia fremontii, Eryngium* spp., *Limnanthes alba, Psilocarphus brevissimus,* and *Pogogyne* spp. are present and abundant. Usually found on vernal pool edges, swale edges, or broad vernally moist flats in open grasslands on volcanic soils. This is a broadly defined association with multiple phases. One phase includes *Layia chrysanthemoides* instead of *L. fremontii,* though other plants are similar to the typical stands of this association. Another phase includes *Lasthenia californica* with *Layia fremontii* and *Achyrachaena* as characteristic species, this phase was previously defined by Klein et al. (2007) as *Layia fremontii – Lasthenia californica – Achyrachaena mollis* Herbaceous Association…

***Layia fremontii – Achyrachaena mollis* Herbaceous Association**

IIA1.d. *Toxicoscordion (=Zigadenus) fremontii* is characteristic in the herbaceous layer with non- native species such as *Lolium perenne* and *Taeniatherum caput-medusae*. This type is clearly related to the *Layia fremontii – Achyrachaena mollis* Alliance, but *Layia fremontii* is absent or present with trace cover. Stands were previously placed by Klein et al. (2007) in the *Lolium perenne* Herbaceous Alliance; while this type is related to that Alliance, the *Toxicoscordion* type has characteristic presence of native species…

***Toxicoscordion fremontii* Herbaceous Alliance (Provisional)**

IIA1d.i. *Toxicoscordion fremontii* is constant and often intermixes with *Triphysaria eriantha* ssp. *eriantha*, *Achyrachaena mollis*, *Fritillaria pluriflora* as well as non-natives species *Lolium perenne*, *Erodium botrys*, *Hypochaeris glabra*, *Geranium dissectum*, *Medicago polymorpha,* and *Taeniatherum caput-medusae*. Found on vernally wet or saturated clay soils…

***Toxicoscordion fremontii* – (*Lolium perenne*) Herbaceous Association (Provisional)**

IIA1.e. *Centromadia* (*=Hemizonia*) *pungens* and *Lepidium dictyotum* are characteristically present with other forb and grass species such as *Distichlis spicata.* This type may be related to *Downingia bella – Centromadia pungens* from Barbour et al. (2007)…

***Centromadia pungens – Lepidium dictyotum* Herbaceous Association of the *Centromadia* (*pungens*) Herbaceous Alliance**

IIA.2. Vegetation characterized by herbs of ephemeral wetlands in swales and vernal pools with very gradual or no slope. All have standing water during the winter and early spring, which may fill and evaporate multiple times during a normal rainy season ("flashy" hydrology). *Deschampsia danthonioides*, *Frankenia salina, Plagiobothrys stipitatus*, *Lasthenia fremontii*, *Downingia bicornuta*, *D. cuspidata*, *D. ornatissima*, and/or *Eryngium castrense* may be characteristic. *Layia fremontii*, *Trifolium variegatum*, and other species of moist stands described above typically are absent or not high in cover. Deeper pools with longer inundation periods and *Eleocharis* spp. diagnostically present may also be keyed here...

IIA2.a. *Lasthenia fremontii*, *Downingia* spp., *Navarretia leucocephala*, and/or *Eryngium* (*castrense*, *vaseyi*) are present and *Deschampsia danthonioides* is characteristic. Upland species such as *Holocarpha virgata*, *Trifolium variegatum*, *Trifolium depauperatum*, *Hypochaeris glabra*, *Erodium botrys*, *Bromus hordeaceus*, and *Vulpia bromoides* are typically absent. Found in shallow pools and broad pool margins throughout the region…

***Lasthenia fremontii – Downingia* (*bicornuta*) Herbaceous Alliance**

IIA2a.i. *Downingia bicornuta* and *Lasthenia fremontii* are conspicuous in the herb layer, while *Ranunculus bonariensis* var. *trisepalus*, *Gratiola ebracteata*, and *Castilleja campestris* subsp. *campestris* are present in part or collectively. Found in hardpan pools on low terraces, high terraces, and (occasionally) on volcanic landforms…

Lasthenia fremontii – Downingia bicornuta **Herbaceous Association**

IIA2a.ii. *Downingia ornatissima* is characteristic with other herbs including *Alopecurus saccatus*, *Deschampsia danthonioides*, and *Plagiobothrys stipitatus*. Other species present may include natives *Lasthenia fremontii*, *Navarretia leucocephala*, *Eryngium castrense*, and *Blennosperma nanum*. Found in northeastern and northwestern Sacramento Valley regions on northern hardpan and volcanic mudflow vernal pools…

Lasthenia fremontii – Downingia ornatissima **Herbaceous Association**

IIA2a.iii. *Downingia bicornuta* and/or *Downingia cuspidata* are present with characteristic species *Psilocarphus brevissimus*, *Deschampsia danthonioides*, and *Eryngium castrense*. *Gratiola ebracteata* and *Lasthenia fremontii* are either absent or insignificant. Found in the northeastern Sacramento Valley region in volcanic vernal pools including high terrace and mudflows…

Downingia **(*bicornuta, cuspidata*) Herbaceous Association**

IIA2a.iv. *Downingia insignis* is characteristically present along with other vernal pool species such as *Lasthenia fremontii, Deschampsia danothonioides,* and *Eryngium vaseyi.*. Stands are found in the northern Solano-Colusa vernal pool region

Downingia insignis–Psilocarphus brevissimus **Herbaceous Association**

IIA2a.v. *Downingia ornatissima*, *D. cuspidata*, *D. bicornuta*, and *Lasthenia fremontii* are absent or insignificant in the herbaceous layer. *Eryngium vaseyi*, *E. castrense, Plagiobothrys stipitatus* var. *micranthus,* and *Psilocarphus brevissimus* are present and abundant with other vernal pool taxa. Found in vernal pools with deeper or longer inundation, hardpan pools, and volcanic mudflows in the northeastern and northwestern Sacramento Valley as well as central and northeastern San Joaquin Valley regions…

Eryngium **(*vaseyi*, *castrense*) Herbaceous Association**

IIA2a.vi. *Lasthenia fremontii* is constant and conspicuous while species of *Downingia* are absent or insignificant. *Lolium perenne*, *Deschampsia danthanioides*, *Alopecurus saccatus*, *Achyrachaena mollis*, and *Navarretia* spp. are characteristic…

Lasthenia fremontii **Herbaceous Association (Provisional)**

IIA2.b. *Hemizonia congesta* ssp. *luzulifolia*, *Lasthenia glabrata*, *Lepidium latipes* var. *latipes*, *Lupinus bicolor*, *Medicago polymorpha*, and/or *Trifolium willdenovii* are characteristic species in the herbaceous layer. Other common non-native species include *Bromus hordeaceus, Lolium perenne* and *Medicago polymorpha*. See Barbour et al. 2007 for full Alliance description…

Hemizonia congesta **Herbaceous Association (Provisional)**
of the *Eryngium aristulatum* Herbaceous Alliance

IIA2.c. *Montia fontana* and/or *Sidalcea calycosa* is characteristically present along with other vernal pool species such as *Lasthenia fremontii, Limnanthes alba, Plagiobothrys* spp.*,* and *Trifolium* spp. …

Montia fontana – Sidalcea calycosa **Herbaceous Association**
of the *Montia fontana – Sidalcea calycosa* Herbaceous Alliance

IIA2.d. *Cotula coronopifolia, Cressa truxillensis, Crypsis schoenoides, Distichlis spicata, Frankenia salina, Triphysaria* spp., and *Myosurus minimus* present along with diagnostic vernal pool plants including *Downingia insignis, D. pulchella, Lasthenia fremontii,* and *Psilocarphus brevissimus.* Found in alkaline or saline vernal pools…

Lasthenia fremontii – Distichlis spicata **Herbaceous Alliance**

IIA2d.i. *Cressa truxillensis* is characteristically present and usually abundant*,* and *Downingia pulchella* is also present and often abundant…

Downingia pulchella – Cressa truxillensis **Herbaceous Association**

IIA2d.ii. *Limnanthes douglasii* ssp. *rosea* and *Pleuropogon californicus* are present along with characteristic species *Achyrachaena mollis, Blennosperma nanum, Distichlis spicata, Trifolium depauperatum,* and *Triphysaria eriantha*…

Limnanthes douglasii **ssp.** ***rosea – Pleuropogon californicus*** **Herbaceous Association**

IIA2d.iii. *Frankenia salina* is often dominant or characteristic in the herb layer and occurs with vernal pool species including *Achyrachaena mollis*, *Myosurus minimus, Psilocarphus brevissimus,* and *Plagiobothrys* spp. This type may be related to *Downingia pulchella – Cressa truxillensis* from Barbour et al. (2007)…

Frankenia salina – Psilocarphus brevissimus **Herbaceous Association (Provisional)**

IIA2.e. *Cressa truxillensis* and *Distichlis spicata* are characteristically present in alkaline or saline sites that are similar to the above Alliance, but do not include typical vernal pool indicator plants…

Cressa truxillensis – Distichlis spicata **Herbaceous Association (Provisional)**
of the *Cressa truxillensis – Distichlis spicata* Herbaceous Alliance

IIA2.f. *Lasthenia glaberrima* is dominant or characteristically present in the herbaceous layer with *Eleocharis macrostachya* and other vernal pool species including *Eryngium vaseyi, Lasthenia fremontii, Plagiobothrys stipitatus* var. *micranthus, Psilocarphus brevissimus* var. *brevissimus, Myosurus minimus* and others…

Lasthenia glaberrima **Herbaceous Alliance**

IIA2f.i. *Lasthenia glaberrima* is dominant or characteristically present in the herbaceous layer with *Eleocharis macrostachya* and *Downingia insignis*; stands occur within claypan pools of the Solano-Colusa and Northern Sacramento Valley vernal pool regions;

Lasthenia glaberrima – Downingia insignis **Herbaceous Association**

IIA2f.ii. *Lasthenia glaberrima* is dominant or characteristically present in the herbaceous layer with *Eleocharis macrostachya* and other indicator species including *Lupinus bicolor, Pogogyne* spp.*, Epilobium* spp.*,* and *Medicago polymorpha*; on Vertisols in Solano-Colusa vernal pool region…

***Lasthenia glaberrima – Lupinus bicolor* Herbaceous Association**

IIA2f.iii. *Lasthenia glaberrima* is dominant or characteristically present in the herbaceous layer with *Eleocharis macrostachya* and other species including *Distichlis spicata, Pleuropogon californicus,* and *Downingia concolor* present; latter species has lower constancy but when present it is a good indicator of this community type; stands occur in the southern part of the Solano-Colusa vernal pool region; see Barbour et al. 2007 for full description…

Lasthenia glaberrima – Pleuropogon californicus* Herbaceous Association

IIA2.g *Eleocharis macrostachya* has at least 2% cover, and is often dominant. Stands are usually found in wetland ponds and may contain a high combined cover of other species including *Lolium perenne*. In vernal pools and swales, stands may contain *Eryngium castrense*, but do not include other typical vernal pool species such as *Lasthenia fremontii* and *Downingia* spp…

***Eleocharis macrostachya* Herbaceous Alliance**

IIA2g.i. *Pleuropogon californicus*, *Glyceria declinata*, or *G. occidentalis* is present with *Eleocharis macrostachya*. Stands usually support a high cover of disturbance-related, non- native wetland species such as *Ranunculus muricatus*, *Rorippa nasturtium-aquaticum*, *Hordeum* spp., or *Rumex* spp. Note: there is question about the identification of the grass *Glyceria* versus *Pleuropogon* in some of these stands found in the valley and adjacent northern Sierra Foothills; thus, parentheses are used to include either *Glyceria* or *Pleuropogon.* Stands are in riparian habitats (draws and basins inundated during springtime)…

***Eleocharis macrostachya* - (*Pleuropogon californicus*) Herbaceous Association (Provisional)**

IIA2g.ii. *Eleocharis macrostachya* is dominant to co-dominant with a variety of native and non-native wetland species such as *Deschampsia danthonioides, Lolium perenne*, and *Lythrum hyssopifolia*. Stands are inundated until late spring, as vernally wet pools and ponds…

***Eleocharis macrostachya* Herbaceous Association**

II.B. Stands occur in upland areas that dry quickly by mid to late spring; not on flats or swales. *Trifolium variegatum* and *Layia fremontii* are not typically conspicuous. Stands may be dominated or characterized by native or non-native annual or perennial grasses or forbs. Settings include steep rocky slopes, rock outcrops, or moderately sloping uplands, among others…

IIB.1. *Lasthenia californica, L. gracilis, L. minor, Plantago erecta*, and/or *Vulpia microstachys* are characteristically present in herbaceous stands. A variety of native forbs including *Lepidium nitidum*, *Trifolium* spp. *Layia pentachaeta*, and upland *Plagiobothrys* spp. are present. If *Achyrachaena mollis* or *Layia fremontii* are present, they are less than half the cover of the indicator species in this upland and vernally moist Alliance…

***Lasthenia californica – Plantago erecta – Vulpia microstachys* Herbaceous Alliance**

IIB1.a. *Lasthenia californica* or *L. gracilis* is dominant in the herbaceous layer. Other characteristic or often present herbs include *Lepidium dictyotum, Centromadia pungens,*

Crassula connata, Bromus hordeaceus, and *Vulpia myuros.* Found on vernal alkaline flats, scalds and low mounds…

***Lasthenia* (*californica, gracilis*) Herbaceous Association**

IIB1.b. *Lasthenia minor* is dominant or co-dominant with other herbs on vernal alkaline flats…

***Lasthenia minor* Herbaceous Association (Provisional)**

IIB1.c. *Vulpia microstachys*, *Lasthenia californica*, and/or *Plantago erecta* occur with characteristic species *Sedella pumila*, *Triphysaria eriantha*, *Hypochaeris glabra*, and *Lepidium nitidum*. Found on skeletal soils of rocky volcanic tablelands and ridge-top mudflows…

***Vulpia microstachys – Lasthenia californica –Sedella pumila* Herbaceous Association**

IIB1.d. *Vulpia microstachys*, *Lasthenia californica*, and/or *Plantago erecta* occur with characteristic species such as *Triphysaria eriantha, Juncus bufonius*, *Chlorogalum angustifolium*, and *Briza minor*. *Agrostis elliottiana* and other species found on weathered volcanic clay soils (e.g., *Cicendia quadrangularis* and *Navarretia tagetina*) are often present. Found mostly on sedimentary and metamorphic substrates in Sacramento County…

***Vulpia microstachys – Lasthenia californica – Agrostis elliottiana* Herbaceous Association**

IIB1.e. *Vulpia microstachys* and/or *Plantago erecta* occur with characteristic species *Navarretia tagetina, Triphysaria eriantha,* and *Bromus hordeaceus*. Typically absent are *Agrostis elliottiana*, *Elymus elymoides*, and *Calycadenia* spp. Stands occur in the Sacramento Valley on upland grazed grasslands with rocky or thin clay soils…

***Vulpia microstachys – Navarretia tagetina* Herbaceous Association**

IIB1.f. *Vulpia microstachys* and *Plantago erecta* occur with other native and non-native species including *Trifolium depauperatum, Bromus hordeaceus,* and *Hypochaeris glabra*. *Navarretia tagetina* is typically absent. Found in moist upland grassland of the southern Sacramento and northern San Joaquin Valley…

***Vulpia microstachys – Plantago erecta* Herbaceous Association**

IIB1.g. *Selaginella hansenii*, *Vulpia microstachys*, and/or *Plantago erecta* intermix with a variety of other native species including *Lupinus spectabilis*, *Eschscholzia lobbii*, *Holocarpha virgata* subsp. *virgata*, *Plantago erecta*, *Dudleya cymosa* subsp. *cymosa*, and *Trifolium willdenovii.*
Found on serpentinite and volcanic substrates…

***Selaginella hansenii – Vulpia microstachys* Herbaceous Association (Provisional)**

IIB1.h. *Vulpia microstachys* characterizes the herbaceous layer with a variety of other native and non-native herbs. Other native annuals can be high in cover including *Brodiaea* spp or *Gilia tricolor* in the early season and *Clarkia* spp. or *Centromadia fitchii* in the later

season. Occurs across the valley on dry sites adjacent to vernal pools and oak woodlands…

***Vulpia microstachys* Herbaceous Association (Provisional)**

IIB1.i. *Lepidium nitidum* is dominant to co-dominant with other native and non-native plants including *Bromus rubens, Crassula connata, Erodium cicutarium, Lasthenia californica* and *Trifolium gracilentum*, and *Vulpia microstachys*…

***Lepidium nitidum – Trifolium gracilentum – Vulpia microstachys* Herbaceous Association**

IIB1.j. *Plagiobothrys acanthocarpa* is dominant to co-dominant with other native and non-native plants including *Lasthenia californica, Plantago erecta, Juncus bufonius, Hedypnois cretica, Medicago polymorpha,* and *Soliva sessilis.* Stands are currently sampled in Merced County on upland alluvium…

***Lasthenia californica – Plagiobothrys acanthocarpa – Medicago polymorpha* Herbaceous Association (Provisional)**

IIB1.k. *Layia pentachaeta, Plagiobothrys canescens* and/or *P. arizonicus* are characteristic and sub-dominant to co-dominant with other native and non-native plants including *Amsinckia menziesii, Bromus rubens, Erodium cicutarium, Hordeum murinum, Lasthenia* spp., *Pectocarya* spp. and *Schismus* spp. In open, patchy grasslands that are in upland grassland and hummocky or concave moist sites…

***Layia pentachaeta – Plagiobothrys* (*canescens*) Herbaceous Association (Provisional)**

IIB.2. Stands are characterized or dominated by perennial grasses or forbs such as *Achnatherum hymenoides, Elymus glaucus, Eriogonum nudum, Grindelia camporum, Hordeum brachyantherum, Isocoma acradenia, Nassella* spp., and *Phalaris aquatica.* Non-native annuals including *Bromus* sp., *Avena* sp., and *Brachypodium distachyon* may be more abundant than the perennials. Stands usually occur in upland to moist riparian settings and are not a component of wet meadows or marsh vegetation…

IIB2.a. *Achnatherum hymenoides* is the dominant or co-dominant perennial with annual species such as *Bromus* spp and *Erodium cicutarium*…

(no association defined)

***Achnatherum hymenoides* Herbaceous Alliance**

IIB2.b. *Nassella pulchra* is co-dominant or characteristically present (with at least 2% cover). Other native and non-native species, including *Bromus hordeaceus, Leontodon taraxacoides* and *Vulpia bromoides*, intermix with variable cover…

***Nassella pulchra* Herbaceous Alliance**

IIB2b.i. *Nassella pulchra* is characteristic in stands and non-native plants (including *Bromus* spp., *Vulpia bromoides,* and *Taeniatherum caput-medusa*) may be high in cover. Native grasses and forbs, including *Nassella, Distichlis spicata,* and *Dichelostemma capitata*, have at least 10% relative cover in these stands…

***Nassella pulchra* Herbaceous Association**

IIB2b.ii. *Nassella pulchra* is characteristic in stands, and occurs with *Leontodon taraxacoides*, *Juncus bufonius*, *Vulpia bromoides*, and variety of *Trifolium* spp. …

***Nassella pulchra – Leontodon taraxacoides* Herbaceous Association (Provisional)**

IIB2b.iii. *Nassella pulchra* is co-dominant in stands (with at least 30% relative cover). Other native plants including *Navarretia* spp., *Sanicula bipinnatifida, S. crassicaulis,* and *Wyethia* sp., and non-native plants including *Bromus* spp. and *Taeniatherum caput-medusa* are present…

***Nassella pulchra – Sanicula bipinnatifida* Herbaceous Association**

IIB2.c. *Nassella cernua* is typically co-dominant as a characteristic grass. Other native and non-native species, including *Bromus hordeaceus, B. rubens,* and *Eschscholzia californica*, intermix with variable cover…

***Nassella cernua* Herbaceous Association (Provisional)**
of the *Nassella cernua* Herbaceous Alliance (Provisional)

IIB2.d. *Elymus glaucus* co-dominates the herbaceous layer with *Bromus hordeaceus*…

***Elymus glaucus* Herbaceous Association (Provisional)**
of the *Elymus glaucus* Herbaceous Alliance

IIB2.e. *Hordeum brachyantherum* is characteristic in the herbaceous layer and co-occurs with annual grasses and forbs including *Hordeum marinum*, *Lolium perenne*, *Medicago polymorpha*, and *Trifolium repens*…

***Hordeum brachyantherum* Herbaceous Association**
of the *Hordeum brachyantherum* Herbaceous Alliance

IIB2.f. *Poa secunda* is dominant or co-dominant with *Bromus* spp. and *Claytonia* spp., *Erodium cicutarium, Dichelostemma capitata, Trifolium willdenovii,* and/or other herbs may also be present. Stands typically occur on north-facing hill slopes…

***Poa secunda*–*Bromus rubens* Herbaceous Association**
of the *Poa secunda* Herbaceous Alliance

IIB2.g. *Isocoma acradenia* is characteristic in the herbaceous layer with variable cover, as a perennial forb or sub-shrub. Other herbs, including *Bromus* spp., *Frankenia salina, Hordeum* spp. and *Lepidium dictyotum,* are present and may be co-dominant. Stands occur on edges of alkali rain pools as well as clay flats to sandy toe-slopes, and they are often seasonally flooded...

***Isocoma acradenia* Shrubland Association**
of the *Isocoma acradenia* Shrubland Alliance

IIB2.h. *Grindelia camporum* is characteristic in the herbaceous layer with variable cover, and other herbs may be present and dominant, including *Anthemis cotula, Bromus* spp., *Centromadia pungens, Distichlis spicata, Eryngium vaseyi, Hordeum* spp., *Lolium perenne, Medicago polymorpha,* and *Phyla nodiflora…*

***Grindelia camporum* Herbaceous Association**
of the *Grindelia* (*camporum, stricta*) Herbaceous Alliance

IIB2.i. *Eriogonum nudum* is characteristic in the herbaceous layer with variable cover. Other herbs, including *Bromus rubens,* may be co-dominant. The shrub layer may be sparse and may include *Gutierrezia californica*. Stands occur on hills, slopes and grassy flats. This association was previously defined from the Inner Central Coast Range by Evens et al. 2006 as *Eriogonum nudum* var. *indictum–Eriogonum vestitum*...

***Eriogonum nudum* Herbaceous Association (Provisional) of the *Eriogonum* (*elongatum, nudum*) Herbaceous Alliance**

IIB2.j. *Heterotheca oregona* is dominant in the herbaceous layer with sparse to intermittent cover. Found on sandy and cobbled gravel bars in floodplains, along riparian terraces and stream banks, and flats or slopes adjacent to riparian areas…

***Heterotheca oregona* Herbaceous Association of the *Heterotheca* (*oregona, sessiliflora*) Herbaceous Alliance**

IIB2.k. *Phalaris aquatica* is strongly dominant alone or with other non-native plants including *Elytrigia pontica* and others (>80% relative cover compared to natives). Herbs may occur at lower cover including *Bromus* spp. …

***Phalaris aquatica* Herbaceous Association (Provisional)**
***Phalaris aquatica* Semi-Natural Herbaceous Stands (Provisional)**

IIB2.l. Other herbs seasonally dominant on upland sites and irregularly flooded riparian sites…

California Annual and Perennial Grassland MacroGroup

IIB.3. Stands have a characteristic presence in the spring of native and annual upland forbs, though non-natives are often present with conspicuous cover. Diagnostic natives include *Amsinckia* spp., *Clarkia* spp., *Croton* (*=Eremocarpus*) *setigerus*, *Eschscholzia californica, Holocarpha virgata, Lupinus nanus*, *L. bicolor, Plagiobothrys nothofulvus,* and *Phacelia* spp.…

IIB3.a. *Holocarpha virgata* is characteristic in the herbaceous layer with variable cover. Other herbs such as *Bromus hordeaceus, Erodium botrys, Juncus bufonius, Lupinus bicolor, Taeniatherum caput-medusae,* and *Vulpia bromoides* are present. This association was previously defined by Klein et al. (2007) as *Bromus hordeaceus– Holocarpha virgata– Taeniatherum caput-medusae*...

***Holocarpha virgata* Herbaceous Association of the *Holocarpha virgata* Herbaceous Alliance**

IIB3.b. *Amsinckia menziesii*, *A. tessellata, Phacelia distans* and/or *P. tanacetifolia* is/are dominant or seasonally characteristic in the herbaceous layer with greater than 15% relative cover. Soils are often well-drained and loamy and may have high levels of (past/current) grazing and/or other disturbance...

***Amsinckia* (*menziesii, tessellata*) Herbaceous Alliance**

IIB3b.i. *Amsinckia menziesii* is present and dominant to sub-dominant with *Erodium* spp., and non-native grasses including *Hordeum murinum* and *Vulpia myuros* may be present with a variety of other native and non-native herbs. This association was previously defined by Buck-Diaz et al. (2011) and Klein and Evens (2005) as *Amsinckia menziesii – Bromus diandrus* and *Amsinckia menziesii – Erodium* spp. Association, respectively…

***Amsinckia menziesii* Herbaceous Association**

IIB3b.ii. *Phacelia tanacetifolia* is seasonally dominant or co-dominant with a variety of other herbs such as *Amsinckia menziesii, Erodium cicutarium,* and *Layia*

pentachaeta. Sometimes *P. distans* or *P. imbricata* may be the dominant instead of *P. tanacetifolia,* though stands occur in similar environments that are typically sloped (rarely flat) with sandy/clay loam to clay soils...

***Phacelia tanacetifolia* Herbaceous Association (Provisional)**

IIB3.c. *Plagiobothrys nothofulvus* is characteristically present with variable cover and may be sub-dominant to dominant with *Bromus* spp., *Castilleja* spp., *Erodium* spp., and *Trifolium* spp.…

***Plagiobothrys nothofulvus* Herbaceous Alliance**

IIB3c.i. *Plagiobothrys nothofulvus* and *Trifolium microcephalum* are characteristically present with *Bromus hordeaceus, Erodium botrys,* and other non-natives. Native species *Amsinckia menziesii, Castilleja attenuata,* and *Daucus pusillus* are often present with a variety of other forbs and grasses. A similar association of *Trifolium microcephalum – Daucus pusillus – Bromus hordeaceus* was previously defined in Yosemite National Park by Keeler-Wolf et al. (2003a)…

***Plagiobothrys nothofulvus – Daucus pusillus – Trifolium microcephalum* Herbaceous Association**

IIB3c.ii. *Plagiobothrys nothofulvus, Castilleja exserta* and *Lupinus nanus* are characteristic with other species including non-native *Erodium cicutarium, Bromus rubens* and/or other non- natives. Native species such as *Crassula connata*, *Lotus wrangelianus,* and *Plagiobothrys arizonicus* are often present with a variety of other forbs and grasses…

***Plagiobothrys nothofulvus – Castilleja exserta – Lupinus nanus* Herbaceous Association (Provisional)**

IIB3.d. *Lupinus nanus* has low to moderate cover and frequently intermixes with *Trifolium hirtum*, *Hypochaeris glabra*, *Bromus hordeaceus*, *Trifolium dubium*, *Erodium botrys*, *Lotus micranthus*, and *Castilleja attenuata*. Other species of *Trifolium* that may intermix include natives *T. willdenovii*, *T. microcephalum*, *T. variegatum*, and/or *T. depauperatum*…

***Bromus hordeaceus – Lupinus nanus – Trifolium* spp. Herbaceous Stand Type (Provisional)**
of the *Bromus* (*diandrus, hordeaceus*)–*Brachypodium distachyon* Semi-Natural Herbaceous Stands

IIB3.e. *Plagiobothrys fulvus* is characteristic with low cover in stands that are dominated by *Bromus hordeaceus* and/or *Erodium botrys*. *Croton* (=*Eremocarpus*) *setigerus, Eschscholzia lobbii, Trifolium* spp. and a variety of other herbs are frequently present…

***Bromus hordeaceus – Erodium botrys – Plagiobothrys fulvus* Herbaceous Stand Type**
of the *Bromus* (*diandrus, hordeaceus*)–*Brachypodium distachyon* Semi-Natural Herbaceous Stands

IIB3.f. *Croton* (=*Eremocarpus*) *setigerus* dominates the herbaceous layer with other forbs and grasses…

***Croton setigerus* Herbaceous Association (Provisional)**

of the *Croton setigerus* Herbaceous Alliance (Provisional)

IIB3.g. *Eschscholzia californica* is seasonally dominant on upland slopes or flats with sandy to loamy soils that are well drained. A variety of other native and non-native forbs and grasses may be present…

***Eschscholzia californica* Herbaceous Association**
of the *Eschscholzia* (*californica*) Herbaceous Alliance

IIB3.h. Other herbs seasonally dominant on upland sites and irregularly flooded riparian sites…

California Annual Herb/Grass Group
of the California Annual and Perennial Grassland MacroGroup

IIB.4. Stands have low or insignificant cover of native grasses or forbs, even during peak phenology. Stands are strongly dominated by non-native annual grasses and/or forbs including species of *Lolium*, *Bromus*, *Avena*, and *Trifolium*...

IIB4.a. *Lolium perenne* including *L. p.* var. *multiflorum* is dominant in the herbaceous layer or co- dominant with *Hordeum* spp*. Taeniatherum caput-medusae* and *Bromus hordeaceus* are often present, though lower in cover. Stands found in settings that have a slightly higher than ambient moisture regime…

***Lolium perenne* Semi-Natural Herbaceous Stands**

IIB4.a.i. *Lolium perenne* is dominant and occurs with other herbs including *Convolvulus arvensis, Hordeum murinum, Lactuca serriola, Rumex crispus* and *Xanthium strumarium.* This association includes stands previously defined by Hickson and Keeler-Wolf (2007) as *Lolium multiflorum – Convolvulus arvensis*…

***Lolium perenne* Herbaceous Stand Type**

IIB4.b. *Toxicoscordion* (=*Zigadenus) fremontii* is characteristic in the herbaceous layer with non- native species such as *Lolium perenne* and *Taeniatherum caput-medusae*. This type is clearly related to the *Layia fremontii – Achyrachaena mollis* Alliance, but *Layia fremontii* is absent or present with trace cover. Stands were previously placed by Klein et al. (2007) in the *Lolium perenne* Herbaceous Alliance; while this type is related to that Alliance, the *Toxicoscordion* type has characteristic presence of native species…

***Toxicoscordion fremontii* Herbaceous Alliance (Provisional)**

IIB4b.i. *Toxicoscordion fremontii* is constant and often intermixes with natives *Triphysaria eriantha* subsp. *eriantha*, *Achyrachaena mollis*, *Fritillaria pluriflora* and non-natives *Lolium perenne*, *Taeniatherum caput-medusae*, *Hypochaeris glabra*, *Geranium dissectum*, *Erodium botrys*, and *Medicago polymorpha*. Found on vernally wet or saturated clay soils…

***Toxicoscordion fremontii* – (*Lolium perenne*) Herbaceous Association (Provisional)**

IIB4.c. A*vena barbata* or *A. fatua* dominates or co-dominates with *Taeniatherum caput-medusae* in the herbaceous layer…

***Avena* (*barbata*, *fatua*) Semi-Natural Herbaceous Stands**

IIB4c.i. *Avena barbata* is dominant. Additional non-native herbs intermix with varying cover, including *Bromus hordeaceus*. Usually found in stands with shallow soils and higher nativity than other non-native types, including *Clarkia purpurea*…

***Avena barbata* Herbaceous Stand Type**

IIB4c.ii. *Avena fatua* strongly dominates the herbaceous layer with other non-native herbs. *Bromus* spp. if present, have low cover…

***Avena fatua* Herbaceous Stand Type**

IIB4.d. *Bromus diandrus, B. hordeaceus, Brachypodium distachyon,* and *Erodium* spp. are dominant or co-dominant with other non-natives in the herbaceous layer…

Bromus* (*diandrus, hordeaceus*) – *Brachypodium distachyon
Semi-Natural Herbaceous Stands

IIB4d.i. *Bromus diandrus* strongly dominates stands composed largely of non-natives, including *Bromus hordeaceus* and *Hordeum murinum…*

***Bromus diandrus* Herbaceous Stand Type**

IIB4d.ii. *Bromus hordeaceus* and *Leontodon taraxacoide*s collectively dominate stands and often have similar cover. Stands are composed largely of non-natives, including characteristic species *Aira caryophyllea*, *Erodium botrys*, *Trifolium dubium*, *Hypochaeris glabra*, *Briza minor* and *Trifolium hirtum…*

***Bromus hordeaceus – Leontodon taraxacoides* Herbaceous Stand Type**

IIB4d.iii. *Bromus hordeaceus* and *Hordeum* spp. co-dominate stands composed largely of non-natives including *Medicago polymorpha…*

***Bromus hordeaceus – Hordeum* spp. – *Medicago polymorpha* Herbaceous Stand Type**

IIB4d.iv. *Plagiobothrys fulvus* is characteristic with low cover in stands that are dominated by *Bromus hordeaceus* and/or *Erodium botrys*. *Croton* (=*Eremocarpus*) *setigerus, Eschscholzia lobbii, Trifolium* spp. and a variety of other herbs are frequently present…

***Bromus hordeaceus – Erodium* (*botrys*) – *Plagiobothrys fulvus* Herbaceous Stand Type**

IIB4d.v. *Taeniatherum caput-medusae* and *Bromus hordeaceus* co-dominate stands composed largely of non-natives*…*

***Bromus hordeaceus – Taeniatherum caput-medusae* Herbaceous Stand Type**

IIB4d.vi. *Bromus diandrus* and/or *B. hordeaceus* occur as dominants with native and non-native species including *Avena fatua, Lactuca serriola, Lolium perenne, Lotus purshianus, Trifolium hirtum,* and *Vicia* spp.…

***Bromus hordeaceus* (*– Vicia villosa – Lolium perenne*) – *Trifolium hirtum* Herbaceous Stand Type**

IIB4d.vii. *Lupinus nanus* has low to moderate cover and frequently intermixes with *Trifolium hirtum*, *Hypochaeris glabra*, *Bromus hordeaceus*, *Trifolium dubium*, *Erodium botrys*, *Lotus micranthus*, and *Castilleja attenuata*. Other species of *Trifolium* that may intermix include natives *T. willdenovii*, *T. microcephalum*, *T. variegatum*, and/or *T. depauperatum*…

***Bromus hordeaceus – Lupinus nanus – Trifolium* spp. Herbaceous Stand Type (Provisional)**

IIB4.e. *Hypochaeris glabra, Vulpia bromoides, V. myuros,* and/or *Bromus* spp. are dominant or co-dominant in the herbaceous layer with other non-natives including *Erodium botrys*…

***Hypochaeris glabra – Vulpia bromoides* Herbaceous Stand Type of the *Bromus* (*diandrus, hordeaceus*) – *Brachypodium distachyon* Semi-Natural Herbaceous Stands**

IIB4.f. *Holocarpha virgata* is characteristic in the herbaceous layer with variable cover. Other herbs such as *Bromus hordeaceus, Erodium botrys, Juncus bufonius, Lupinus bicolor, Taeniatherum caput-medusae,* and *Vulpia bromoides* are present. This association was previously defined by Klein et al. (2007) as *Bromus hordeaceus– Holocarpha virgata– Taeniatherum caput-medusae...*

***Holocarpha virgata* Herbaceous Association of the *Holocarpha virgata* Herbaceous Alliance**

IIB4.g. *Bromus rubens* and/or *Schismus* spp. are conspicuous in the herbaceous layer, with virtually no significant cover of native species...

***Bromus rubens – Schismus* (*arabicus, barbatus*) Semi-Natural Herbaceous Stands**

IIB4g.i. *Bromus rubens* intermixes with other non-natives such as *Bromus diandrus* and *Erodium cicutarium*…

***Bromus rubens* Herbaceous Stand Type**

IIB4g.ii. *Schismus* spp. dominates the herbaceous layer…

***Schismus barbatus* Herbaceous Stand Type**

IIB4.h. *Centaurea solstitialis* (in late season) is conspicuous in the herbaceous layer, with virtually no significant or detectable cover of native species. Other non-natives include *Bromus hordeaceus*, *B. diandrus*, *Trifolium hirtum*, and *Vulpia myuros*…

***Centaurea solstitialis* Herbaceous Stand Type of the *Centaurea* (*melitensis*, *solstitialis*) Semi-Natural Herbaceous Stands**

IIB4.i. *Conium maculatum* dominates the herbaceous layer with other herbs and grasses...

***Conium maculatum* Herbaceous Stand Type of the *Conium maculatum–Foeniculum vulgare* Semi-Natural Herbaceous Stands**

IIB4.j. Upland mustard species including *Brassica nigra, Hirschfeldia incana* and *Raphanus sativus* dominate the herbaceous layer with other non-native herbs and grasses, if native species are present they have low cover...

***Brassica* (*nigra*) and Other Mustards Semi-Natural Herbaceous Stands**

IIB4j.i. *Hirschfeldia incana* dominates the herbaceous layer with other non-natives…

***Hirschfeldia incana* Herbaceous Stand Type (Provisional)**

IIB4j.ii. *Brassica nigra* dominates the herbaceous layer…

***Brassica nigra* Herbaceous Stand Type**

IIB4.k. Other non-native herbs are strongly dominant (>80% relative cover) in the herbaceous layer forming open to continuous cover. Non-natives include (*Hordeum murinum, Silybum marianum, Sorghum halepense,* and *Vulpia myuros*). Stands occur adjacent to riparian areas and upland sites…

Mediterranean California Naturalized Annual and Perennial Grassland Group

Appendix D: Imagery of each Mapping Unit utilized from the Classification

(First image on each page following is NAIP imagery 2016 and second is Google Earth)

ECW: California Evergreen Coniferous Forest and Woodland Group

***Juniperus californica* Alliance**

ECW: California Evergreen Coniferous Forest and Woodland Group
***Pinus sabiniana* Alliance**

IMF: Introduced North American Mediterranean Forest Group

***Ailanthus altissima* – provisional Alliance**

IMF: Introduced North American Mediterranean Forest Group
***Eucalyptus (globulus, camaldulensis)* Alliance**

IMF: Introduced North American Mediterranean Forest Group

Ornamental trees Mapping Unit

IMF: Introduced North American Mediterranean Forest Group
***Prosopis glandulosa* Alliance**

IMF: Introduced North American Mediterranean Forest Group
***Robinia pseudoacacia* Alliance**

RWF: Riparian Evergreen and Deciduous Woodland Group
***Acer negundo* Alliance**

RWF: Riparian Evergreen and Deciduous Woodland Group
***Juglans hindsii* and hybrids Alliance**

RWF: Riparian Evergreen and Deciduous Woodland Group
***Platanus racemosa* Alliance**

RWF: Riparian Evergreen and Deciduous Woodland Group
***Populus fremontii* Alliance**

RWF: Riparian Evergreen and Deciduous Woodland Group
***Quercus lobata* Alliance**

RWF: Riparian Evergreen and Deciduous Woodland Group
***Salix gooddingii* Alliance**

RWF: Riparian Evergreen and Deciduous Woodland Group
***Salix laevigata* Alliance**

VRF: Vancouverian Riparian Deciduous Forest Group
***Alnus rhombifolia* Alliance**

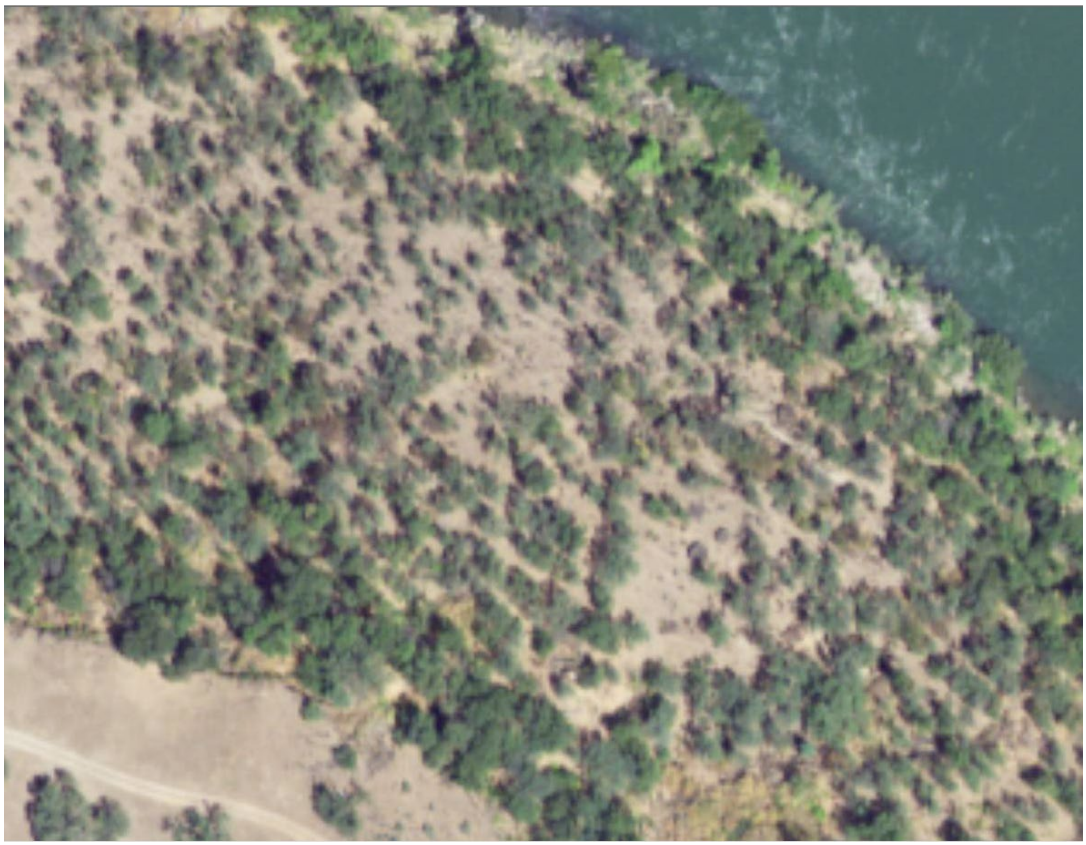
VRF: Vancouverian Riparian Deciduous Forest Group
***Fraxinus latifolia* Alliance**

VRF: Vancouverian Riparian Deciduous Forest Group

Salix lucida

WVO: California Broadleaf Forest and Woodland Group
***Aesculus californica* Alliance**

WVO: California Broadleaf Forest and Woodland Group
***Quercus douglasii* Alliance**



WVO: California Broadleaf Forest and Woodland Group
***Quercus lobata* Alliance (upland)**

Note: CNPS has combined this with the riparian *Q. lobata* Alliance, it was kept as WVO for this project for comparison between 2009 and 2016.

WVO: California Broadleaf Forest and Woodland Group
***Quercus wislizenii* – tree Alliance**

RIS: Riparian Introduced Scrub Group
***Arundo donax* Alliance**

RIS: Riparian Introduced Scrub Group
***Rubus armeniacus* Alliance**

RIS: Riparian Introduced Scrub Group
***Sesbania punicea* Alliance**

RIS: Riparian Introduced Scrub Group

***Tamarix spp.* Alliance**

Phragmites australis - Arundo donax - Alopecurus pratensis **Semi-natural Stands (This is just *Phragmites australis*)**

RWS: Southwestern North American Riparian Wash/Scrub Group
***Baccharis salicifolia* Alliance**

RWS: Southwestern North American Riparian Wash/Scrub Group
***Cephalanthus occidentalis* Alliance**

RWS: Southwestern North American Riparian Wash/Scrub Group
***Rosa californica* Alliance**

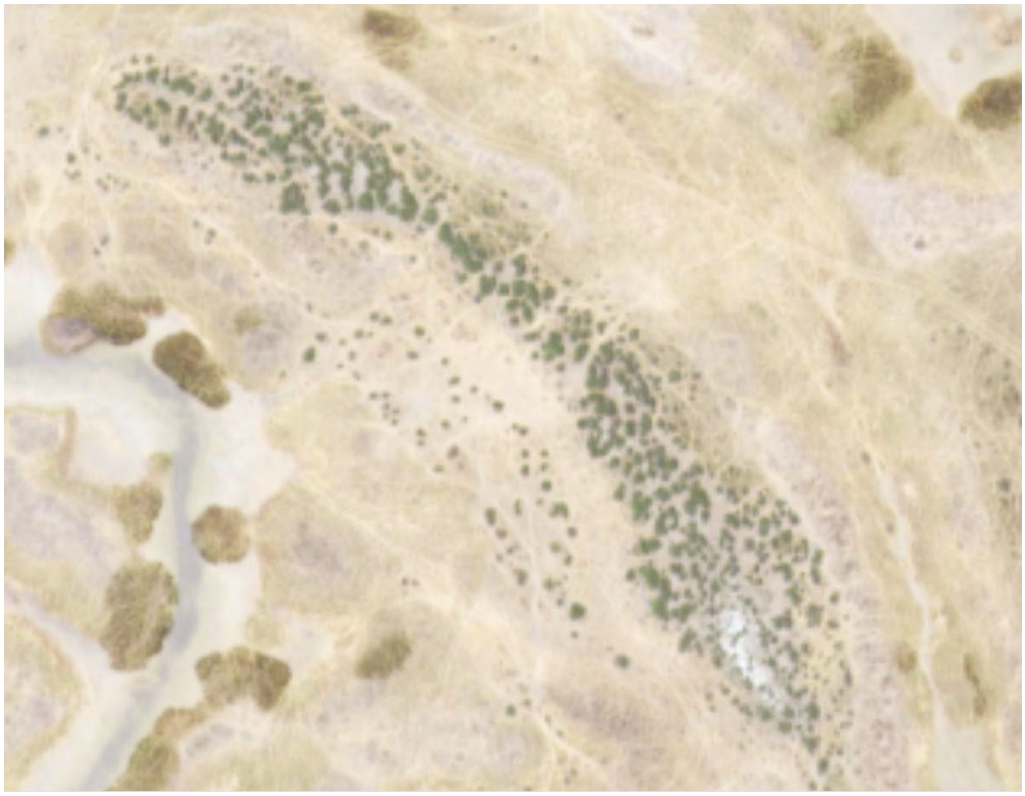
RWS: Southwestern North American Riparian Wash/Scrub Group
***Salix exigua* Alliance**

RWS: Southwestern North American Riparian Wash/Scrub Group
***Salix lasiolepis* Alliance**

RWS: Southwestern North American Riparian Wash/Scrub Group
***Sambucus nigra* Alliance**

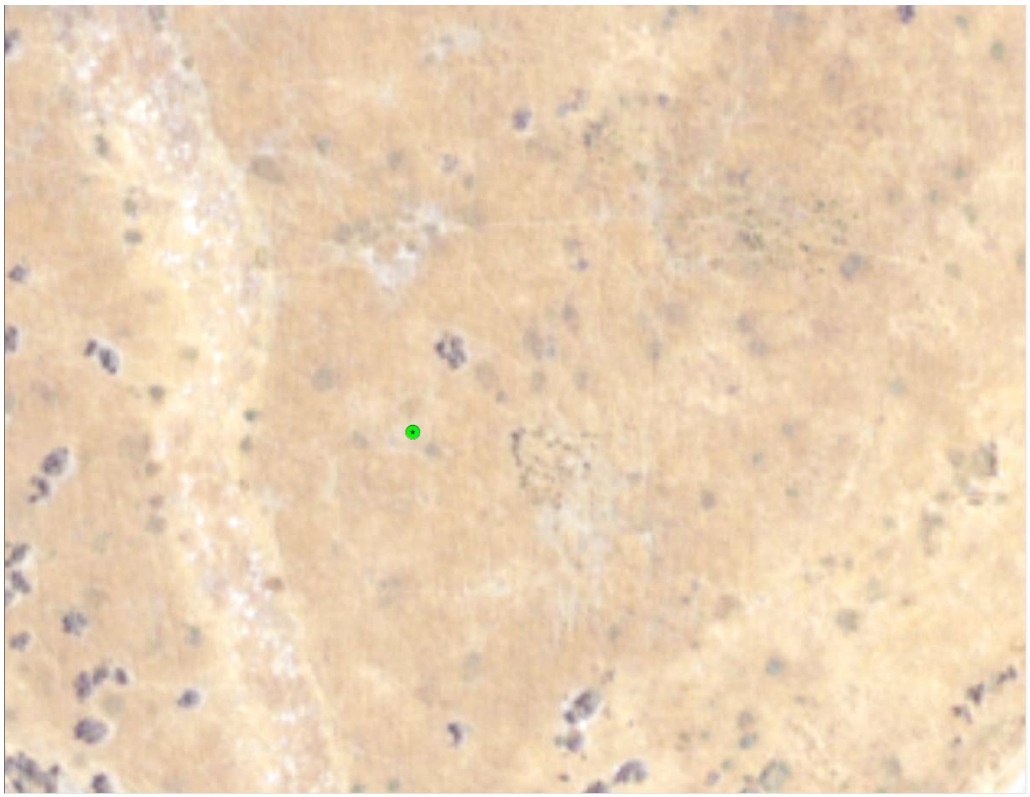
RWS: Southwestern North American Riparian Wash/Scrub Group
***Vitis californica* – provisional Alliance**

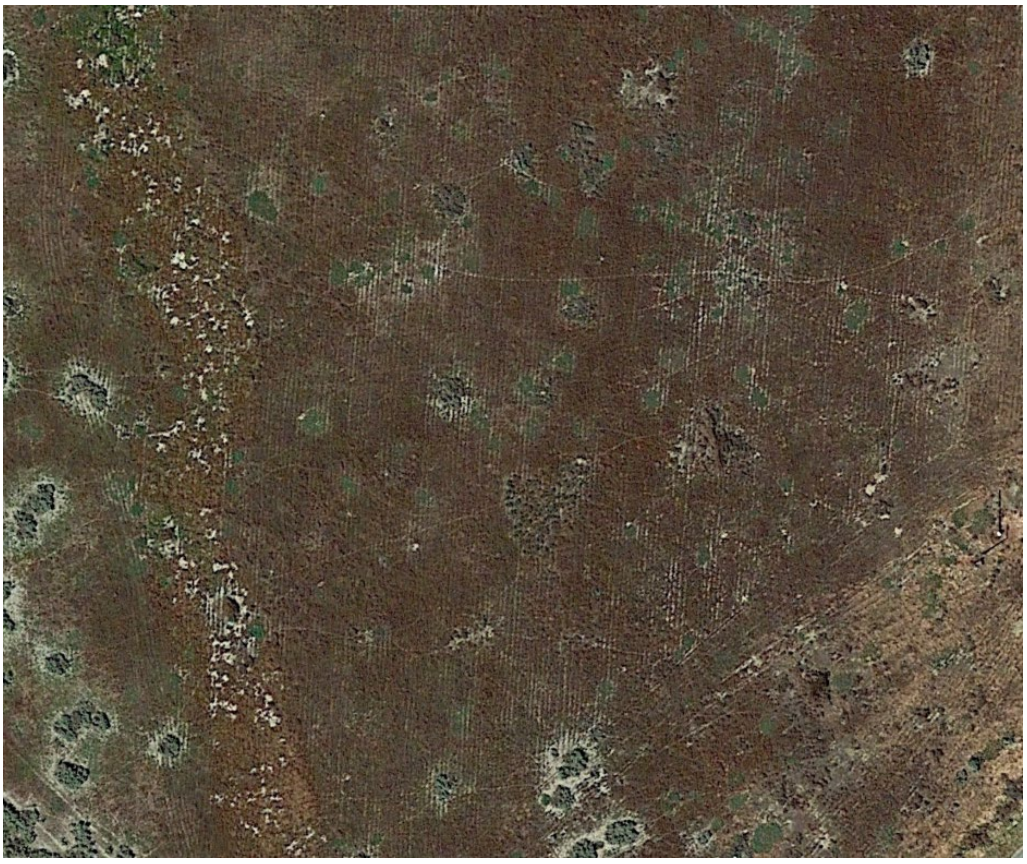
SSB: Southwestern North American Salt Basin and High Marsh Group
***Allenrolfea occidentalis* Alliance**



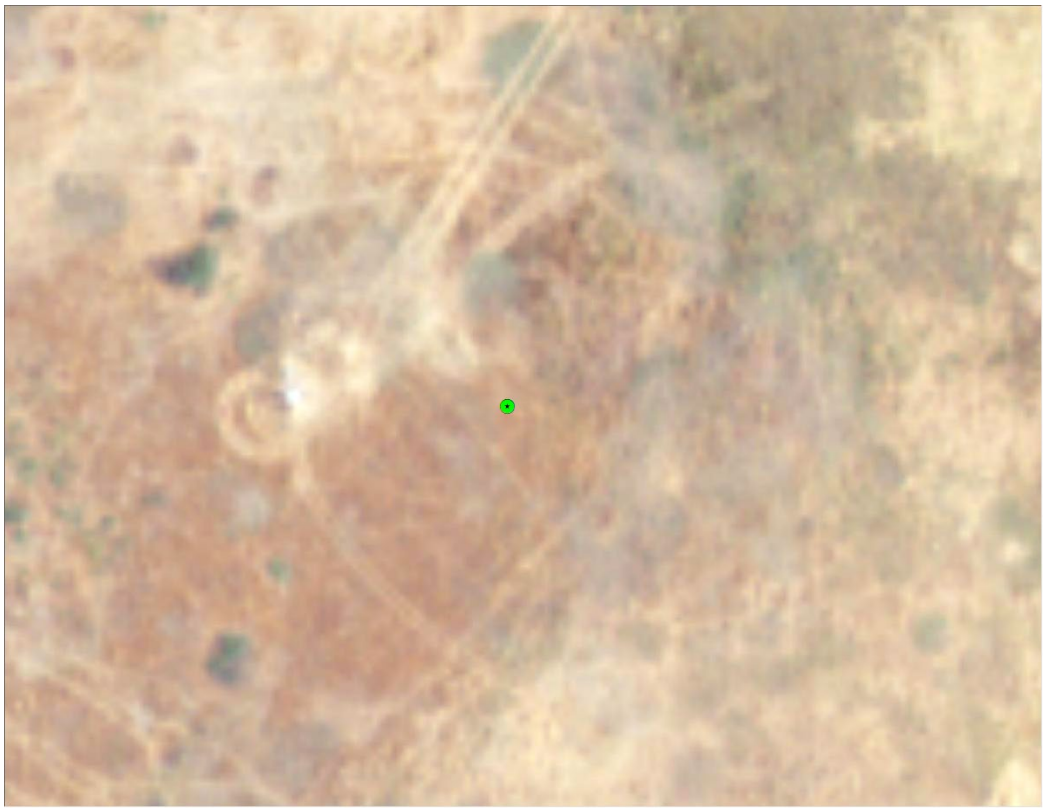
SSB: Southwestern North American Salt Basin and High Marsh Group
***Atriplex lentiformis* Alliance**

SSB: Southwestern North American Salt Basin and High Marsh Group
***Atriplex spinifera* Alliance**



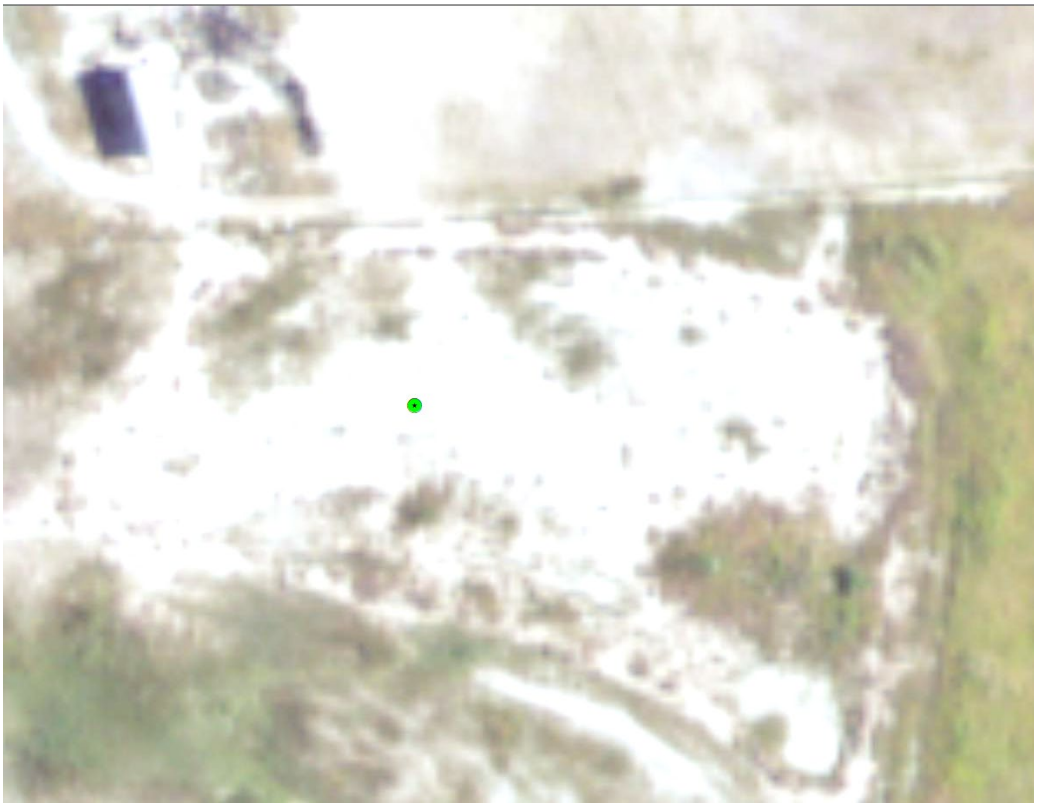


SSB: Southwestern North American Salt Basin and High Marsh Group
***Frankenia salina* Alliance**



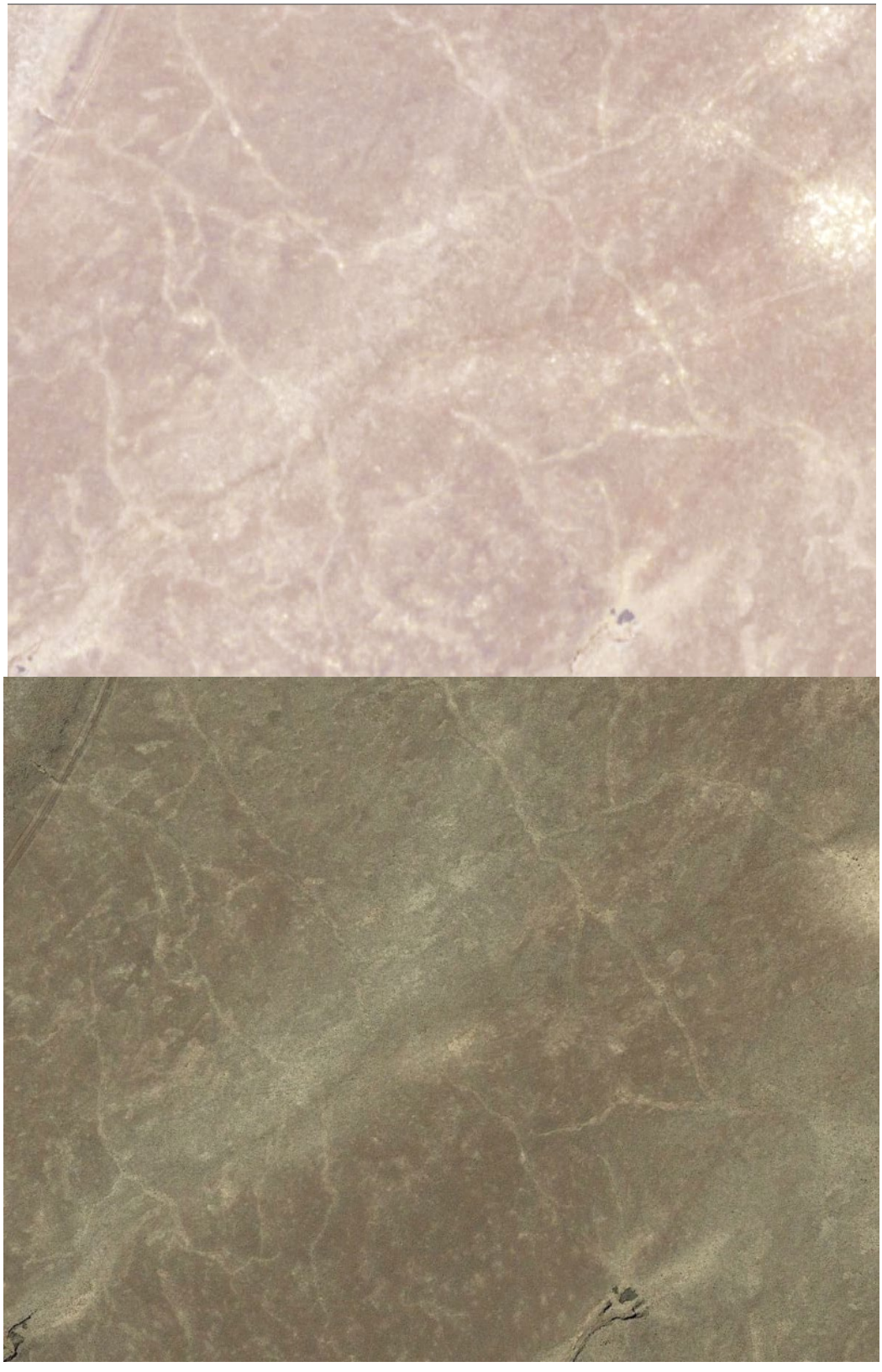
SSB: Southwestern North American Salt Basin and High Marsh Group
***Isocoma acradenia* Alliance**

SSB: Southwestern North American Salt Basin and High Marsh Group
***Suaeda moquinii* Alliance**



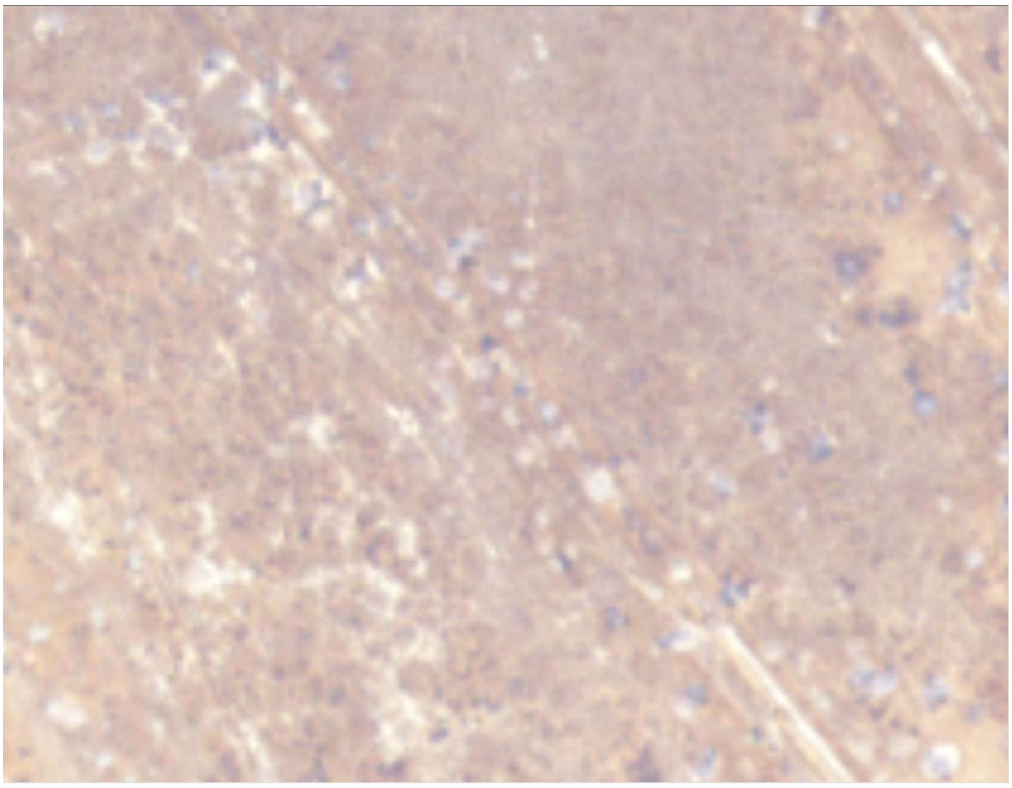
CAI: California Introduced Annual and Perennial Herbaceous Group

CFG: California Annual Forbs and Grasses Group



CPG: California Perennial Grassland Group

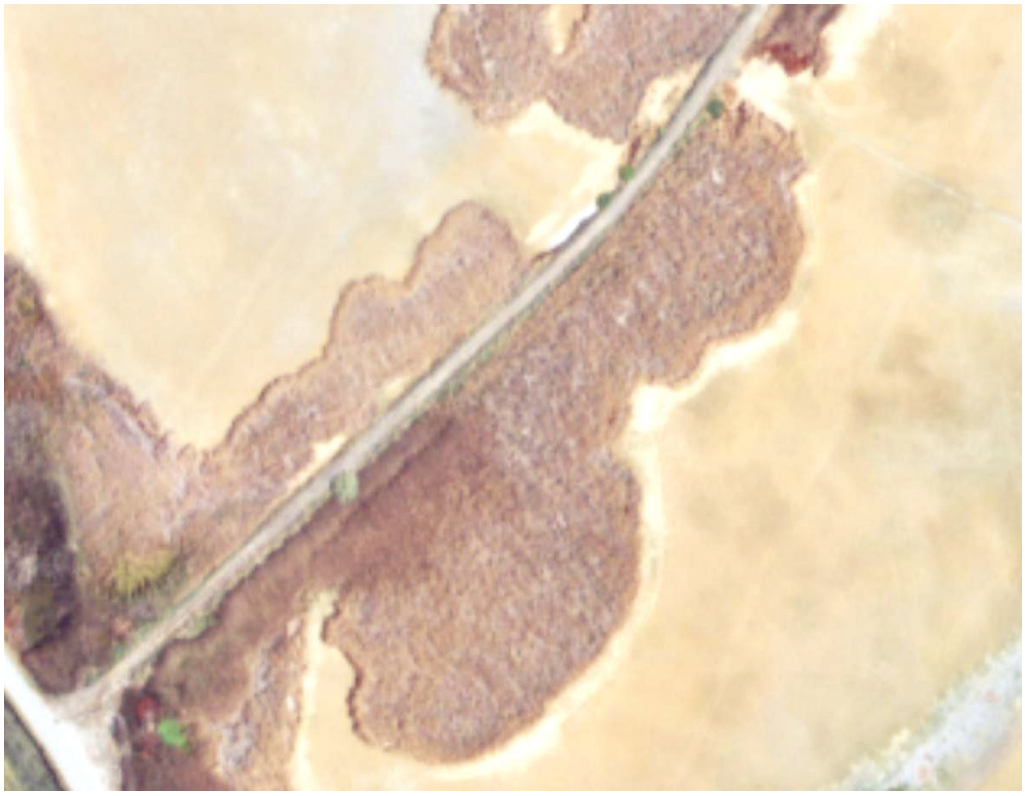
DAM: Western North American Disturbed Alkaline Marsh and Meadow Group
***Bassia hyssopifolia* Alliance**



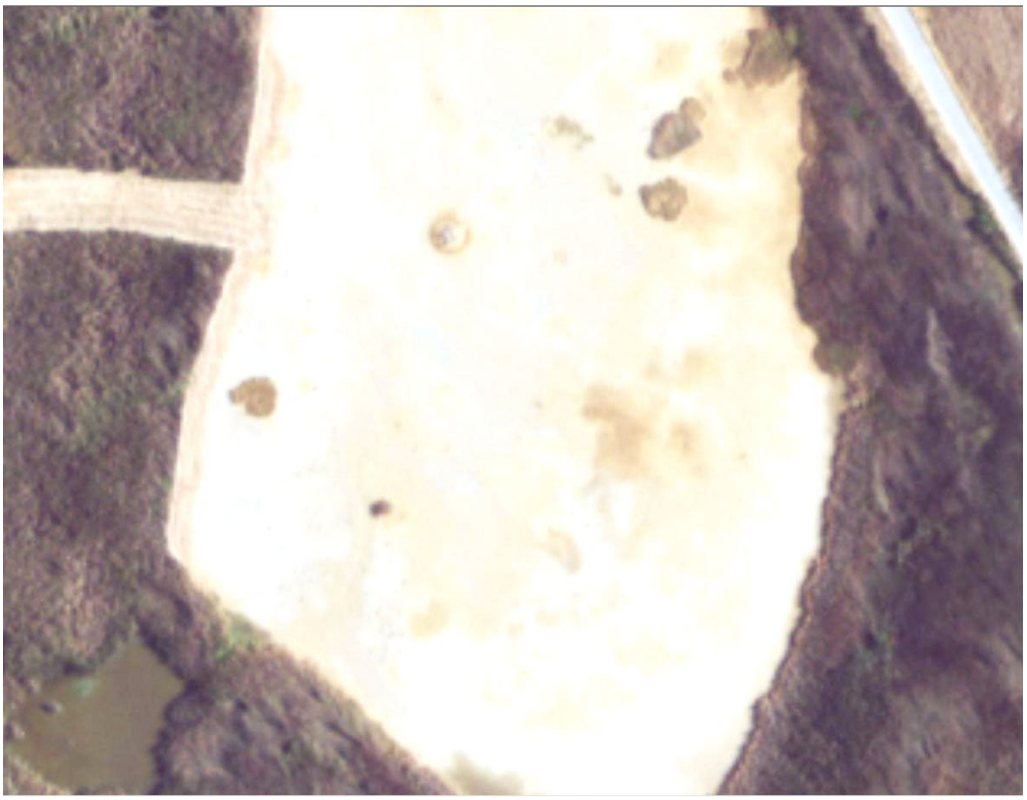
DUP: Dry Upland Perennial Grassland Group
***Elymus glaucus* Alliance**

FEM: Freshwater Emergent Marsh Group
***Schoenoplectus (acutus, californicus)* Alliance**

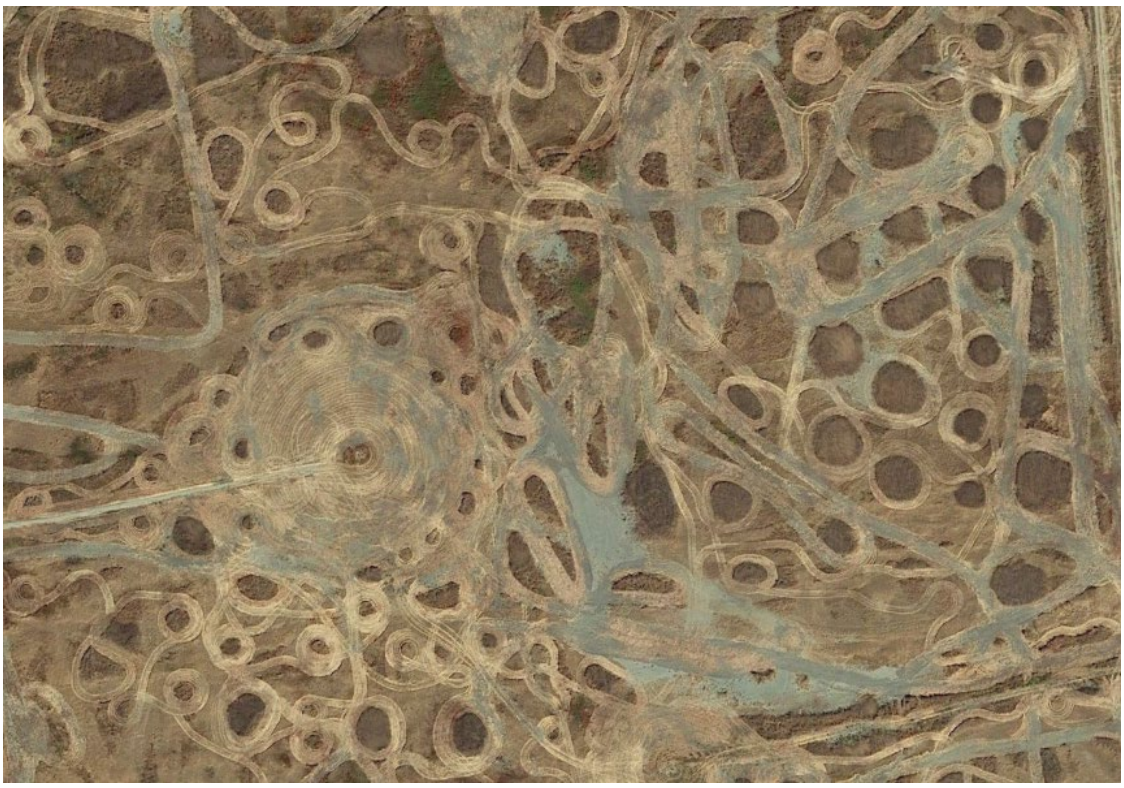
FEM: Freshwater Emergent Marsh Group
***Typha (angustifolia, domingensis, latifolia)* Alliance**



NRW: Naturalized Warm-Temperate Riparian/Wetland Group
***Crypsis (schoenoides, vaginiflora)* Provisional Alliance**



NRW: Naturalized Warm-Temperate Riparian/Wetland Group
Managed annual and perennial wetland vegetation Alliance

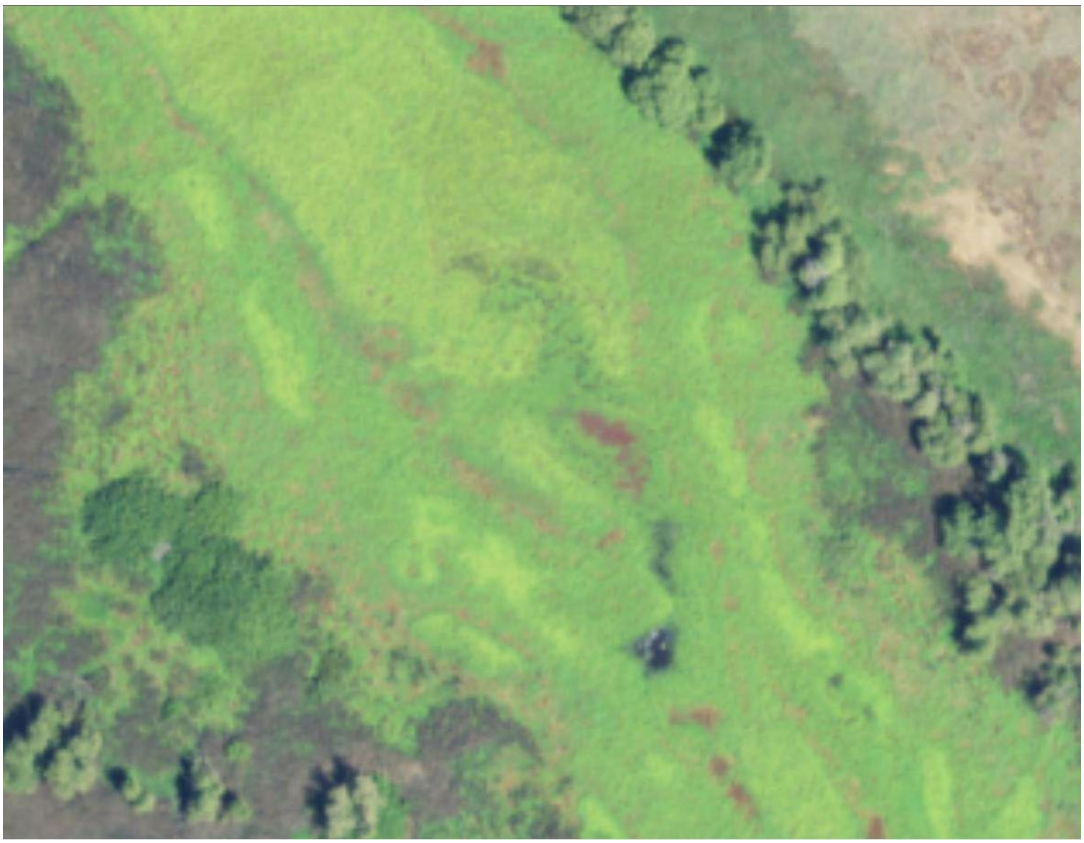


NRW: Naturalized Warm-Temperate Riparian/Wetland Group
***Persicaria lapathifolia - Xanthium strumarium* Alliance**

NRW: Naturalized Warm-Temperate Riparian/Wetland Group
***Lepidium latifolium* Alliance**

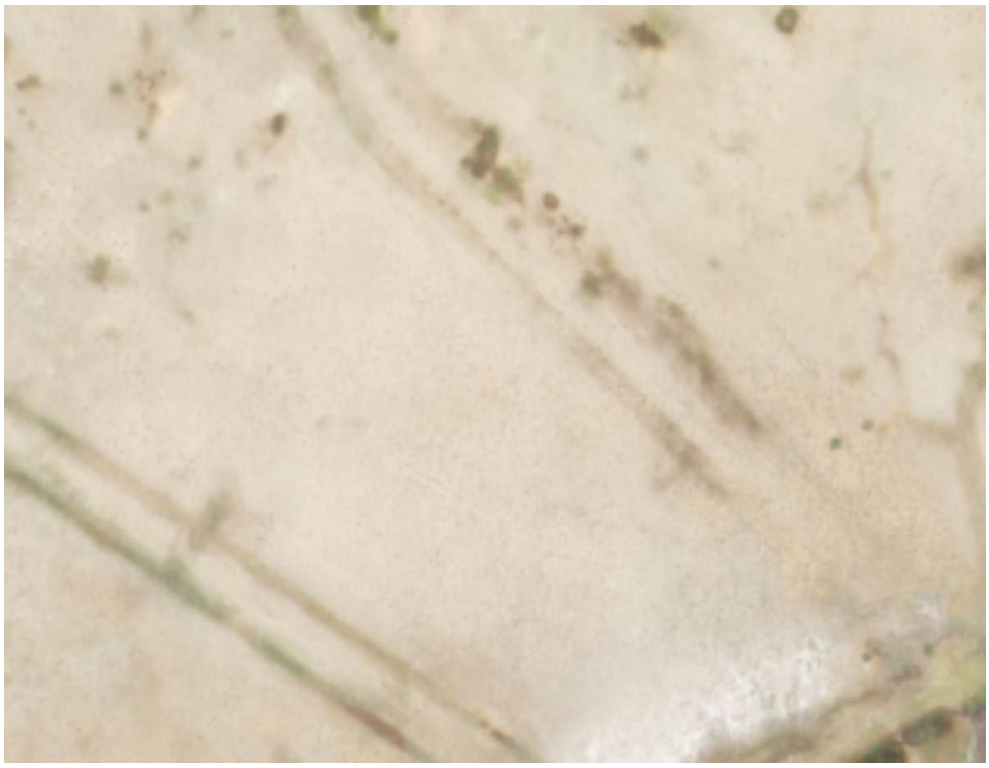
NTF: Naturalized Temperate Pacific Freshwater Vegetation Group
***Eichhornia crassipes* Alliance**

NTF: Naturalized Temperate Pacific Freshwater Vegetation Group
***Ludwigia (hexapetala, peploides)* Alliance**



***Myriophyllum spp.-Egeria densa* Provisional Alliance (No good images for this submerged aquatic Alliance)**

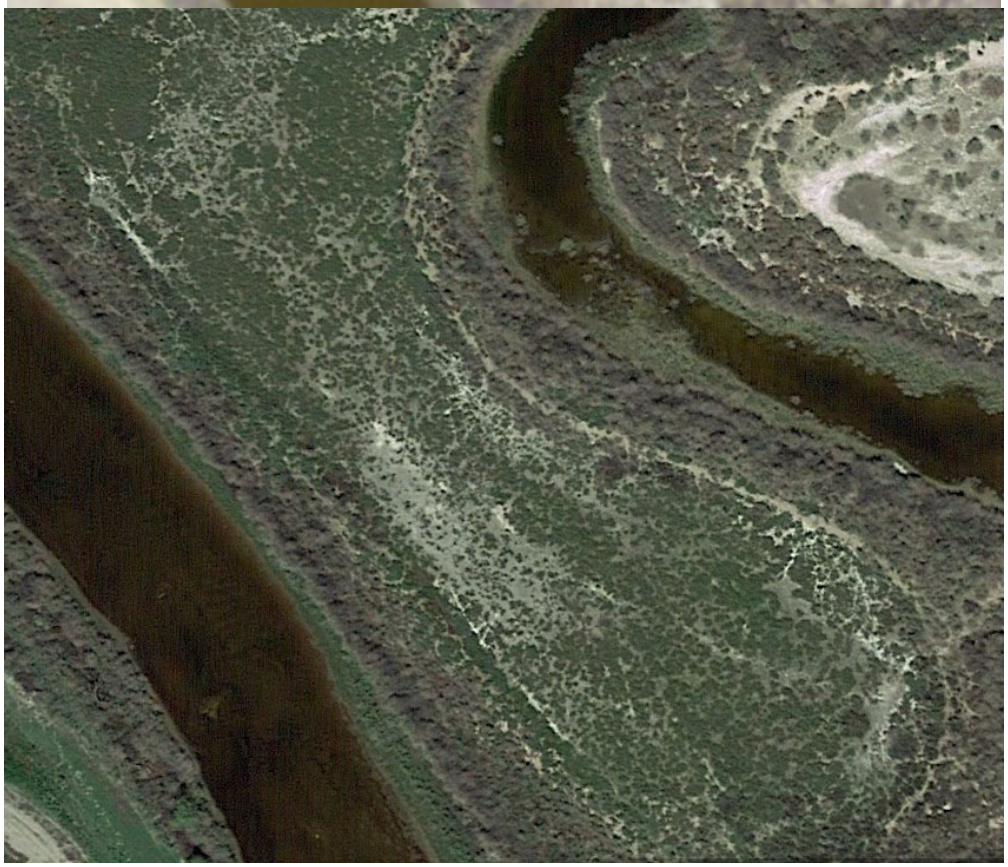
SAM: Southwestern North American Alkali Marsh/Seep Vegetation Group
***Sporobolus airoides* Alliance**



TBM: Temperate Pacific Tidal Salt and Brackish Meadow Group
***Distichlis spicata* Alliance**

TBM: Temperate Pacific Tidal Salt and Brackish Meadow Group

***Sarcocornia pacifica*-annual grasses Alliance**



TBM: Temperate Pacific Tidal Salt and Brackish Meadow Group

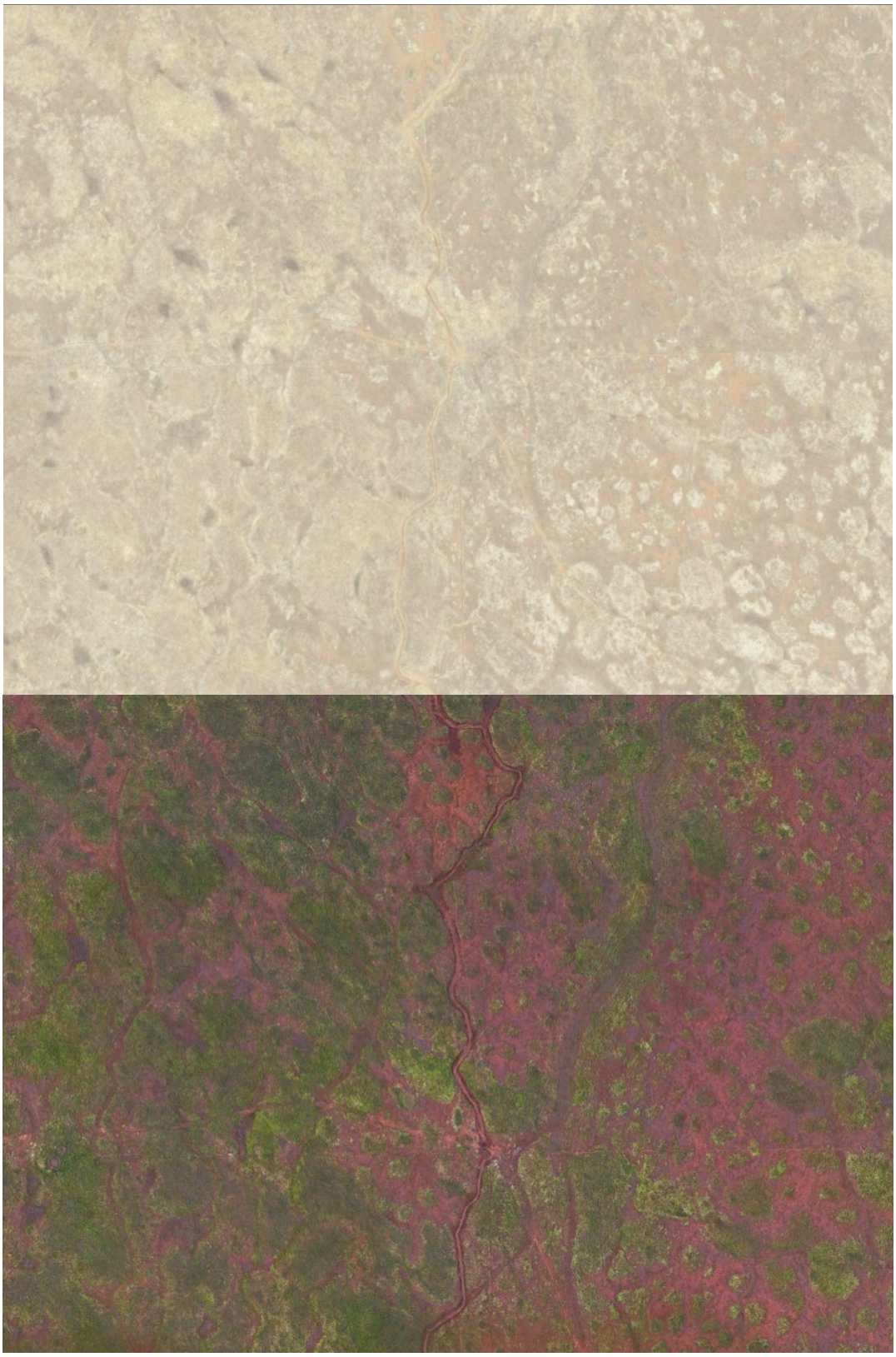
***Sarcocornia pacifica* (variable signature)**

TFF: Temperate Freshwater Floating Mat Group
***Azolla (filiculoides, mexicana)* Alliance**

TFF: Temperate Freshwater Floating Mat Group
***Lemna minor* and Relatives Alliance**

VCM: Vancouverian Coastal/Tidal Marsh and Meadow Group
***Juncus effuses* Alliance**

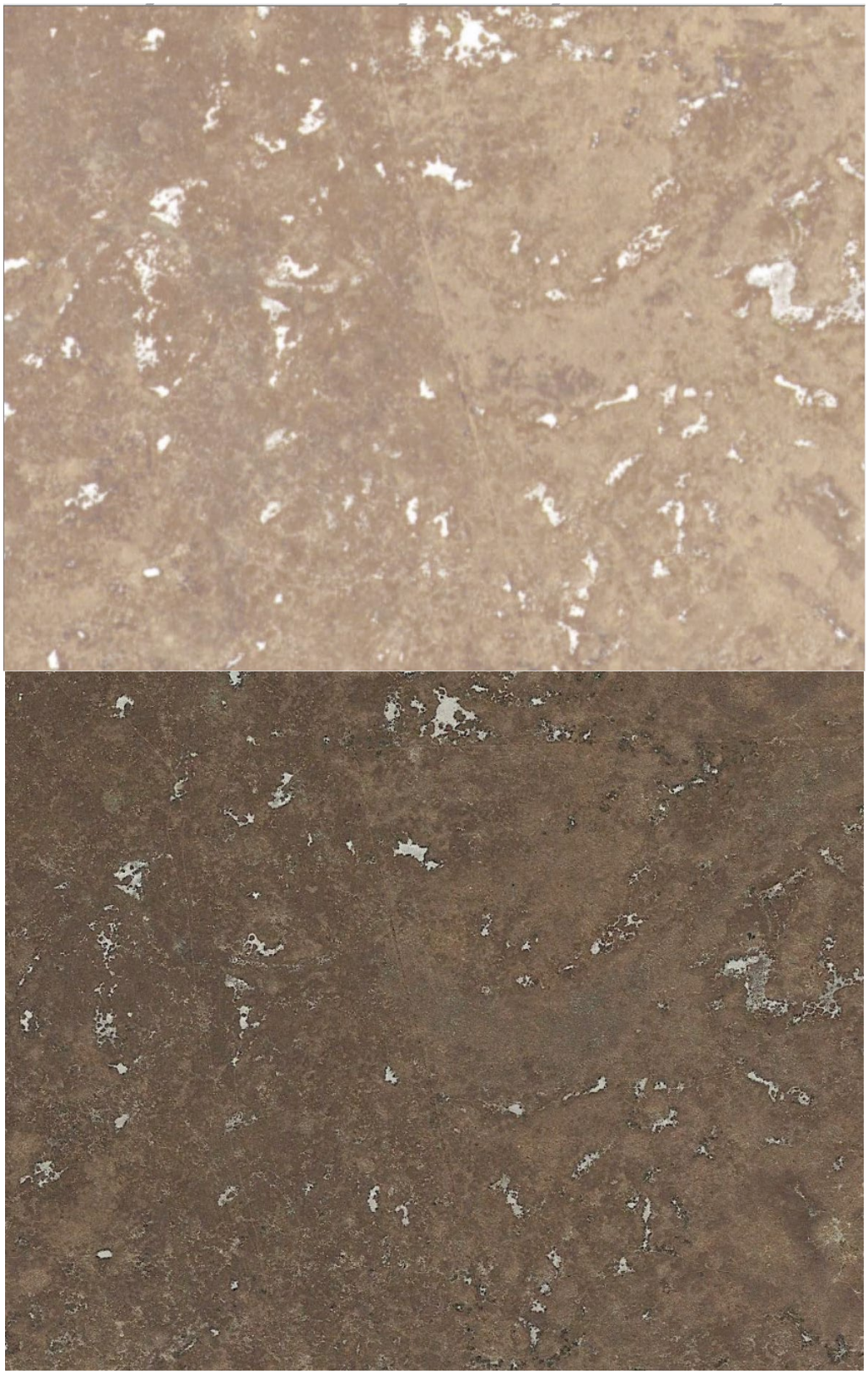
VPG: California Vernal Pool and Grassland Matrix Mapping Unit



VPB: Californian Mixed Annual/Perennial Freshwater Vernal Pool/Swale Bottomland Group
***Lasthenia fremontii-Distichlis spicata* Alliance**

SVP: Sparsely Vegetated Playa/Pool Group

AGP: Alkali Grassland - Playa/Pool Matirx Mapping Unit



WTM: California Warm Temperate Marsh/Seep Group

CCS: Central and South coastal Californian coastal sage scrub Group
***Eriogonum fasciculatum* Alliance**

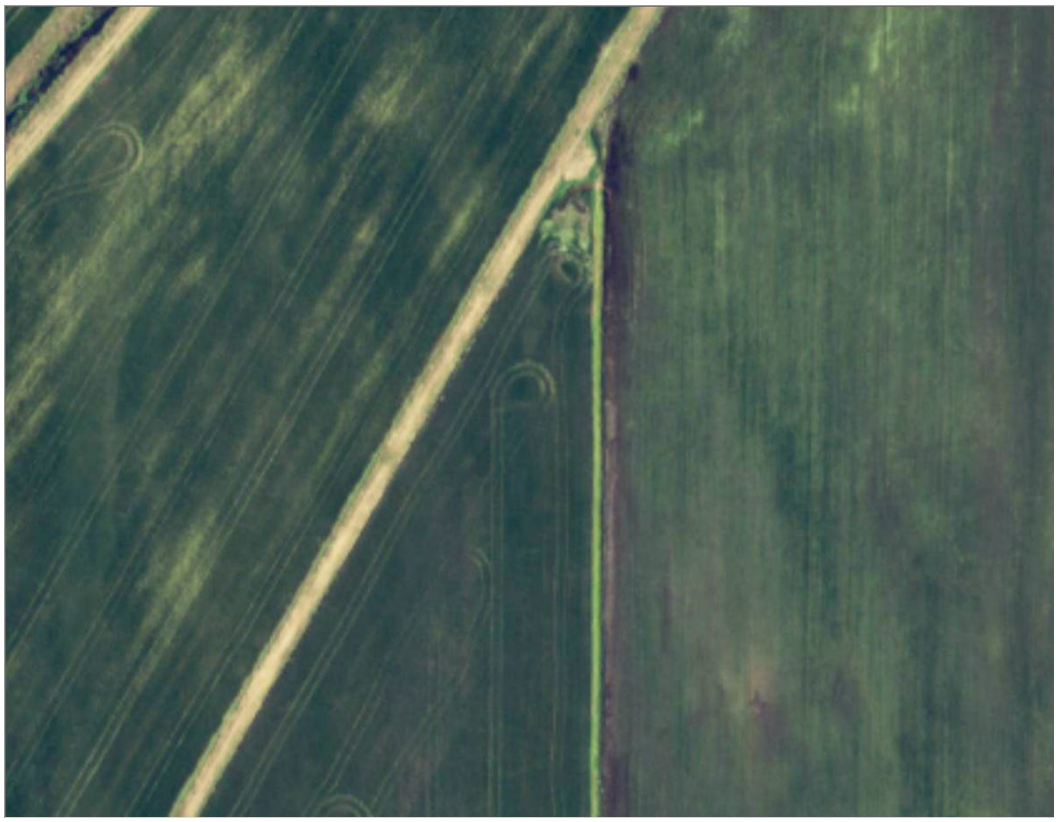
LDS: Lower Bajada and Fan Mojavean-Sonoran desert scrub Group
***Atriplex polycarpa* Alliance**

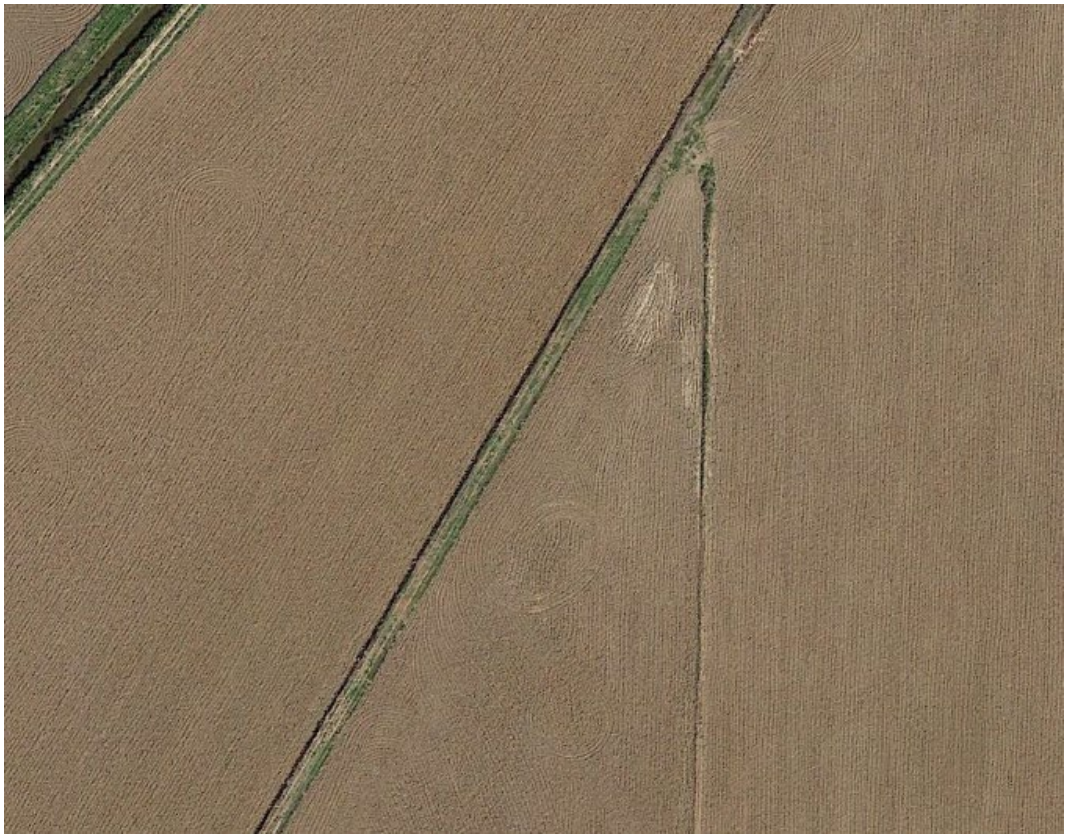
BDS: California Coastal evergreen bluff and dune scrub Group
***Frangula californinca* Alliance (No good images)**

NMS: Naturalized non-native Mediterranean scrub Group
Broom (*Cytisus scoparius* and others) Alliance

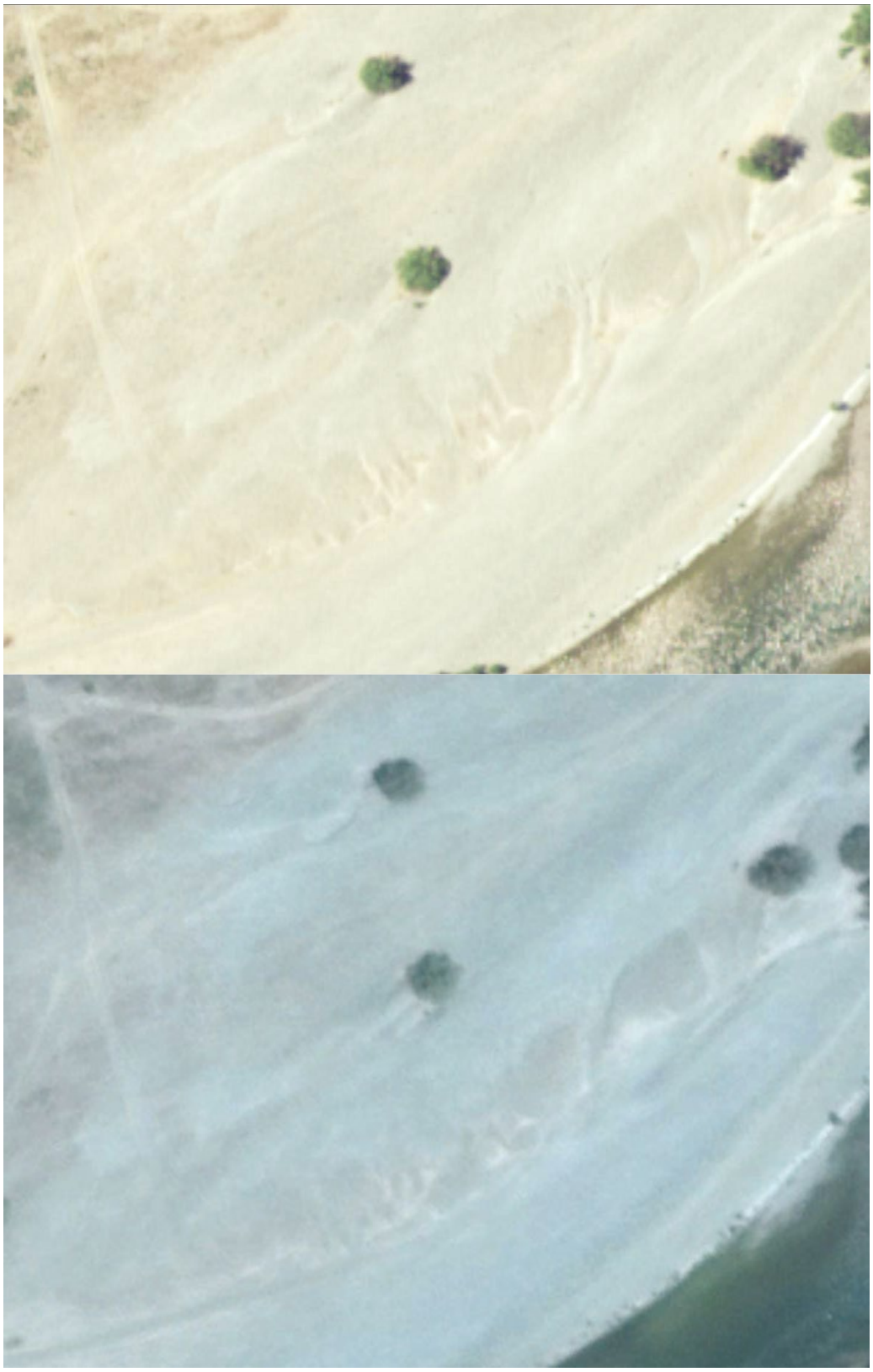
RMM: Western North American Ruderal Marsh, Wet Meadow & Shrubland Group
***Phalaris arundinacea* Western Marsh Alliance**

AGR: Agriculture





BGS: Barren, Gravel, Sand



URB: Urban

WAT: Water

CRO: Cliffs and Rock Outcrop

QMG: Strip-mines, Quarries and Gravel pits