Fine-Scale Riparian Vegetation Mapping of the

Central Valley Flood Protection Plan Area

Final Report

Developed for the California Department of Water Resources Central Valley Flood Protection Program (CVFPP) Systemwide Planning Area (SPA), major rivers and tributaries

Prepared by the

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Introduction

Vegetation abundance and composition is considered to be the single best surrogate in 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; and
- identifying and evaluating potential lands for restoration and/or acquisition.

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. Furthermore, regional changes in habitat types or acreage can be monitored when the vegetation maps are periodically updated using standardized protocols over time. Detailed vegetation maps can also provide a scientific baseline for climate change and land conversion studies in the future.

Purpose

The California Department of Water Resources (CDWR) is tasked with developing critical components of the Central Valley Flood Protection Plan (CVFPP). To further this effort CDWR collaborated with the California Department of Fish and Wildlife (CDFW) and contracted with the Geographical Information Center (GIC), California State University, Chico and the California Native Plant Society (CNPS) to develop a highly detailed vegetation classification system and a fine-scale vegetation map of the Central Valley Flood Protection Plan area within the Great (Central) Valley.

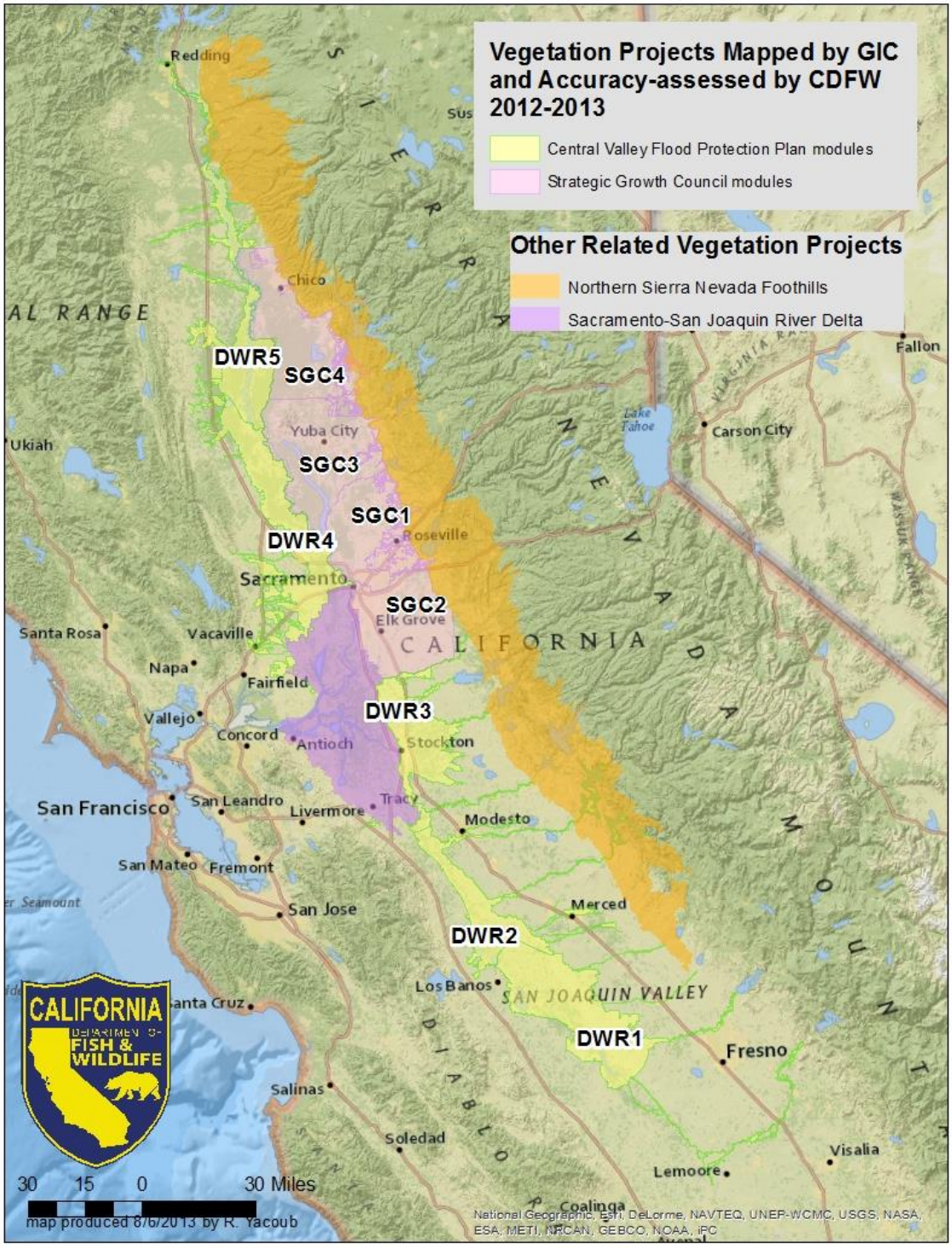
Background

In 2011, GIC mapped vegetation within the CVFPP area in accordance with the Group level of the hierarchy of the National Vegetation Classification Standard (NVCS) developed by the Federal Geographic Data Committee (FGDC 2008). The 2011 mapping effort is also known as the “medium-scale” map, which refers to its medium thematic resolution (i.e., Group level), not

its spatial resolution. One acre was used for the minimum mapping unit (MMU) for natural vegetation and 10 acres for agriculture and urban polygons. This medium-scale mapping used 2009 National Agricultural Imagery Program (NAIP) base imagery, as does the fine-scale mapping detailed in this report. The mapping standards and accuracy assessment for the medium-scale map are detailed in reports by GIC (2011) and CDFW (2012).

After the medium-scale map was complete, GIC received funding from CDWR to map the CVFPP area to the NVCS Alliance level. The Strategic Growth Council (SGC) also provided funding to expand this fine-scale mapping to the Great Valley portions of Butte, Yuba, Sutter, Placer and Sacramento counties; the mapping standards and accuracy assessment for the SGC portion of the mapping area are detailed by in reports by GIC (2013) and CDFW (2013). The combined CDWR and SGC mapping area totals 3.356 million acres and abuts previously completed fine-scale vegetation maps of the northern Sierra Nevada Foothills and the Legal Delta (Figure 1). These two areas are combined in this report because they were mapped at the same time using the same standards, and were assessed for accuracy together and in the same way.

Figure 1. Project Mapping Area, Modules, and Adjacent Existing NVCS Vegetation Maps



Basis of the Vegetation Classification and Map Legend

The California Native Plant Society (CNPS) was contracted to analyze approximately 800 vegetation samples collected by GIC contractors and 1800 samples from other data sets from the entire Great Valley Ecoregion to create a classification meeting NVCS standards. The methodology, classification, vegetation type descriptions, and a field key to the types are detailed in Buck-Diaz *et al*. (2012).

Appendix A contains the original map classification that was derived from the field-based vegetation classification. It includes the vegetation alliances described by Buck-Diaz *et al*. (2012) that were judged to be interpretable from the base imagery. It also includes alliances that would not be interpretable but could help the mappers determine the correct group. This is particularly true for herbaceous types which are typically not mappable to alliance level using aerial imagery.

Some of the types in Appendix A were not mapped in the project area. This could be because they occurred in stands below the minimum mapping unit – the vegetation classification is not scale-dependent – or because they occurred outside the mapping area, since Buck-Diaz *et al*. (2012) covers the entire Great Valley Ecoregion.

Mapping Methods

For this project, GIC refined the CVFPP area medium-scale vegetation map to the state standard for mapping at a fine scale. GIC and CDFW established project-specific map attributes and GIC then used heads-up digitizing at 1:2000 scale and photointerpreted 2009 NAIP satellite imagery (USDA Summer 2009) as the base. Additional imagery and layers such as Google maps, Normalized Data Vegetation Index (NDVI), and color infrared were used as ancillary information. GIC delineated stands (polygons) of vegetation types and assigned cover classes and other map attributes according to state standards.

Vegetation alliances as described in Buck-Diaz *et al*. (2012) were identified when possible. When it was not possible to identify a stand at the alliance level, the polygon was attributed with the appropriate Group-level type. When requested by photointerpreters (mappers), GIC, sometimes in conjunction with CDFW staff, conducted field reconnaissance to confirm any uncertain vegetation signatures. GIC also conducted field verification and performed quality assurance/quality control of the resulting geodatabase to ensure topological integrity and complete attribution of the polygons.

Mapping Standards

Overview of Medium-Scale Mapping

In the medium-scale mapping project, all vegetated polygons were mapped to the Group level with the one exception of Floating Aquatic Vegetation (FAV). This macro group was later subdivided for the fine scale into the Temperate Freshwater Floating Mat (TFF) group and Naturalized Temperate Pacific Freshwater Vegetation (NTF) group. The minimum mapping unit for a group level polygon was one acre with an average width >10m.

Overview of Fine-Scale Mapping

In this fine-scale mapping, Group-level polygons from the medium-scale mapping were further divided (when possible) to the Alliance level as detailed in *A Manual of California Vegetation* (Sawyer *et al*. 2009). A few provisional alliances added since the book was written were included in the mapping classification. As in the medium-scale map, the minimum mapping unit for an alliance level polygon was one acre with an average width >10m.

Exceptions to the minimum mapping unit rules were allowed for important or obvious types, such as in-stream islands or gravel bars, or in the instance when less than one acre of an exogenous vegetation polygon crossed into the periphery of the mapping area.

Vegetation Types and Cover

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

Shrub vegetation alliances were mapped when tree cover was <5%, and the shrub cover was ≥10%. The percent of absolute shrub cover was estimated taking into account the porosity of the shrub layer. *Heterotheca oregona*, *Allenrolfea occidentalis, Suaeda moquinii, Atriplex lentiformis,* and *Frankenia salina* are the exceptions to this rule and are classified as shrub types with cover as low as 2%.

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

All vegetation cover was estimated using "Bird's-eye Total Cover," i.e., what can be seen on the air photo excluding understory layers when covered by an overstory layer.

Agriculture, Urban, Water, Bare Gravel/Sand, and Roads

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

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

The MMU for water (WAT) is one acre.

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

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

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

Attributes and Associated Rules

OBJECTID_1
Auto calculated numbers that correspond to each polygon; unique values.

NVCSNAME
The mapping class name per NVCS.

NVCSLEVEL
The NVCS hierarchy level, e.g., Group, Alliance, Semi-natural Stands, Provisional.

MAPCLASS
The mapping class, including unvegetated map classes, e.g., WAT (=water).

RIP_GROUP
The project-specific code of the NVCS Group level of the map class.

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

HT_CODE
Tree heights were estimated and coded using the following ranges:

4 = 2-5 m
5 = 5-10 m
6 = 10-15 m
7 = > 15 m

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

1 = Seedling (<1”)
2 = Sapling (1-6”)
3 = Pole (6-11”)
4 = Small (11-24”)
5 = Medium-large (>24”)
6 = Multi-layered, medium/large over small

PER_HARDWOOD
The percentage of hardwood tree cover was estimated using absolute cover. This is the proportion of the entire polygon that the trees occupy taking into account the porosity of the canopy. Understory portions of trees, shrubs and grasses covered by the overstory layers are not accounted for, as they are not visually observable via aerial photos. The absolute cover value could range from 0-100, with a value over 60 being

rare due to vegetative porosity and natural tree growth patterns. A value of 0.2 was used when hardwood cover totaled only a fraction of a percent.

PER_CONIFER

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

PER_TREE

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

PER_SHRUB

Absolute cover was used to estimate the percentage of shrubs present in a polygon. If the overstory layer(s) were greater than or equal to 40%, then the understory layer(s) would not be visible in the aerial photo and would not be estimated. If tree cover was greater than or equal to 40%, 99 was entered for the shrub value. In Agricultural (AGR) and Urban (URB) polygons PER_SHRUB was coded with 333.

HERB_CODE

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

Herb cover is coded as:

1 = <2%
2 = 2-9%
3 = 10-39%
4 = 40-59%
5 = >60%

PER_TOTAL_COVER

The percent of total cover was calculated by adding the total tree, total shrub, and the mean of the herbaceous layers. Mean values for the range of the herbaceous layer were rounded to the values of 1, 5, 25, 50, and 80.
Note: Because the mean value of the cover class was used for the herbaceous layer, for some of the polygons, total actual cover may be slightly over or underestimated.

ISOLATED_TREE

"Yes" indicates the presence of natural or semi-natural isolated trees in agricultural, shrub, and herbaceous polygons when the presence of trees is <5%. Actual percentage of tree cover is reported in the PER_TREE field. HT_CODE and SIZE_CATEGORY are null. A null value in this field indicates that no natural or semi-natural isolated trees are present.

RESTORATION

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

CLEARING_DISTURBANCE

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

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

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

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

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

INVASIVE_PLANT

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

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

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

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

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

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

CALVEGNAME
After completion of the map by GIC, VegCAMP crosswalked the mapping types to the USDA Forest Service, Pacific Southwest Region CALVEG Classification (Various dates, 1977-2013); this is the full CALVEG name.

CALVEGCODE
The CALVEG code of the crosswalked CALVEG type.

CWHRTYPE
After completion of the map by GIC, VegCAMP crosswalked the mapping types to the California Wildlife Habitat Relations (CWHR) classification (Mayer and Laudenslayer 1988); this is the full CWHR name.

CWHRCODE
The CWHR code of the crosswalked CWHR type.

GLOBALRANK
VegCAMP-assigned global (G) rarity ranking of the vegetation class.

STATERANK
VegCAMP-assigned state (S) rarity ranking of the vegetation class.

RARE
Classes ranked S1, S2, or S3 are marked with "Yes."

CACODE
The California code assigned by VegCAMP to track vegetation classes.

NVCSALLIANCE
The NVCS full alliance name.

NVCSGROUP
The NVCS full Group name.

NVCSMG
The NVCS full Macrogroup name (the step above Group in the hierarchy).

Accuracy Assessment

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. The California Department of Fish and Wildlife Vegetation Classification and Mapping Program (VegCAMP) staff conducted an accuracy assessment with field verification to validate the attributes assigned to the mapped vegetation by the GIC photointerpreters (mappers). Data collected for the SGC project and for the Central Valley Flood Protection Plan area have been combined and analyzed as a single dataset to provide a more complete and understandable accuracy analysis of the entire mapped area.

Sample Allocation and Data Collection

The mapping area was broken into "modules" (labeled SGC 1-4 and DWR 1-5 in Figure 1) with sequential delivery dates to VegCAMP. AA samples were allocated by VegCAMP for each map module as the attributed delineations for the module were received from GIC. Sample allocation employed an analysis that balanced three goals: achieving target levels of samples for each module based on budgeted staff time for conducting the accuracy assessment, distributing the samples among the vegetated mapping classes, and facilitating access to vegetation polygons based on land ownership and access efficiency.

The first step in the analysis was creating a series of subsets of the submitted vegetation data set. The first subset removed polygons that had been previously visited in the field either by crews collecting vegetation data or conducting reconnaissance surveys. The second subset selected polygons that intersected the California Protected Areas Database in order to isolate polygons in publicly accessible areas. The last subset selected polygons within protected areas that were close (<500 m) to roads. The next step was to summarize the number of polygons in the module by map unit and set target numbers for subsequent modules, which were informed

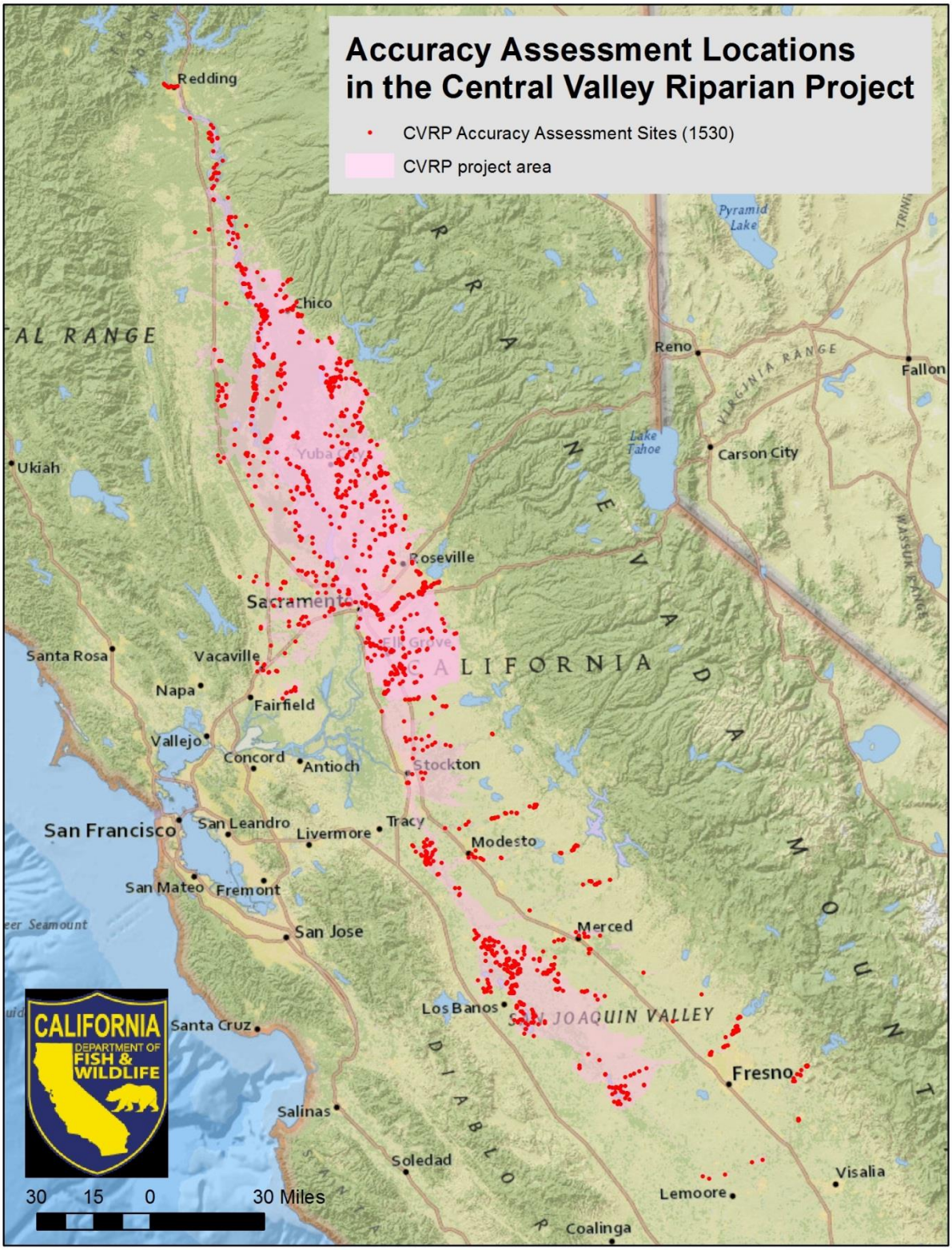
by what had already been sampled in previous modules. This process is thus learning-based and tends to improve overall accuracy of the map.

Finally, starting with the rarest types and progressing to the most common types, potential polygons were selected and examined using imagery for accessibility. All polygons of rare types that weren't selected in the above sub-setting process were reexamined to see if they could possibly be assessed from a distance survey if they were on private land, or if they were not unreasonably farther than the cut-off of 500 meters from a road on publicly accessible land. Once rarer polygons were selected, more common ones were selected from the more restrictive subsets. Where possible, stands of different types were selected within reasonable proximity for walking between stands to make surveying more efficient. Polygons were selected in excess of the count targeted for each module to allow for replacement of inaccessible polygons. Polygons were assigned a priority level based on whether they were rare and insufficiently sampled, rare locally or common locally but rare project-wide, or common types for which there were (or definitely would be) sufficient samples – with the rarest polygons having highest priority. Polygon priority levels were incorporated into field maps to help staff prioritize the time they would spend accessing particular polygons. To prevent bias, paper and digital maps prepared for AA field crews did not include the vegetation type or other attributes as assigned by GIC. Additionally, only the polygons to be assessed were shown on the maps so that the shape of surrounding polygons would not influence the field crews.

VegCAMP staff contacted the land owners and managers for permission to access the properties and collect data in the allocated polygons. AAs on private property were conducted from public roads.

From March 19, 2012 to June 18, 2013, VegCAMP collected 1530 AA field verification surveys in the mapping area using paper AA forms (Appendix B), and Trimble™ Juno and F4Devices© Flint handheld data collector/GPS receivers (Figure 2). Crews identified the vegetation type(s) within the allocated polygon using the "field key to vegetation types" provided in Appendix 3 of Buck-Diaz *et al*. (2012). A set of digital photographs was taken from the GPS waypoint within or adjacent to the polygon and archived in folders by waypoint identification number(s) associated with the polygon. As AAs were collected, they were entered into a Microsoft Access database, which is archived at the VegCAMP office. Data quality control was performed prior to analysis.

Figure 2. Location of Accuracy Assessment Samples within the Mapping Area



Scoring

For each module, VegCAMP staff reviewed each AA and removed from consideration those samples that had issues with access, vegetation identification due to phenology or visibility, or significant changes in land use or vegetation since the date of the imagery on which the map was based. If the field crews could not identify the vegetation type based on the field key, senior VegCAMP staff assigned the correct type based on the species covers recorded for the AA, any additional notes taken by the field crews, and sometimes the field photos. Of the 1530 field samples, 224 were excluded based on one of four reasons (J through M) as listed in Table 1. All field calls were reviewed and a "Final call" was recorded in the database for 1306 samples.

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 Macro Group 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

Scoring compared the alliance/group vegetation type assigned to each polygon in the map (i.e., the photo-interpreted map unit attribute) with the alliance/group vegetation type assigned by the field crews and reviewed by senior staff. Other attributes (cover, disturbance, 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 modules.

A fuzzy logic method was used to score each AA, rather than simply denoting if a sample was correct or incorrect (Gopal and Woodcock 1994; Congalton and Green 1999; Foody 2002; Hagen 2003; Metzler and Sader 2005). Each field-verified polygon was scored according to the set of decision rules (Table 1), with a total of 5 possible points for each polygon. Scores were summed for each vegetation type, then divided by the total possible score and multiplied by 100 for an accuracy percentage. The scores and reviewer's notes were provided to GIC after each module was completed so that systematic errors could be corrected. This modular approach increased the final accuracy of the map product beyond the scores reported here.

AA Results

The scored 1306 AAs evaluated 65 of the 71 mapped vegetation types in the study area (Table 2). The six types that were mapped but not assessed were inaccessible; however, they were also very rare in the map (with 1-7 total stands mapped each). Mapping units considered lacking natural or semi-natural vegetation cover (agriculture, urban, bare gravel/sand, and open water) were not assessed.

Table 2. Number of pre-Accuracy Assessment polygons of each class as mapped and number of AAs in each mapped class (listed in NVCS Macrogroup hierarchical order). Types in red were not assessed for accuracy.

Code – Group (or Macrogroup)	Map Class	# polygons mapped	# AAs
WVO – California Broadleaf Forest and Woodland	*Aesculus californica* Alliance	4	4
	Quercus douglasii Alliance	2279	44
	Quercus lobata (upland) Alliance	383	30
	Quercus wislizeni (tree) Alliance	931	39
	Umbellularia californica Alliance	1	0
	WVO	2	2
ECW - California Evergreen Coniferous Forest and Woodland	*Juniperus californica* Alliance	1	0
	Pinus sabiniana Alliance	114	17
VRF – Vancouverian Riparian Deciduous Forest	*Alnus rhombifolia* Alliance	121	11
	Fraxinus latifolia Alliance	32	5
	Salix lucida Alliance	5	1

Code – Group (or Macrogroup)	Map Class	# polygons mapped	# AAs
IMF – Introduced North American Forest and Woodland	*Ailanthus altissima* Provisional Alliance	44	13
	Eucalyptus (*globulus, camaldulensis*) Semi-natural Stands	366	38
	Ornamental trees	256	35
	Robinia pseudoacacia Provisional Alliance	13	2
	IMF	24	9
RIS – Riparian Introduced Scrub	*Rubus armeniacus* Alliance	725	33
	Tamarix spp. Alliance	128	10
	Arundo donax Alliance	311	26
	RIS	9	1
RWF – Southwestern North American Riparian Evergreen and Deciduous Woodland	*Acer negundo* Alliance	583	35
	Juglans hindsii and Hybrids Special and Semi-natural Stands	517	34
	Platanus racemosa Alliance	303	35
	Populus fremontii Alliance	5938	54
	Quercus lobata (riparian) Alliance	5376	60
	Salix gooddingii Alliance	4620	50
	Salix laevigata Alliance	71	12
	RWF	77	10
RWS – Southwestern North American Riparian/Wash Scrub	*Baccharis salicifolia* Alliance	3	1
	Cephalanthus occidentalis Alliance	7	0
	Rosa californica Alliance	3	0
	Salix exigua Alliance	2319	52
	Salix lasiolepis Alliance	564	33
	Sambucus nigra Alliance	50	9
	Vitis californica Provisional Alliance	249	24
	RWS	26	4
CMC – California Mesic Chaparral	*Quercus berberidifolia* Alliance	5	0
CXC – California Xeric Chaparral scrub	*Arctostaphylos manzanita* Alliance	6	1
	Arctostaphylos viscida Alliance	2	0
	Ceanothus cuneatus Alliance	14	2
CSS – Central and South Coastal California Seral Scrub	*Baccharis pilularis* Alliance	201	15
	Lupinus albifrons Alliance	17	5
	Heterotheca oregona Alliance	131	21
CFG – California Annual Forb/ Grass Vegetation	CFG	720	37
VPG - California Vernal Pool and Grassland Matrix	VPG	518	42
VPB - Californian Mixed Annual/Perennial Freshwater Vernal Pool/Swale Bottomland	VPB	256	21

Code – Group (or Macrogroup)	Map Class	# polygons mapped	# AAs
CAI – Mediterranean California Naturalized Annual and Perennial Grassland	CAI	7988	43
FEM – Arid West Freshwater Emergent Marsh	*Schoenoplectus-Typha*[1] Mapping Unit	256	18
	Typha-Schoenoplectus Mapping Unit	412	20
	FEM	36	9
	Schoenoplectus (*acutus*, *californicus*) Alliance	1260	30
	Typha (*angustifolia*, *domingensis*, *latifolia*) Alliance	310	21
WTM - California Warm Temperate Marsh/Seep	*Artemisia douglasiana* Provisional Alliance	58	14
	Elymus (=*Leymus*) *triticoides* Alliance	16	5
	WTM	454	27
NRW – Naturalized Warm-Temperate Riparian and Wetland Group	Managed Annual and Perennial Wetland Vegetation	465	36
	Persicaria lapathifolia–Xanthium strumarium Provisional Alliance	25	3
	NRW	2352	25
TBM – Temperate Pacific Tidal Salt Marsh and Meadow	*Distichlis spicata* Alliance	90	14
SAM – Southwestern North American Alkali Marsh/Seep Vegetation	*Sporobolus airoides* Alliance	23	2
SSB – Southwestern North American Salt Basin and High Marsh Group	*Allenrolfea occidentalis* Alliance	609	25
	Atriplex lentiformis Alliance	77	18
	Atriplex spinifera Alliance	3	2
	SSB	4	2
AGP – Alkali Grassland – Playa/Pool	AGP	276	36
SVP – Sparsely Vegetated Playa/Pool	SVP	402	23
NTF - Naturalized Temperate Pacific Freshwater Vegetation	*Eichhornia crassipes* Semi-natural Stands	16	1
	Ludwigia (*hexapetala*, *peploides*) Provisional Semi-natural Stands	668	21
	Myriophyllum spp. Alliance	22	3
	NTF	52	8
TFF – Temperate Freshwater Floating Mat	TFF	256	23

[1] Schoenoplectus-Typha and Typha-Schoenoplectus were mapping units (i.e., not true Alliances per NVCS) created at the start of the project and were used depending on which genus was observed to have greater cover. Mid-project, these types were attributed in the dominant alliance [e.g. Schoenoplectus (acutus, californicus)] and all previous mapping units were updated in the map to the appropriate alliance.

Code – Group (or Macrogroup)	Map Class	# polygons mapped	# AAs
AGR – Agriculture	AGR	1354	
BGS – Bare Gravel/Sand	BGS	887	
URB – Urban	URB	1023	
WAT – Water	WAT	3121	

Note that the numbers in the third column of Table 2 refer to the "pre-AA" numbers of polygons that were mapped of each type. After AA, GIC made corrections, often refining to Alliance level what had been originally mapped as Group level.

Two forms of accuracy (users' and producers') can be estimated from the data (Story and Congalton 1986). Users' accuracy provides an estimate of commission error, or how well spatial mapping data actually represents what is found on the ground, i.e., if the user goes to a location mapped as a certain class, what is the probability it is in fact that class? Producers' accuracy, on the other hand, measures omission error, or the probability that vegetation of a given class in the field is mapped as that class. Producers' accuracy may inform the producers how easily a type is distinguishable on imagery (Story and Congalton 1986, Lea and Curtis 2010).

A contingency table displaying the users' and producers' accuracy for the map is found in Table 3. Note that the table does not include fuzzy scores, only the numbers of assessed polygons. In some cases, the Final Call was to Alliance level, when in fact the mapper was only expected to map to Group level, such as for herbaceous types. If the mapper chose the correct Group in such a case, a full score would be given, though the assessment would not show up on the diagonal indicating a correct call.

	Mapped Classes																																																																															
Observed Classes ("Final Call")	WVO	Quercus douglasii	Quercus lobata WVO	Quercus wislizeni tree	Aesculus californica	Pinus sabiniana	IMF	Ailanthus altissima Provisional	Eucalyptus (globulus, camaldulensis)	Ornamental trees	Robinia pseudoacacia	Alnus rhombifolia	Fraxinus latifolia	Salix lucida	RIS	Tamarix spp.	Arundo donax	Sesbania punicea	RWF	Acer negundo	Juglans hindsii and Hybrids	Platanus racemosa	Populus fremontii	Quercus lobata RWF	Salix gooddingii	Salix laevigata	RWS	Cephalanthus occidentalis	Rosa californica	Salix exigua	Salix lasiolepis	Sambucus nigra	Vitis californica Provisional	Baccharis salicifolia	Rubus armeniacus	Arctostaphylos manzanita	Ceanothus cuneatus	Arctostaphylos viscida	CSS	Baccharis pilularis	Heterotheca oregona	Lupinus albifrons	CFG	VPG	VPB	CAI	Centaurea (solstitialis, melitensis)	FEM	Schoenoplectus (acutus, californicus)	Typha (angustifolia, domingensis, latifolia)	Schoenoplectus-Typha	Typha-Schoenoplectus	Juncus effusus	WTM	Artemisia douglasiana Provisional	Elymus triticoides	NRW	Managed annual and perennial wetland vegetatio	Persicaria lapathifolia–Xanthium strumarium	Cynodon dactylon	Distichlis spicata	DAM	Sporobolus airoides	SSB	Allenrolfea occidentalis	Atriplex lentiformis	Atriplex spinifera	Suaeda moquinii	Frankenia salina	AGP	SVP	NTF	Eichhornia crassipes	Ludwigia (hexapetala, peploides)	Myriophyllum spp.	TFF	Azolla (filiculoides, mexicana)	Lemna (minor) and relatives	Nuphar lutea	BGS	WAT	Total
WVO																																																																																			0
Quercus douglasii		20	2	6		4																		3																																																											35
Quercus lobata WVO	1	8	18	5				1																2								2																																																				37
Quercus wislizeni tree		5	2	18	1	4				1												1	1	3								1																																																			37
Aesculus californica					3																																																																														3
Pinus sabiniana				1		8																																																																													9
IMF		1		1			6		1	2													1		1																																																										13
Ailanthus altissima Provisional								10												1																																																																11
Eucalyptus (globulus, camaldulensis)							1		33														1		1																																																									36
Ornamental trees				1			2		1	30											1	1	1								1																																																					38
Robinia pseudoacacia									1	1	2										2			2																																																												8
Alnus rhombifolia												6								1						2																																																											9
Fraxinus latifolia								1				1	2						2		1		1			2				1																																																						11
Salix lucida																																																																																			0
RIS																1																																			1						1																													3
Tamarix spp.																2																																																			1															3
Arundo donax															1		22																																																																	23
Sesbania punicea																																																						1																														1
RWF								1											4			1	1				1																														1																												9
Acer negundo													1				2			27		1	2							1	1	1	1																																																		37
Juglans hindsii and Hybrids																				1	16		3	2	2																																																											24
Platanus racemosa				1															1		1	19		2							1																																																					25
Populus fremontii		1				1			1										1	2	3	10	33	3	11					1	3				1																																																	71
Quercus lobata RWF	1	9	8	6						1		2								2	8	2	5	42	8	2				1	2	1																																																			100
Salix gooddingii												1	1						1				4	1	25	3				3	3		1		1																																																	44
Salix laevigata														1						1						1																																																										3
RWS																1			1											1																																																						3
Cephalanthus occidentalis																															1				1					1																																										3
Rosa californica																																	1																					1																														2
Salix exigua									1							3	2				1		1		2	2				42	8	1								1														1	1																											66
Salix lasiolepis												1	1			1														1	11		1							1												1																														18
Sambucus nigra																											1					2																																																				3
Vitis californica Provisional																					1												19		2																																																	22
Baccharis salicifolia																2																								1																																												3
Rubus armeniacus																															1	1			26					1																																				1						30
Arctostaphylos manzanita																																																																																			0
Ceanothus cuneatus																																																																																			0
Arctostaphylos viscida																																				1	1																																															2
CSS																																					1																																															1
Baccharis pilularis																											1				1		1	1						9														1			1																											15
Heterotheca oregona																																									20																																												20
Lupinus albifrons																																										4																																											4
CFG																																											21		3	1																																									25
VPG																																											7	38	2	1																																									48
VPB																																												1	13									2																																	16
CAI																																			1					1	1	1	8	3	1	36									2		2	1												1													58
Centaurea (solstitialis, melitensis)																																																							1																													1
FEM																																																		1							1																												2
Schoenoplectus (acutus, californicus)																																																5	24	7																					1											37
Typha (angustifolia, domingensis, latifolia)																																																1	5	11							3								1																	21
Schoenoplectus-Typha																																																1			9	5																																15
Typha-Schoenoplectus																																																2			6	13		4			1		1													1											28
Juncus effusus																																																	1	1									1																								3
WTM																																													1	1					1	1		6	1		2																									13
Artemisia douglasiana Provisional																											1								1								1			1								5	8																											17
Elymus triticoides																																														1										5					1									3												10
NRW																																													1	1								1	1		9															1										14
Managed annual and perennial wetland vegetation																																																			1						2	34													1											38
Persicaria lapathifolia–Xanthium strumarium																																																											1															1								2
Cynodon dactylon																																																						2																													2
Distichlis spicata																																																						2				1			11									1												15
DAM																																																																1						1												2
Sporobolus airoides																																																															1																				1
SSB																																														1																																							1
Allenrolfea occidentalis																																																																1	22	4					1											28
Atriplex lentiformis																														1																				1													1		1	14	1																19
Atriplex spinifera																																																																																				0
Suaeda moquinii																																																																	1																	1
Frankenia salina																																																									1				2									1												4
AGP																																																																						29												29
SVP																																																																							18											18
NTF																																																																								2			1							3
Eichhornia crassipes																																																																																			0
Ludwigia (hexapetala, peploides)																																																						1			1															2		19	2							25
Myriophyllum spp.																																																																								1										1
TFF																																																																												17						17
Azolla (filiculoides, mexicana)																																																																								1		1		2						4
Lemna (minor) and relatives																																																																												3						3
Nuphar lutea																																																																										1									1
BGS																																																																							1											1
WAT																																																																								1										1
Total	2	44	30	39	4	17	9	13	38	35	2	11	5	1	1	10	26	0	10	35	34	35	54	60	50	12	4	0	0	52	33	9	24	1	33	1	2	0	0	15	21	5	37	42	21	43	0	9	30	21	18	20	0	27	14	5	25	36	3	0	14	0	2	2	25	18	2	0	0	36	23	8	1	21	3	23	0	0	0	0	0	1306

Table3. Accuracy Assessment Contingency Table.

Column headings are vegetation classes as mapped by the photointerpreters. Row headings are classes as observed in the field. Entries in the table are the number of AA polygons. The diagonal indicates completely correct AAs. Users' (or commission) errors can be seen by reading down the table, showing how many polygons in each map class were incorrectly labeled. For example, four polys mapped as Pisa sabiniana are actually Quercus douglasii. Producers' (omission) errors are read across the table, and show how many stands of a vegetation class were not mapped (missed), for example, one of the sampled stands of Ailanthus altissima was missed because it was incorrectly mapped as Acer negundo. Note that the map was scored using fuzzy logic rules, rather than simply right/wrong (see text).

Due to land access restrictions, it was not possible to get adequate numbers of AAs for all mapped types. In general, we attempted to get at least 5 samples per type and consider results for those types reportable. Users' and producers' average fuzzy accuracy scores for map classes with five or more AA samples in both counts are shown in Table 4.

Table 4. Users' and producers' average fuzzy accuracy scores for map classes with ≥ 5 AA Samples in both Users' and Producers' Counts (n≥5)

Mapping Class	Users' Count (n)	Users' Accuracy	Producers' Count (n)	Producers' Accuracy
Quercus douglasii Alliance	44	83.2	35	85.7
Quercus lobata Alliance (WVO, upland)	30	97.3	37	89.2
Quercus wislizeni tree Alliance	39	85.1	37	83.2
Pinus sabiniana Alliance	17	**76.5**	9	95.6
IMF	9	95.6	13	**78**
Eucalyptus (*globulus, camaldulensis*) Semi-natural Stands	38	95.8	35	95.6
Ornamental trees	35	95.4	38	88.9
Alnus rhombifolia Alliance	11	86.3	9	86.7
Fraxinus latifolia Alliance	5	80	11	**60**
Arundo donax Alliance	26	93.1	23	99.1
RWF	10	84	9	**77.8**
Acer negundo Alliance	35	93.7	37	92.4
Juglans hindsii and Hybrids Special and Semi-natural Stands	34	84.1	24	93.3
Platanus racemosa Alliance	35	87.1	25	93.6
Populus fremontii Alliance	54	88.1	71	86.2
Quercus lobata Alliance (RFW, riparian)	60	91.7	100	85.8
Salix gooddingii Alliance	50	87.2	44	87.3
Salix exigua Alliance	52	92.3	66	85.4
Salix lasiolepis Alliance	33	78.2	81	81.1
Vitis californica Provisional Alliance	24	93.3	22	94.5
Rubus armeniacus Alliance	33	86.1	30	92.7
Baccharis pilularis Alliance	15	**76**	15	**73.3**
Heterotheca oregona Alliance	21	97.1	20	100
VPG	42	97.1	48	93.6
VPB	21	85.7	16	95
CFG	37	90.3	25	92.8
CAI	43	93.5	58	83.1
Schoenoplectus (*acutus*, *californicus*) Alliance	30	95.3	37	91.9
Typha (*angustifolia*, *domingensis*, *latifolia*) Alliance	21	85.7	21	81.0

Mapping Class	Users' Count (n)	Users' Accuracy	Producers' Count (n)	Producers' Accuracy
Schoenoplectus-Typha Mapping Unit	18	95.6	15	98.7
Typha-Schoenoplectus Mapping Unit	20	94	28	87.1
WTM	27	**65.2**	13	80
Artemisia douglasiana Provisional Alliance	14	**74.3**	17	84.7
Distichlis spicata Alliance	14	95.7	15	85.3
Elymus (=*Leymus*) *triticoides* Alliance	5	100	10	**76**
NRW	25	**57.6**	14	81.4
Managed annual and perennial wetland vegetation	36	95.6	38	96.3
Allenrolfea occidentalis Alliance	25	96	28	94.2
Atriplex lentiformis Alliance	18	95.6	19	83.2
AGP	36	90	29	100
SVP	23	87.0	18	100
Ludwigia (*hexapetala*, *peploides*) Semi-natural Stands	21	95.2	25	91.2
TFF	23	95.7	17	100
Mean overall accuracy		**84.5**		**88.4**

Since the preferred accuracy for fine-scale vegetation mapping products is ≥80%, the map exceeded the standard overall. However, the map did not meet the standard in several map classes either in users' or producers' accuracy, or both, as noted in red in the table; the likely reasons are discussed in a following section.

Despite making every attempt to sample adequate numbers of all mapped types, 33 map units had a sample size (n) of <5, resulting in reportable results for approximately 72% of the mapped classes. Table 5 shows the under-sampled mapped classes and some types that were observed in the field during AA but were not mapped at all in the initial, pre-AA mapping.

Table 5. Mapping Classes with fewer than 5 AA surveys (excluded from mean accuracy scores)

Mapping Class	Users' Count (n)	Users' Accuracy	Producers' Count (n)	Producers' Accuracy
WVO	2	80	0	0
Aesculus californica Alliance	4	95	3	100
Salix lucida Alliance	1	60	0	0
Tamarix spp. Semi-natural Stands	10	56	3	66.7
Sesbania punicea Alliance	0	0	1	40
Salix laevigata Alliance	12	68.3	3	80
RWS	4	70	3	66.7
Baccharis salicifolia Alliance	1	20	3	60
Cephalanthus occidentalis Alliance	0	0	3	46.7
Rosa californica Alliance	0	0	2	70
Sambucus nigra Alliance	9	71.1	3	93.3
Arctostaphylos manzanita Alliance	1	80	0	0
Arctostaphylos viscida Alliance	2	80	0	0
Ceanothus cuneatus Alliance	2	50	0	0
CSS	0	0	1	20
Lupinus albifrons Alliance	5	96	4	100
Centaurea (*solstitialis, melitensis*) Semi-natural Stands	0	0	1	20
FEM	9	82.2	2	60
Juncus effusus Alliance	0	0	3	53.3
Persicaria lapathifolia–Xanthium strumarium Semi-natural Stands	3	60	2	70
DAM	0	0	2	60
Cynodon dactylon Semi-natural Stands	0	0	2	40
Sporobolus airoides Alliance	2	50	1	100
SSB	2	70	1	60
Atriplex spinifera Alliance	2	40	0	0
Suaeda moquinii Alliance	0	0	1	80
Frankenia salina Alliance	0	0	4	65
NTF	8	75	3	93.3
Eichhornia crassipes Semi-natural Stands	1	80	0	0
Myriophyllum spp. Alliance	3	80	1	80
Azolla (*filiculoides, mexicana*) Alliance	0	0	4	80
Lemna (*minor*) and Relatives Alliance	0	0	3	100
Nuphar polysepala Alliance	0	0	1	80

Interpretation of Scores

When scores drop below 80% accuracy for a type we have the option to choose whether to modify the hierarchy to be less restrictive or to accept the scores because the original categories chosen for the map unit are overall more informative at their current level. The nine classes with adequate samples receiving lower than 80% accuracy scores (red in Table 4) are discussed below. Each has specific characteristics which make it difficult to map. Six are less than 10% below the acceptable level, while 3 are greater than 10% below the acceptable level. We have chosen to maintain the classification as it is to retain the more detailed information. However, caution should be used when relying on typological attributes for all of these types, but in particular for the *Fraxinus latifolia* Alliance, the Naturalized Warm-Temperate Riparian and Wetland group (NRW), and California Warm Temperate Marsh/Seep group (WTM).

Artemisia douglasiana Provisional Alliance (74.3% users'): The mappers called this a variety of types, including *Salix exigua*, CAI, *Centaurea solstitialis*, WTM and NRW, with no apparent pattern except that in all but one case it was mistaken for other herbaceous types.

Baccharis pilularis Alliance (76% users', 73.3% producers',): This typically coastal alliance was more common than expected in the project. Stands tended to be small, characterized by an open shrub layer, and often interfingered with other riparian shrubland or young forest. There was no prevalent misapplication of this type to any other type; instead mappers mistook it for several types including *Cephalanthus occidentalis*, *Salix exigua*, *Rubus armeniacus*, or *Baccharis salicifolia* alliances, and the generic group level Southwestern North American Riparian/Wash Scrub (RWS). Users found it was sometimes included in *Baccharis salicifolia*, *Vitis californica* or *Salix lasiolepis* alliances, all shrub types that occur in similar riparian settings.

Elymus (Leymus) triticoides (76% producers'): Mappers misidentified this type as the group AGP (Alkali Grassland-Playa/Pool Matrix) in three instances and in one instance each as the group CAI (Mediterranean California Naturalized Annual and Perennial Grassland) and *Distichlis spicata* Alliance. Stands of the *Elymus triticoides* Alliance tolerate a range of salinities, occurring in and adjacent to brackish marshes and medium salinity moist soils throughout the mapping area, but also as small stands within CAI or other grasslands. It often occurs within the Alkali Grassland-Playa/Pool Matrix as a single component of that mapping unit. This is technically a "miss" because, if large enough, the stand should be identified at the alliance level. However, ecologically this alliance is regularly a component of the AGP group and less regularly occurs as small stands adjacent to CAI.

Introduced North American Forest and Woodland (IMF) (78% producers'): Mappers misidentified this type as Ornamental Trees in two instances and in one instance each as

Quercus lobata Alliance, *Quercus wislizeni* (Tree) Alliance, *Eucalyptus (globulus, camaldulensis)* Semi-natural Stands, and the *Populus fremontii* and *Salix gooddingii* Alliances. The IMF mapping unit is a macrogroup that encompasses all non-native semi-natural stands of *Eucalyptus* and other species. Thus, an error of not mapping to a specific type of IMF is an error of inclusion.

A mistake between IMF and Ornamental Trees is understandable because the difference between an ornamental tree plantation and a semi-natural (self-perpetuating) stand of non-native trees is gradational. For example, stands of *Eucalyptus, Acacia*, and *Schinus* can occur adjacent to planted stands of the same or similar species, and distinguishing between a plantation and a naturalized stand of these or similar trees is very difficult from aerial imagery. Native tree alliance stands of *Quercus, Populus* and *Salix* species can also be intermixed with non-natives and appear similar to non-native stands, explaining some of the cases described above.

Pinus sabiniana Alliance (76.5% users'): Mappers mistakes were minor, always within the same macrogroup, and were related to the threshold canopy cover of *P. sabiniana* versus co-occurring oaks such as *Quercus wislizeni* or *Quercus douglasii*. Photointerpreter errors were usually based on an overestimate of cover of the *Pinus* versus the co-dominant oak species. This is of minor ecological consequence.

Southwestern North American Riparian Evergreen and Deciduous Woodland (RWF) (77.8% producers'): This category was used by the mappers when they were uncertain to which alliance a particular stand belonged, but felt certain at the group level. This group includes many of the most commonly mapped riparian alliances such as *Populus fremontii, Quercus lobata* (riparian), and *Salix gooddingii*. Two errors were due to a decision by the photo-interpreter to attribute to the group level when they could not determine the more specific alliance. One was in mistaking the introduced tree alliance, *Ailanthus altissima*, as a member of this group, one in mistaking the shrub version of this group (RWS) for this group, and one in mistaking it for NRW, an herbaceous type

Fraxinus latifolia Alliance (60% producers'): Mappers misidentified this type as *Ailanthus altissima*, *Alnus rhombifolia, Juglans hindsii* and Hybrids, *Populus fremontii, Salix laevigata* and *Salix exigua* alliances one time each, and the group RWF (Riparian Evergreen and Deciduous Woodland) twice. *Fraxinus latifolia* Alliance is of intermittent occurrence in the mapping project, being more common in northwestern California coast range riparian forests. The signature of this alliance and its ecological position is similar to other more typical tree alliances as mentioned above. *F. latifolia* stands also tend to be small and regularly intermix with the aforementioned tree alliances.

Naturalized Warm-Temperate Riparian and Wetland Group (NRW) (57.6% users'): Mappers' accuracy was the lowest average of any type with adequate sample size. This class was most frequently mistaken for *Typha* (*angustifolia*, *domingensis*, *latifolia*) alliance, but also was mistaken for California Warm Temperate Marsh/Seep (WTM) and Mediterranean California Naturalized Annual and Perennial Grassland (CAI) more than once. Correct interpretation of this seral, disturbance-related group is difficult and there is ecological overlap with natural *Typha* stands, the native WTM Group, and in late-season dry conditions with the CAI group. Further refinement of the classification and possible aggregation within macro- groups is suggested by the results of the accuracy assessment.

California Warm Temperate Marsh/Seep (WTM) (65.2% users'): This Group level category was mapped 454 times in the study and was more commonly used than the individual component alliance categories such as *Elymus triticoides* or *Artemisia douglasiana*. The most frequent error was mistaking *Artemisia douglasiana* Alliance for WTM, which is really just an error of confidence by the photo-interpreters, since *A. douglasiana* Alliance is a component of WTM. The second most frequent error was mistaking WTM for *Typha* or *Schoenoplectus* Alliance stands. Other errors included mistaking WTM for wetland grass alliances such as *Cynodon dactylon* or *Distichlis spicata* Alliances. Herbaceous wetland types such as WTM are difficult to determine with the 1-meter resolution NAIP imagery because of indistinct signatures. WTM stands also tend to undergo frequent change because of often rapidly shifting ecological conditions due to flooding, fire, or clearing. Another factor affecting the low users' score may be the imprecision of the classification for this group, suggesting further sampling and comparison between this and similar groups should be undertaken.

Mapping Results

Table 6 combines the results of the final fine-scale map done for the Strategic Growth Council with those of DWR's recent fine-scale Central Valley Flood Protection Plan area. The number of Polygons Mapped and Acres in the table below represent the map after it was corrected based on the AA results.

Table 6. Mapping classes, number of polygons mapped, and mapped acres.

Mapping Class	Polygons Mapped	Acres
WVO – California Broadleaf Forest and Woodland	24	137.4
Quercus douglasii Alliance	2,496	25,411.6
Quercus lobata (upland) Alliance	429	2,352.1
Quercus wislizeni Alliance	1,190	8,219.3
Umbellularia californica Alliance	41	256.3
Aesculus californica Alliance	27	67.9
ECW – California Evergreen Coniferous Forest and Woodland	0	0
Juniperus californica Alliance	1	4.0
Pinus sabiniana Alliance	117	800.8
CMF - California Montane Conifer Forest	0	0
Pinus ponderosa Alliance	2	7.4
IMF - Introduced North American Mediterranean Forest	11	26.2
Ailanthus altissima Provisional Semi-natural Stands	46	105.5
Eucalyptus (*globulus*, *camaldulensis*) Semi-natural Stands	381	2,433.7
Robinia pseudoacacia Provisional Semi-natural Stands	19	59.4
Ornamental Trees	306	1,215.3
VRF - Vancouverian Riparian Deciduous Forest	0	0
Alnus rhombifolia Alliance	131	326.8
Fraxinus latifolia Alliance	39	135.5
Salix lucida Alliance	5	12.1
RIS - Riparian Introduced Scrub	8	14.1
Arundo donax Semi-natural Stands	319	1,363.0
Tamarix spp. Semi-natural Stands	128	454.5
Rubus armeniacus Semi-natural Stands	848	2,444.1
Sesbania punicea Provisional Semi-natural Stands	1	2.3
RWF - Riparian Evergreen and Deciduous Woodland	112	799.9
Acer negundo Alliance	625	2,518.4
Juglans hindsii and Hybrids Special and Semi-natural Stands	532	2,972.9
Platanus racemosa Alliance	297	1,278.0
Populus fremontii Alliance	6,490	42,677.1
Quercus lobata (riparian) Alliance	5,780	34,618.6
Salix gooddingii Alliance	4,838	16,630.6
Salix laevigata Alliance	76	290.9
RWS - Southwestern North American Riparian Wash/Scrub	51	253.1
Baccharis salicifolia Alliance	13	21

Mapping Class	Polygons Mapped	Acres
Cephalanthus occidentalis Alliance	10	36.5
Rosa californica Alliance	5	24.7
Salix exigua Alliance	2,466	7,336.4
Salix lasiolepis Alliance	577	1,928.1
Sambucus nigra Alliance	45	133.1
Vitis californica Provisional Alliance	256	1,293.7
CMC - Californian Mesic Chaparral	0	0
Cercocarpus betuloides Alliance	1	2
Quercus berberidifolia Alliance	39	658.3
CXC - California Xeric Chaparral	0	0
Arctostaphylos manzanita Alliance	3	7.1
Arctostaphylos viscida Alliance	5	13.7
Ceanothus cuneatus Alliance	12	17.5
CSS - Central and South Coastal California Seral Scrub	1	1.2
Baccharis pilularis Alliance	194	698.4
Lupinus albifrons Alliance	11	50.1
Heterotheca oregona Provisional Alliance	137	1,268.9
CFG - California Annual Forbs and Grasses	804	35,157.0
CAI - California Introduced Annual and Perennial Herbaceous	8,539	219,418.8
Centaurea (*solstitialis, melitensis*) Semi-natural Stands	1	1.0
FEM - Freshwater Emergent Marsh	27	130.0
Schoenoplectus (*acutus, californicus*) Alliance	1,825	18,235.9
Typha (*angustifolia*, *domingensis, latifolia*) Alliance	485	2,809.1
VCM – Vancouverian Coastal/Tidal Marsh and Meadow	0	0
Juncus effusus Alliance	3	24.5
WTM - California Warm Temperate Marsh/Seep	480	2,417.6
Artemisia douglasiana Provisional Alliance	60	338.0
Elymus (=*Leymus) triticoides* Alliance	22	785.4
NRW - Naturalized Warm-Temperate Riparian/Wetland	2,466	16,042.6
Cynodon dactylon Semi-natural Stands	1	6.1
Persicaria lapathifolia-Xanthium strumarium Provisional Alliance	25	325.8
Managed Annual and Perennial Wetland Vegetation (i.e. duck clubs)	475	145,935.8

Mapping Class	Polygons Mapped	Acres
AGP - Alkali Grassland-Playa/Pool Matrix (similar to VPG but alkaline, with *Suaeda moquinii, Allenrolfea occidentalis, Sporobolus airoides*)	281	81,366.0
SVP - Sparsely Vegetated Playa/Pool[2]	392	9,073.2
DAM - Western North American Disturbed Alkaline Marsh and Meadow	1	14.4
TBM - Temperate Pacific Tidal Salt and Brackish Meadow	0	0
Distichlis spicata Alliance	91	1,019.4
TFB - Temperate Pacific Freshwater Aquatic Bed	8	29.9
SAM - Southwestern North American Alkali Marsh/Seep Vegetation	0	0
Sporobolus airoides Alliance	22	723.8
SSB - Southwestern North American Salt Basin and High Marsh	1	5.0
Allenrolfea occidentalis Alliance	616	5,999.7
Atriplex lentiformis Alliance	79	387.0
Suaeda moquinii (=*nigra*) Alliance	2	46.4
Frankenia salina Alliance	4	124.3
NTF - Naturalized Temperate Pacific Freshwater Vegetation	61	131.4
Eichhornia crassipes Provisional Semi-natural Stands	12	55.4
Ludwigia (*hexapetala, peploides*) Semi-natural Stands	698	3,715.1
Myriophyllum spp. Alliance	21	103.1
TFF - Temperate Freshwater Floating Mat	308	860.9
Azolla (*filiculoides, mexicana*)	30	92.7
Lemna (*minor*) and Relatives	1	3.6
VPB - Californian Mixed Annual/Perennial Freshwater Vernal Pool / Swale Bottomland	256	1,118.3
VPG - California Vernal Pool and Grassland Matrix[3]	608	197,421.4
SUB-TOTAL VEGETATION MAPPED	**47,850**	**905,298.3**

[2] Describes the alkali scalds or claypan pools occurring in the San Joaquin Valley and adjacent areas. Limited to (seemingly) unvegetated, whitish reflective substrate in known alkaline or saline sinks that are mapped only if the entity was 1 acre or larger

[3] A mix of VPB and CFG, where grasslands contain vernal pools/swales smaller than 1 acre each.

Mapping Class	Polygons Mapped	Acres
Non-Vegetated Types		
BGS – Bare Gravel/Sand	1,025	9,898.8
WAT - Water	3,236	70,474.4
AGR - Agriculture	1,431	1,947,393.1
URB - Urban	1,088	423326.2
SUB-TOTAL NON-VEGETATED MAPPED	**6,780**	**2,451,092.5**
PROJECT TOTAL	**54,630**	**3,356,390.8**

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Appendix A. Mapping Classification

Below is the original mapping classification in the National Vegetation Classification System hierarchy order. It is drawn from the vegetation classification of the Great Valley Ecoregion (Buck-Diaz *et al*. 2012). Note that some of the types were not mapped because they were not observed in the mapping area (the classification was for an area greater than the mapping area), because they occurred in stands smaller than the minimum mapping unit, or because they were not distinguishable on the aerial imagery (particularly true for herbaceous types). Some types were mapped, even though they were not distinguishable on the imagery, because they were observed in the field during reconnaissance or accuracy assessment. A YES in the Mapped column below means mapped in the final map as corrected after the accuracy assessment.

Three mapping units were created to deal with special circumstances that were encountered in this project. The Vernal Pool and Grassland Matrix(VPG) encompasses native annual grasslands mixed with alkali vernal pools that are smaller than one acre, and the Sparsely Vegetated Playa/Pool(SVP) captures areas over one acre, have alkali reflectivity, and minimal vegetation. The Managed Marsh category, under the Naturalized Warm-Temperate Riparian/Wetland class, encompasses areas that have been anthropogenically altered within the past five years for management purposes. Older imagery was used to identify such alteration.

Mapping Class	Judged Mappable (YES/NO)	Mapped (YES/NO)
WVO - California Broadleaf Forest and Woodland	YES	YES
Quercus agrifolia Alliance	NO	NO
Quercus chrysolepis Alliance	NO	NO
Quercus douglasii Alliance	YES	YES
Quercus lobata upland Alliance[4]	YES	YES
Quercus wislizeni Alliance	YES	YES
Umbellularia californica Alliance	YES	YES
Aesculus californica Alliance	YES	YES
ECW – California Evergreen Coniferous Forest and Woodland	YES	NO
Juniperus californica Alliance	YES	YES
Pinus sabiniana Alliance	YES	YES

[4] Note that there are two Quercus lobata Alliance types, one occurring in upland settings (in WVO group) and one in riparian settings (RWF group).

Mapping Class	Judged Mappable (YES/NO)	Mapped (YES/NO)
CMF - California Montane Conifer Forest	YES	NO
Pinus ponderosa Alliance	YES	YES
IMF - Introduced North American Mediterranean Forest	YES	YES
Ailanthus altissima Provisional Semi-natural Stands	YES	YES
Eucalyptus (*globulus*, *camaldulensis*) Semi-natural Stands	YES	YES
Robinia pseudoacacia Semi-natural Stands	YES	YES
Ornamental Trees	YES	YES
VRF - Vancouverian Riparian Deciduous Forest	YES	NO
Alnus rhombifolia Alliance	YES	YES
Fraxinus latifolia Alliance	YES	YES
Salix lucida Alliance	YES	YES
RIS - Riparian Introduced Scrub	YES	YES
Arundo donax Semi-natural Stands	YES	YES
Tamarix spp. Semi-natural Stands	YES	YES
Rubus armeniacus Semi-natural Stands	YES	YES
Sesbania punicea Semi-natural Stands	YES	YES
RWF - Riparian Evergreen and Deciduous Woodland	YES	YES
Acer negundo Alliance	YES	YES
Juglans hindsii and Hybrids Special and Semi-natural Stands	YES	YES
Platanus racemosa Alliance	YES	YES
Populus fremontii Alliance	YES	YES
Quercus lobata Alliance	YES	YES
Salix gooddingii Alliance	YES	YES
Salix laevigata Alliance	YES	YES
RWS - Southwestern North American Riparian Wash/Scrub	YES	YES
Baccharis salicifolia Alliance	NO	YES
Cephalanthus occidentalis Alliance	YES	YES
Rosa californica Alliance	YES	YES
Salix exigua Alliance	YES	YES
Salix lasiolepis Alliance	YES	YES
Sambucus nigra Alliance	YES	YES
Vitis californica Provisional Alliance	YES	YES
CMC - Californian Mesic Chaparral	YES	NO
Cercocarpus betuloides Alliance	YES	YES
Heteromeles arbutifolia Alliance	YES	NO
Quercus berberidifolia Alliance	YES	YES

Mapping Class	Judged Mappable (YES/NO)	Mapped (YES/NO)
CXC - California Xeric Chaparral	YES	NO
Adenostoma fasciculatum Alliance	YES	NO
Arctostaphylos manzanita Alliance	YES	YES
Arctostaphylos myrtifolia Alliance	YES	NO
Arctostaphylos viscida Alliance	YES	YES
Ceanothus cuneatus Alliance	YES	YES
Eriodictyon californicum Alliance	YES	NO
CSS - Central and South Coastal California Seral Scrub	YES	YES
Baccharis pilularis Alliance	YES	YES
Lotus scoparius Alliance	YES	NO
Lupinus albifrons Alliance	YES	YES
Heterotheca oregona sub-shrub scrub Provisional Alliance	YES	YES
CFG - California Annual Forbs and Grasses	YES	YES
Ambrosia psilostachya Provisional Alliance	NO	NO
Amsinckia (*menziesii*, *tessellata*) Alliance	NO	NO
Eschscholzia (*californica*) Alliance	NO	NO
Lasthenia californica-Plantago erecta-Vulpia microstachys Alliance	NO	NO
Lotus purshianus Provisional Alliance	NO	NO
Plagiobothrys nothofulvus Alliance	NO	NO
CPG - California Perennial Grassland	YES	NO
Nassella (=*Stipa*) *pulchra* Alliance	YES	NO
CAI - California Introduced Annual and Perennial Herbaceous	YES	YES
Avena (*barbata*, *fatua*) Semi-natural Stands	NO	NO
Brassica (*nigra* and other mustards) Semi-natural Stands	NO	NO
Bromus (*diandrus*, *hordeaceus*)-*Brachypodium distachyon* Semi-natural Stands	NO	NO
Centaurea (*solstitialis*, *melitensis*) Semi-natural Stands	NO	YES
Centaurea (*virgata*) Semi-natural Stands	NO	NO
Conium maculatum-Foeniculum vulgare Semi-natural Stands	NO	NO
Cortaderia (*jubata*, *selloana*) Semi-natural Stands	NO	NO
Cynosurus echinatus Semi-natural Stands	NO	NO
Lolium perenne Semi-natural Stands	NO	NO
DUP – Dry Upland Perennial	YES	NO
Elymus glaucus	NO	NO
FEM - Freshwater Emergent Marsh	YES	YES
Phragmites australis Alliance (most considered weedy types)	NO	NO
Schoenoplectus (*acutus*, *californicus*) Alliance	YES	YES
Typha (*angustifolia*, *domingensis*, *latifolia*) Alliance	YES	YES

Mapping Class	Judged Mappable (YES/NO)	Mapped (YES/NO)
VCM – Vancouverian Coastal/Tidal Marsh and Meadow	YES	NO
Juncus effusus Alliance	YES	YES
WTM - California Warm Temperate Marsh/Seep	YES	YES
Artemisia douglasiana Provisional Alliance	YES	YES
Carex barbarae Alliance	NO	NO
Carex densa Provisional Alliance	NO	NO
Carex nudata Alliance	NO	NO
Juncus arcticus (var. *balticus*, *mexicana*) Alliance	NO	NO
Juncus (*oxymeris*, *xiphioides*) Provisional Alliance	NO	NO
Elymus (=*Leymus) triticoides* Alliance	NO	YES
NRW - Naturalized Warm-Temperate Riparian/Wetland	YES	YES
Cynodon dactylon Semi-natural Stands	YES	YES
Lepidium latifolium Semi-natural Stands	NO	NO
Persicaria lapathifolia-Xanthium strumarium Provisional Alliance	YES	YES
Managed annual and perennial wetland vegetation (i.e. duck clubs)	YES	YES
AGP - Alkali Grassland-Playa/Pool Matrix	YES	YES
SVP - Sparsely Vegetated Playa/Pool	YES	YES
DAM - Western North American Disturbed Alkaline Marsh and Meadow	YES	YES
Sesuvium verrucosum	NO	NO
Bassia hyssopifolia	NO	NO
Cynodon dactylon–Crypsis spp.–Paspalum spp. Semi-natural Stands	YES	NO
TBM - Temperate Pacific Tidal Salt and Brackish Meadow	YES	NO
Distichlis spicata Alliance	YES	YES
Salicornia pacifica Alliance	NO	NO
TFB - Temperate Pacific Freshwater Aquatic Bed	YES	YES
SAM - Southwestern North American Alkali Marsh/Seep Vegetation	YES	NO
Schoenoplectus americanus	YES	NO
Sporobolus airoides Alliance	YES	YES
SSB - Southwestern North American Salt Basin and High Marsh	YES	YES
Allenrolfea occidentalis Alliance	YES	YES
Atriplex spinifera Alliance	YES	NO
Atriplex lentiformis	YES	YES
Isocoma acradenia Alliance	YES	NO
Suaeda moquinii (=*nigra*) Alliance	YES	YES
Frankenia salina Alliance	NO	YES

Mapping Class	Judged Mappable (YES/NO)	Mapped (YES/NO)
NTF - Naturalized Temperate Pacific Freshwater Vegetation	YES	YES
Eichhornia crassipes Alliance	YES	YES
Ludwigia (*hexapetala*, *peploides*) Alliance	YES	YES
Myriophyllum spp. Alliance	YES	YES
TFF - Temperate Freshwater Floating Mat	YES	YES
Azolla (*filiculoides*, *mexicana*) Alliance	NO	YES
Lemna (*minor*) and Relatives Alliance	NO	YES
Nuphar lutea	NO	NO
VPB - Californian Mixed Annual/Perennial Freshwater Vernal Pool / Swale Bottomland	YES	YES
Centromadia (*pungens*) Alliance	NO	NO
Cressa truxillensis–Distichlis spicata Alliance	NO	NO
Lasthenia fremontii–Distichlis spicata Alliance	NO	NO
Layia fremontii–Achyrachaena mollis Alliance	NO	NO
Trifolium variegatum Alliance	NO	NO
VPG - California Vernal Pool and Grassland Matrix	YES	YES
Mimulus guttatus	NO	NO
TYPES JUDGED MAPPABLE	93	
TYPES MAPPED		80

Appendix B. Field Accuracy Assessment Form and Protocol

Accuracy Assessment, CVRP/SGC Fine Scale (11/13/2012)

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

Waypoint ID:	**GPSname: Projected? Yes / No / Base / Digitized** If projected or digitized, enter base Waypoint ID: **Bearing: _____(degrees) Distance: _____ (meters)**
Polygon UID:	Base UTMs / projected UTMs (circle one) UTME __ __ __ __ __ __ __ __ UTMN __ __ __ __ __ __ __ __ __ __ PDOP: +/-

Strata	Species	% cover		Strata	Species	% cover	

Notes: (including recommendations for line-work revision, state of veg. "discernability" based on season and topography, classification interpretation, homogeneity and unusual sightings of plants or animals)		
Alliance		
Map Unit (group code and name)		
Camera/Photos		
Tree Height	2-5m 5-10m 10-15m >15m NA	
Tree Size (dbh)	<1"dbh 1-6"dbh 6-11"dbh 11-24"dbh >24"dbh multi-layered NA	
Hardwood Cover: _____%	Conifer Cover: _____% Total Tree Cover: _____% Shrub Cover: _____%	
Herb Cover	<2% 2-9% 10-39% 40-59% >60% NA	
	Total Cover: _____%	
Isolated Tree	Yes (tree cover <5%) NA	
Clearing Disturbance	<5% 5-25% 25-50% >50%	
Invasive Plants (absolute cover)	<5% 5-25% 25-50% >50%	
Restoration	No Yes	
Estimated area of identifiable vegetation viewed	Radius (m) _____ or rough % of polygon viewed from point _____	
Linework ok ☐	Only 1 vegetation type in this polygon ☐	Vegetation change since imagery taken ☐

Accuracy Assessment Protocol
CVRP/SGC Fine Scale

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 photo-interpreters 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 don't 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 ok: Check the box if the photo-interpreters 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 1 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).