VEGETATION AND LAND USE CLASSIFICATION AND MAP OF THE SACRAMENTO-SAN JOAQUIN RIVER DELTA

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ABSTRACT

The following report describes the vegetation classification and mapping of the Legal Delta portion of the Sacramento-San Joaquin River Delta conducted in 2005-2006 for use in conjunction with the Delta Regional Ecosystem Restoration Implementation Plan. The Legal Delta covers approximately 725,600 acres, of which approximately 104,600 acres are natural vegetation, 555,100 acres agriculture and urban development, and 65,900 acres are open water or inundated lands. Vegetation sampling by means of the CNPS Rapid Assessment Protocol was used to obtain a total of 377 Rapid Assessments, which were used to develop a quantitative classification based on cluster analysis. A total of 52 vegetation alliances were identified, which included an additional 45 defined plant associations. In combination, 95 fine-scale floristic classification units emerged from the analysis. These classification units were either directly or indirectly used to develop a combination of 129 fine-scale to mid-scale vegetation mapping units. Mapping was completed via heads-up digitizing, and each delineated polygon was coded with both a vegetation type and one of 25 land use types. Base imagery was true color 1-foot resolution aerial photography from spring 2002 with additional marginal areas of the study area supplemented by true color 1-meter resolution photography from summer 2005. This type of mapping approach was then compared with a more traditional fine-scale vegetation mapping product of Suisun Marsh to provide measures of efficiency and accuracy for future mapping efforts in the Bay-Delta Region.

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PROJECT STAFF

This classification and mapping project was completed by a team of agency biologists and contracting field staff, air photo interpreters, and GIS analysts. The following lists the basic roles and the staff involved in each.

Field data collection and coordination and plant identification: Jeff Kennedy, Kristi Lazar, Jeanne Taylor and Jahalel L. Tuil [University of California Davis Information Center for the Environment (ICE)]; Brad Burkholder, Daniel Burmester, Curtis Hagen, Diana Hickson, Todd Keeler-Wolf [Department of Fish and Game (DFG)].

Riparian mapping and classification consultant: Mehrey Vaghti.

Vegetation and mapping data management (entry, quality control): Kristi Lazar, Jeanne Taylor, Jeff Kennedy, and Mehrey Vaghti (ICE); Diana Hickson, and Todd Keeler-Wolf.

Vegetation classification, description, and key development, and report preparation: Diana Hickson and Todd Keeler-Wolf.

Vegetation mapping and geodatabase development: John Menke and Carmelita Gutierrez (natural and semi-natural vegetation), Debbie Johnson and Janet Reyes (human land use) (Aerial Information Systems).

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INTRODUCTION

The Sacramento-San Joaquin River Delta (Delta) currently is the subject of a major Federal-State-stakeholder effort called the CALFED Bay-Delta Ecosystem Restoration Program. The goal is to develop a long-term plan to restore ecological health and to improve water management of the Bay-Delta system. One of the basic principles adopted by the CALFED plan is to restore and manage the complex, interacting biological and physical processes in the Delta at the ecosystem (or habitat) level, rather than at the species level.

This integrated vegetation classification and mapping of the Legal Delta (Figure 1) is meant to provide an accurate, biologically-driven base map to assist in habitat restoration planning. For this reason, natural vegetation is mapped at a finer scale than agriculture and other land cover. However, both levels of classification and mapping comply with the draft mapping standards of the interagency Vegetation MOU Group (see http://ceres.ca.gov/biodiversity/vegmou.html), and the finer scale level complies with the Manual of California Vegetation (Sawyer and Keeler-Wolf 1995 and current revisions) and the National Vegetation Classification Standard (NVCS) as defined in the April, 2003 Federal Geographic Data Committee draft standards (see http://biology.usgs.gov/npsveg/nvcs.html). Along with the map, provided in ArcGIS shapefile format, and the classification, we provide keys to and descriptions of the vegetation types, as well as a crosswalk to the California Wildlife Habitat Relationships (CWHR) classification. Other products include databases of the field data and ground photos taken at sampling points, which are useful as baseline or reference site data.

Background

The Sacramento-San Joaquin River Delta, located at the confluence of the Sacramento and San Joaquin Rivers, was once a great tidal brackish-to-freshwater marsh interspersed with riparian scrub and forest underlain by peat and peaty alluvium. The Delta receives runoff from about 40 percent of the land area of California and about 50 percent of California's total streamflow. Natural levees were formed by sediments deposited during spring floods and stabilized by woody riparian vegetation. Natural islands built up over thousands of years from deposition of peat originating from non-decomposed dead stems of tules (*Schoenoplectus acutus* and *S. californicus*, primarily) and other emergent wetland plant species.

Beginning in the late 1800s, levees were reinforced and built-up along the stream channels, and the protected land was drained, cleared, and planted. By around 1930 the system of modified levees and drainage systems was largely complete and the Delta had taken on its current appearance, with most of its 1,150-square-mile area reclaimed for agricultural use (Thompson 1957).

Although the Delta is now an exceptionally rich agricultural area, it is also a source of freshwater for much of the rest of the state. It is the core of a massive southward-bound water-delivery system. State and federal water projects provide for export of up to 7.5 million acre-feet per year from two huge pumping stations in the southern Delta near the Clifton Court Forebay (DWR 1993). About 83 percent of this water is used for agriculture, with the remainder used for various urban uses in central and southern California. The nearly 60 individual leveed tracts and islands help to protect water-export facilities in the southern Delta from saltwater intrusion by displacing water and maintaining favorable freshwater gradients. However, ongoing subsidence behind the levees reduces levee stability and, thus, threatens to degrade water quality in the water-transfer system.

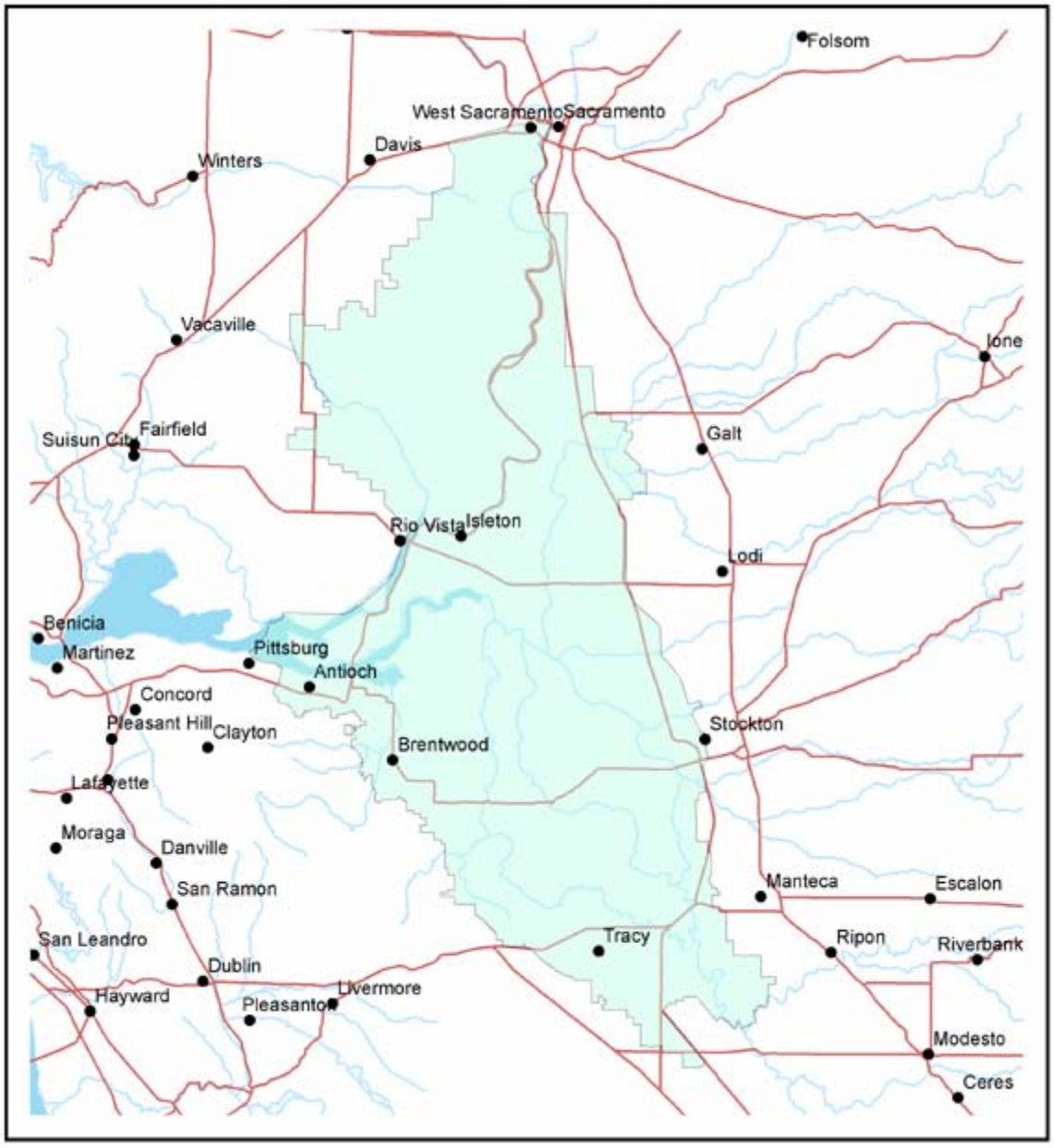

Figure 1. Study area location.
The Legal Delta is shown in green.

Levee failures have been common in the Sacramento-San Joaquin Delta since reclamation began in the 1850s. Each of the islands and tracts in the Delta has flooded at least once, with several flooding repeatedly. About 100 levee failures have occurred since the early 1890s. Initially, most of the failures were caused by overtopping during periods of spring flooding. Although construction of upstream reservoirs since the 1940s has reduced the threat of overtopping, it has not reduced the incidence of levee failure.

The dominant cause of land subsidence in the Delta is decomposition of organic carbon in the peat soils. Prior to agricultural development, the soil was water-logged and anaerobic. Thus, organic carbon accumulated faster than it could decompose. Drainage for agriculture led to aerobic conditions that favor rapid microbial oxidation of the carbon in the peat soil.

The waterways of the Delta are subject to tidal action. Ocean tides moving into San Francisco Bay are observed 5–6 hours later along the Cosumnes River in the eastern Delta. The position

of the interface between the saline waters of the Bay and the freshwaters of the Delta depends upon the tidal cycle and the flow of freshwater through the Delta. Before major dams were built on rivers in the Delta watershed, the salinity interface migrated far upstream (see Figure 2) along the Sacramento River (DWR 1993). Today, releases of freshwater from dams help reduce the maximum land-ward migration of the salinity interface during the late summer. However, in the spring, the filling of these reservoirs and the export of Delta water consistently interact to move the salinity interface further inland, well beyond that expected under natural unimpaired flows in this season (Knowles 2000). Water quality (especially salinity) becomes a critical issue as brackish water moves into the vicinity of the south Delta pumping stations. Thus, there is now a powerful human-induced tension between providing good quality drinking and agricultural water, and maintaining the natural ecosystems that support the Delta's unique fauna and flora.

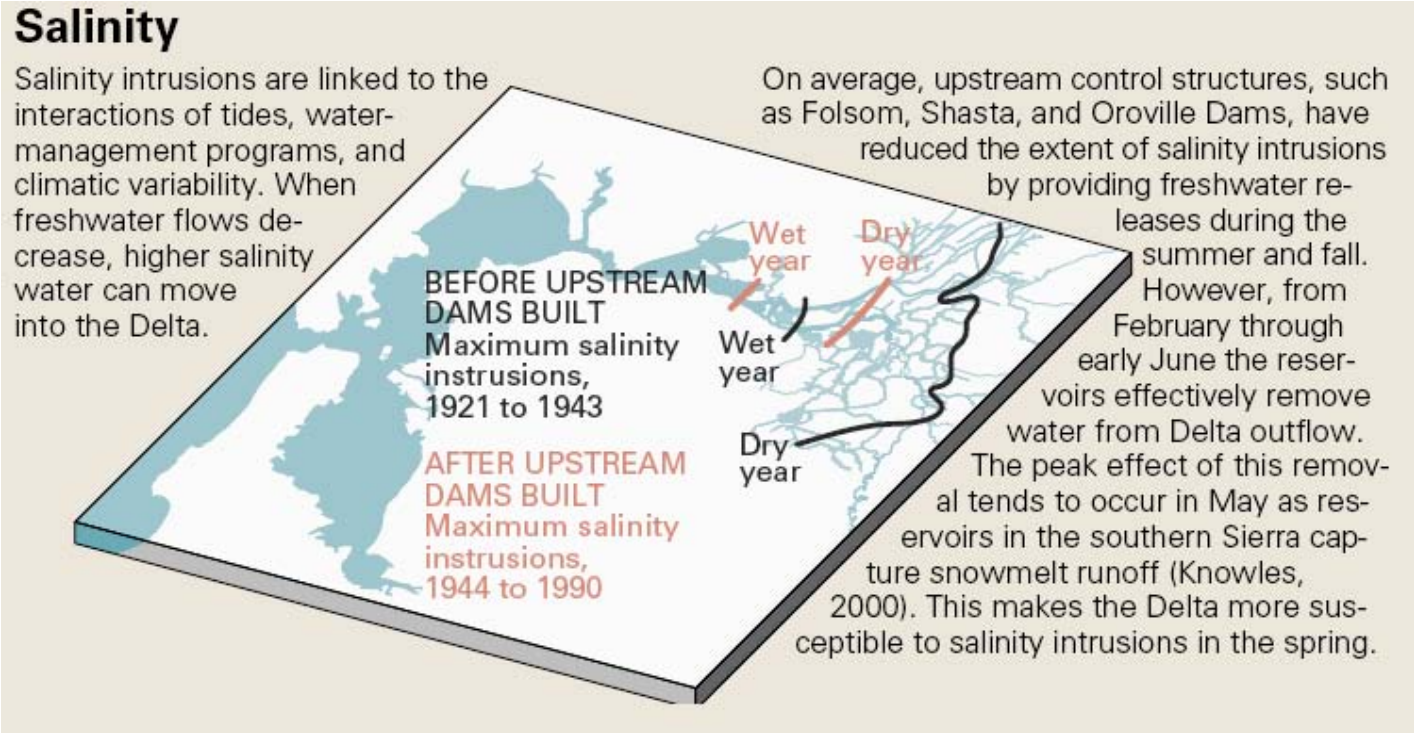

Figure 2. Schematic of salinity issues for the Delta
(Excerpted from S.E. Ingebritsen, Marti E. Ikehara, Devin L. Galloway, and David R. Jones, Delta Subsidence in California: The sinking heart of the State. USGS Factsheet FS-005-00 April 2000).

Historically, the Delta probably became brackish in dry summers. Its native fishes and other aquatic species evolved in a highly variable system. Eventually, saltwater may again penetrate into the Delta as a result of: 1) a drought strong and long enough to deplete reservoirs; 2) levee failures on subsided Delta islands; 3) changes in the way freshwater is routed south, eliminating the need for constantly fresh conditions in the Delta; or 4) an adaptive management-based manipulation to control introduced species or to study the consequences of unavoidable increases in salinity.

The CALFED Ecosystem Restoration Program Plan includes restoring wetland and riparian habitat along the outside of the levees and on several of the smaller, less-subsided islands.

Possible long-term strategies for various Delta islands include:

1) Shallow flooding to mitigate subsidence by slowing peat oxidation and allowing growth of wetland vegetation that contributes to biomass accumulation.

2) Shallow flooding combined with thin-layer mineral deposition (a possibly beneficial reuse of dredge material), which would perhaps accelerate the effects of strategy (1).
3) Continued use of agricultural areas with shallow peat and (or) low organic-matter content, under the assumption that the additional subsidence will not destabilize the levees.
4) Addition of thick layers of mineral soil, possibly using controlled levee breaches or deposition of dredge material, to slow peat oxidation and raise land-surface elevation.
5) Deep flooding to create freshwater reservoirs.

These strategies may be implemented throughout the Delta in a mosaic that creates a substantial diversity of wildlife habitat—uplands, open water, shallow permanent wetlands, and seasonal wetlands.

Previous Vegetation and Habitat Mapping Projects in Relation to the Current Effort

There have been several previous vegetation and habitat mapping projects in the Delta, described below, based on data provided by Ken Devore of DFG.

Preliminary Sacramento-San Joaquin Delta Atlas (DWR 1993). Fine-scale delineation of habitat and natural community information for the entire Delta based on 1:24,000 scale orthophoto quadrangle maps. This was first produced as a book in 1987 and was never completely digitized, but could serve as a baseline of existing extent of habitat in the late 80's or early 90's.

GAP analysis vegetation layer (Davis et al. 1998). This statewide map, produced from 1990 information and completed in 1995, is a very coarse view of terrestrial vegetation and natural communities. Although it covers the Delta area, the minimum mapping unit is 250 acres (100 ha), so fine scale patches of vegetation and habitat are largely missed and poorly estimated.

The Central Valley Wetlands and Riparian Areas GIS database (CDFG 1997). This map was developed to inventory wetlands, riparian woody areas, and surrounding land cover in the Sacramento Valley, San Francisco Bay/Delta, and San Joaquin Valley to support cooperative conservation planning and wetland resource protection efforts of state, federal, and local agencies and private organizations. For the three regions, Landsat Thematic Mapper satellite imagery was processed to map land cover classes from three broad categories: wetlands, agriculture, and uplands. A cooperative grant from DFG (using funds from the U.S. Environmental Protection Agency), the Wildlife Conservation Board (WCB), the Resources Agency of California, and the U.S. Bureau of Reclamation (BOR), funded the development of this GIS database by Ducks Unlimited, Inc. and their subcontractor Pacific Meridian Resources, in cooperation with DFG, WCB, and BOR staff.

None of these three efforts have the detail, currency or quantitative rule-based classification system of the current project. Both the GAP and 1997 efforts are too coarse to track fine-scale changes important to habitat and ecosystem monitoring, and the 1987 effort is now out of date and is not in digital format.

The vegetation classification and mapping project described in this report is a necessary step to describe the current degraded ecological state of the Delta and to establish a baseline from which to build a restoration plan that may include improvement of necessary habitats as described above. By measuring the different types of existing vegetation and comparing future vegetation conditions to this baseline, it will be possible to measure the amount of change that can be linked to different measures of restoration or destruction. This map may also be used to assess the direct habitat value of the vegetation with regard to the numerous plant and animal species considered sensitive or indicative of certain desired ecological conditions.

METHODS

Study Area

The Legal Delta portion of the Sacramento-San Joaquin River Delta stretches from Sacramento in the north to just south of Tracy in the south and from Antioch in the west to Stockton in the east. It includes parts of Alameda, Contra Costa, Solano, Sacramento, San Joaquin, and Yolo counties. Elevations are low, ranging from below sea level on many of the leveed Delta islands to about 300 ft. in the Montezuma Hills. Ecologically, the area is an inland delta where the waters of the two major rivers mingle with the seawater of the Pacific Ocean as it passes through the estuaries of the San Francisco Bay and the adjacent Suisun Bay areas. Tidal influence occurs throughout most of the area's interconnected waterways and salinity values vary from 1-2 ppt to completely fresh on a gradient from west to east throughout the area. Most of the Delta is now maintained as a freshwater system with brackish prevailing only in the extreme western portion. However, as shown in Figure 2, historically this varied substantially from season to season and from year to year.

Vegetation of the Delta was once composed of extensive freshwater and brackish marshes with tules (*Schoenoplectus acutus* and *S. californicus*) and cattails (*Typha* spp.), broad riparian thickets of scrub willows (*Salix* spp.), buttonwillow (*Cephalanthus occidentalis*), and native brambles (*Rubus ursinus, Rosa californica*), and extensive riparian forests of Fremont cottonwood (*Populus fremontii*), valley oak (*Quercus lobata*), Oregon ash (*Fraxinus latifolia*), box elder (*Acer negundo*), white alder (*Alnus rhombifolia*), and black willow (*Salix gooddingii*). Upland, non-riparian stands of valley oak and coast live oak (*Quercus agrifolia*) occurred in a mosaic with seasonally flooded herbaceous vegetation including vernal pools and alkali wetlands. Currently, much of the land has been taken over by agriculture, urban and suburban development, and pasture land. The remaining natural vegetation is largely restricted to the edges of waterways, flooded islands, and small protected areas such as parks, wildlife areas, and nature reserves (Figure 3). Based on this study, approximately 14% of the area is considered to be covered by natural vegetation, while 67% is agriculture and pasture, 10% urban/other and 9% is open water.

Site Selection and Sampling

The primary goal of sampling was to collect replicate samples of all significant vegetation types expressed in the study area. To aid field crews in identifying types that should be sampled, a preliminary list of vegetation types for the study area was developed in early April 2005 from an existing California vegetation classification (Sawyer and Keeler-Wolf 1995, with augmentation from the most recent California Natural Communities List compiled by DFG's Vegetation Classification and Mapping Program). It was later updated with information from initial reconnaissance of the study area conducted in June of 2005. We recognized this list as preliminary and used it for project management purposes to target stands for sampling. This initial inventory included around 50 alliances and suggested about 100 associations or phases (an informal subdivision of an association) in the mapping area.

Figure 3. A high-quality, natural, tidally-influenced marsh with high native floristic diversity and evidence of otter activity (Brown's Island)

Access to the maze of natural channels, artificial "cuts," canals, and privately-owned islands was recognized initially as one of the great challenges to attaining an adequate and representative field sample of the full array of natural and semi-natural vegetation. This problem was much simplified by the generous assistance of boat operators from the staff of the DFG Bay-Delta Branch, Curtis Hagen and Brad Burkholder. Access by water was essential for all field components of this project, from initial reconnaissance to vegetation sampling, and finally to verification and accuracy assessment data collection. A total of 25 individual "boat days" were used for this project.

In addition to boat access, the field crew visited publicly accessible portions of the Delta including the Department of Fish and Game's Yolo Bypass Wildlife Area and Calhoun Cut Ecological Reserve; California Department of Parks and Recreation's Delta Meadows and Caswell Memorial State Park: US Fish and Wildlife Service's Antioch Dunes and Stone Lakes National Wildlife Refuges; and The Nature Conservancy's Cosumnes River Preserve.

Survey sites were selected by subjectively identifying stands of vegetation. A *stand* is defined as a homogeneous patch of vegetation that has a characteristic combination of plant species, that is similar in age, size, and disturbance history, and that repeats across a landscape. A stand may be a small seep measuring several square meters in size or a brush stand measuring several acres in size.

Over the course of the field season, the CNPS Rapid Assessment method was used to collect samples of stands of vegetation (see www.cnps.org for the protocol descriptions). The focus of the field data collection was to collect as many Rapid Assessments as could be completed in

the accessible portions of the study area. The majority of field data were collected between June 29 and September 25, 2005. In April 2006, a final group of Rapid Assessment samples was collected from the Byron area in Eastern Contra Costa County.

All Rapid Assessment surveys were collected using paper forms, a sample of which is provided in Appendix A. The Rapid Assessment protocol is a concise method for collecting environmental variables, species composition, and wildlife habitat information across an entire stand of vegetation. Each assessment takes about 30-45 minutes to complete. Survey time depends on the size and accessibility of the stand.

For each stand identified, a list of the major tree, shrub, and/or herb species was recorded (each Rapid Assessment list could contain up to 12 native species and additional non-native species). Each species was designated a height stratum (low=<0.5 m, medium=>0.5 to 5 m, and tall=>5 m), and the abundance or percent cover of each species was assessed by estimating the percentage of ground area covered by living parts. Sometimes, species were identified in more than one stratum (*e.g.*, *Quercus lobata* could be found in the low, medium and tall layers). In these instances, percent cover was estimated separately for each stratum in which the species occurred. Additional variables recorded include total vegetative cover, total tree, shrub, and herb cover, and degree aspect and degree slope when applicable. Elevation as indicated by a GPS unit was recorded, but is generally not reliable.

Additional sampling was done using Reconnaissance surveys to provide the photo interpreters with a maximum number of on-the-ground data points to create an accurate vegetation map. This shortened version of the Rapid Assessment method provides supplementary ground points indicating the dominant species in a stand. A sample form is included as Appendix B. Note that the data collected from Reconnaissance Surveys were not used in the data analysis phase of classification.

In a separate effort, from late September until late October 2005, map accuracy assessment field data were collected. For this effort, the Rapid Assessment field forms were modified to describe individual stands observed from one point so that up to five stands could be assessed from a single GPS point. For each stand, the following were recorded: the dominant species in the dominant layer, listed in order of cover, high to low; the stand's bearing and distance from the GPS point; and the stand's size and associated geographic landmarks. These data were collected prior to the final polygon delineation, and so specific attention was paid to the ability of the photo interpreters to discern vegetation on the air photo and the minimum polygon size or minimum mapping unit (mmu). Notes were made if the field crew believed these factors would be an issue in the mapping (*e.g.*, stand was less than ½ acre in size).

Throughout the field season, unknown plant specimens were identified using The Jepson Manual (Hickman 1993).

All survey locations were recorded with global positioning system (GPS) receivers using Universal Transverse Mercator (UTM) coordinates based on the North American 1983 datum (NAD 83). One GPS location was recorded within a representative location of each Rapid Assessment, Reconnaissance, and Accuracy Assessment survey. When a stand was inaccessible due to distance or water, and the stand could be *clearly viewed*, survey data were collected remotely. The GPS location information was recorded at each survey point and a distance and bearing to the stand center were taken. Distance to the stand was measured using a digital rangefinder. Compass bearings were true north using a declination of 16° east. GPS points were later downloaded and the points shifted to the stand center via trigonometric calculations using the distance and bearing.

Rapid Assessment survey data were entered directly into a Microsoft Access database. The majority of surveys were entered into the standardized database in fall of 2005, with the

remaining entered following the Spring 2006 field work. Error checking of the database was conducted in Fall 2005, and again prior to final analysis in Spring 2006. The information is archived in the MS Access database for Rapid Assessment surveys of Delta Vegetation. All associated data survey information is located in the RAPlots, RAPlants, and RAImpacts tables. Other tables are look-up reference tables for the functionality of the forms and data tables. A separate database, similar to the Rapid Assessment database, contains the Reconnaissance information.

Digital photos were taken for virtually all of the Rapid Assessment and Reconnaissance field samples, and for many of the Accuracy Assessments. Photos for each Rapid Assessment and Reconnaissance sample are in separate files titled by sample number. Accuracy Assessment photos are individually titled with the sample number. These have been placed on DVD and are part of the project deliverables. Photos were used to verify classification assignments of the samples. Additionally, they should be useful for long-term monitoring.

From the end of June 2005 to the end of October 2005, we collected 372 Rapid Assessment surveys (Figure 4) and 203 Reconnaissance surveys (Figure 5) in the Delta study area. We sampled 414 polygons for accuracy assessment (Figure 6). In April 2006, seven additional Rapid Assessment surveys were collected for a total of 379 Rapid Assessments (two samples, SSJD0046 and SSJD0143, were later removed from the classification because their dominant species was likely misidentified).

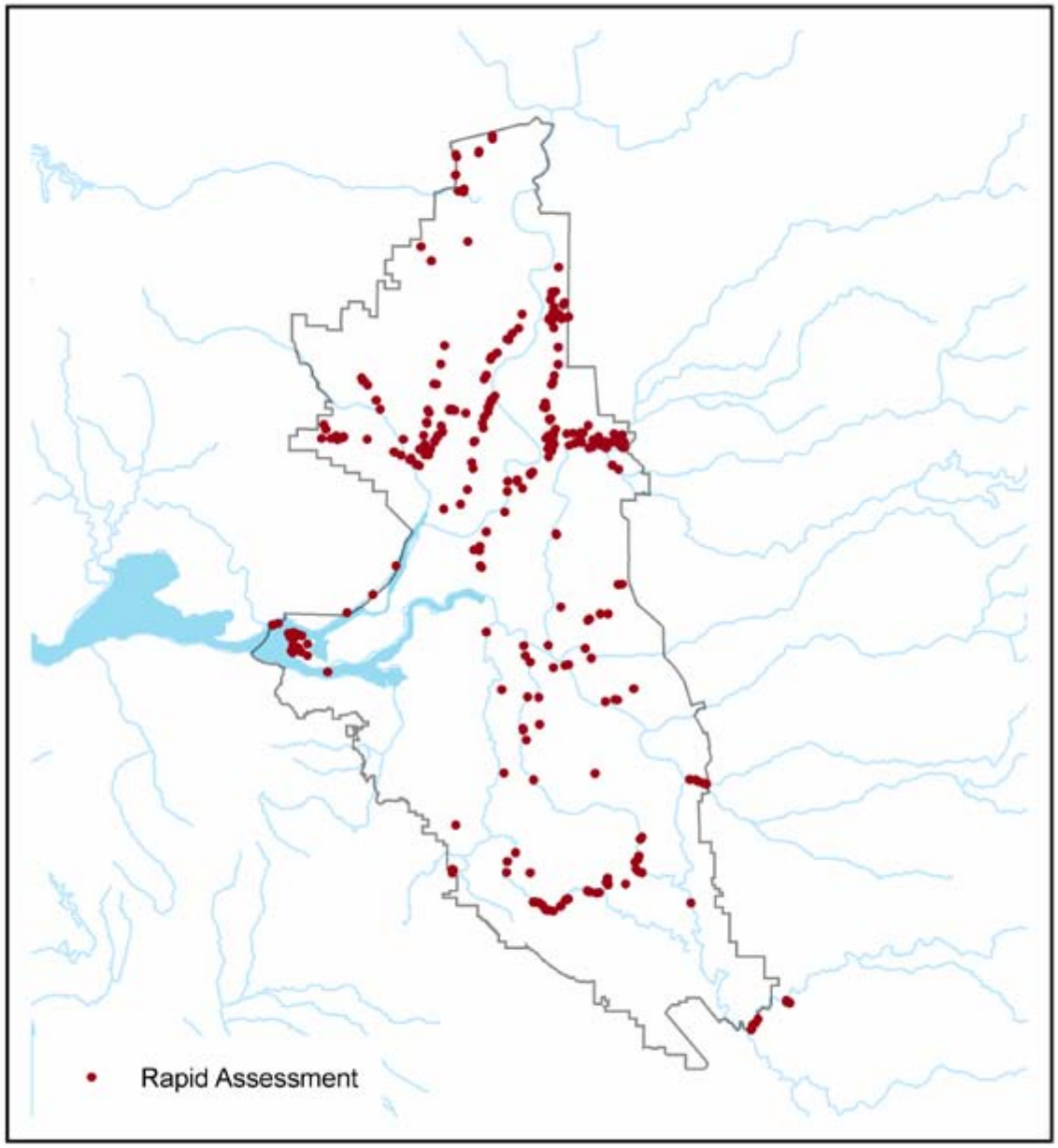

Figure 4. Location of Rapid Assessment samples

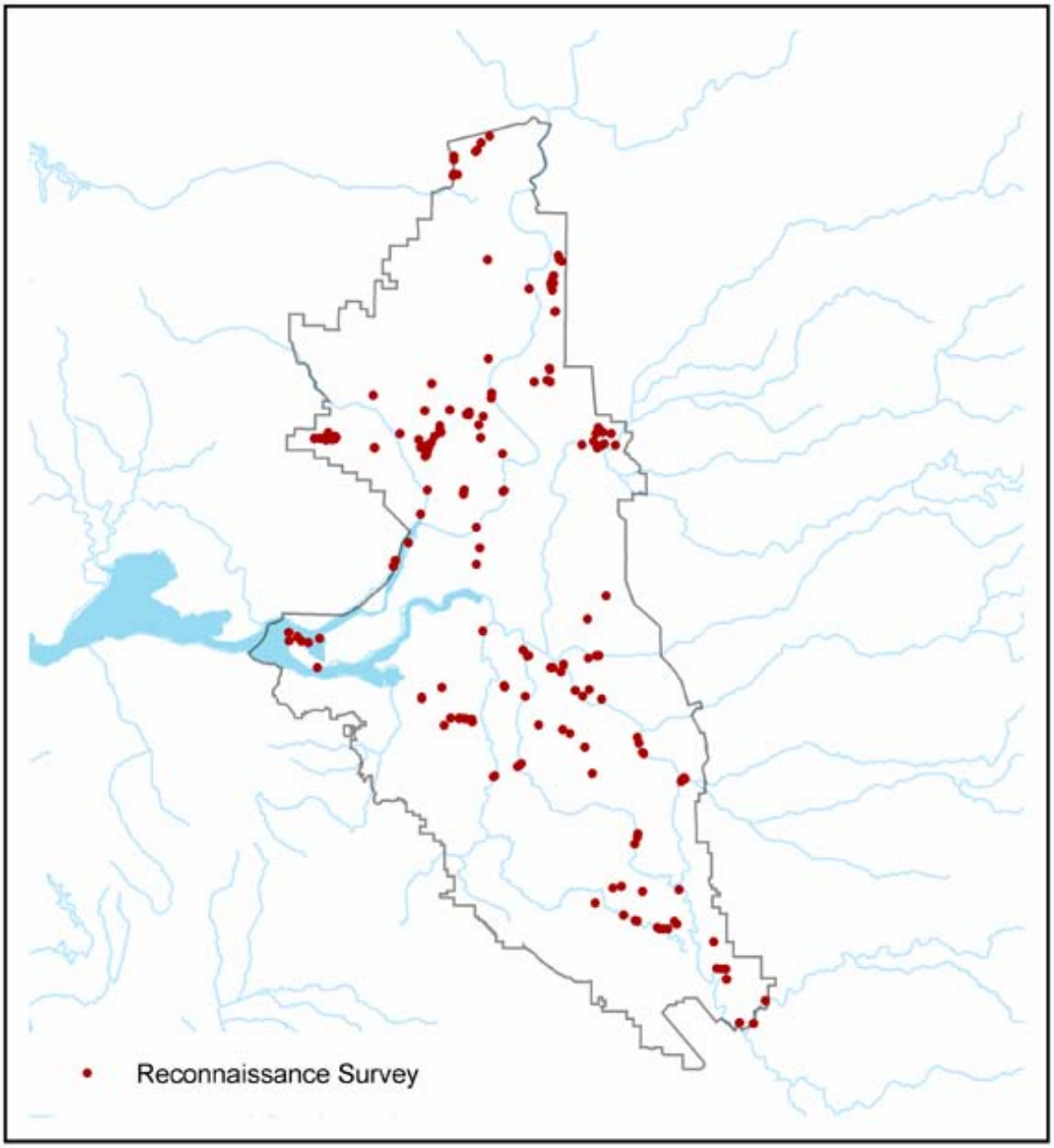

Figure 5. Location of Reconnaissance Surveys

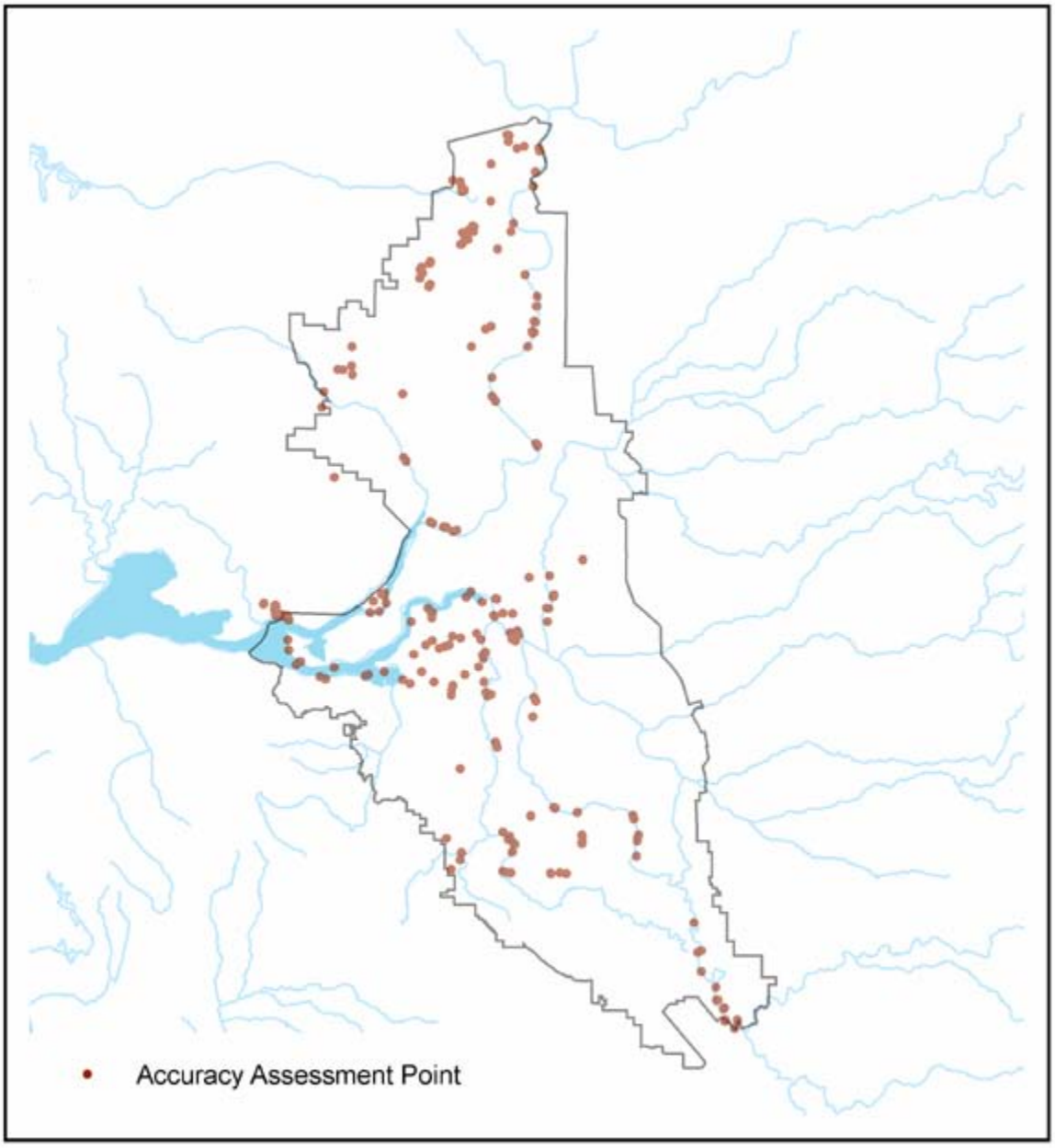

Figure 6. Location of Accuracy Assessment Points

Rapid Assessment and Reconnaissance data were collected over 51 individual field days, (149 person-days). Accuracy Assessment data were collected over 14 individual days (18 person-days). (Days in which both Rapid Assessment and Accuracy Assessment data were collected were attributed to the former, which consumes more time.) Data entry, quality checking, and photo archiving took a total of 168 hours.

This project has attempted to describe all the vegetation types in the study area. However, we limited sampling to areas that were accessible by boat or car, and did not seek permission to collect data from private lands. It is possible that additional alliances and associations could be identified with further research. Additionally, detailed sampling using the CNPS relevé protocol (see www.cnps.org) and classification could be allocated to vegetation with an abundant herbaceous cover, which is not addressed well in the Rapid Assessment protocol.

Classification Analysis

For quantitative analysis of the collected field data, scientific names of the taxa were converted to alpha-numeric codes. Codes for taxa occurring in multiple strata were initially given a modifier indicating the layers in which they occurred (-t for tall layer, -m for middle layer, and –l for low layer). For example, *Quercus lobata* sampled in tall and low strata are coded "QULO-t" and "QULO-l", respectively. Based on the assessment of the frequency of distribution of these "pseudo-taxa," in the case of the shrubby willows (*Salix exigua, S. lasiolepis, S. lucida*), we lumped the tall and mid strata into the mid stratum. For example, in most cases *Salix lasiolepis* tends to be 1-5 meters tall (thus technically middle layer), however some individuals attain heights of slightly greater than 5 meters (technically tall layer). However, for classification, the covers of these two layers were merged into a single, middle layer category.

Following the 2005 sampling effort by the field staff, 372 Rapid Assessment surveys were statistically analyzed. With the addition of seven samples in April 2006 the analyses were re-run to include these. The analysis of sample data was undertaken using the PC-ORD software suite of classification and ordination tools (McCune and Mefford 1997). PC-ORD performs multivariate analyses to generate order out of complex biological patterns. It can be used to objectively define groups of samples into a formalized classification of community types. Using cluster analysis (McCune and Mefford 1997), groups are defined by similarities in species composition and abundance.

Since plant community datasets are inherently complex and more than one environmental axis determines the heterogeneity in plant patterns, hierarchical agglomerative cluster analysis techniques were used to define the most reasonable interpretation of the arrangement of plot and species data. Several exploratory analyses were conducted before a final analysis technique was settled upon. These included using Ward's Euclidian Distance measures and relative Euclidian distance in conjunction with varying the cover classes from 6 to 7. The final analysis used the Sorensen distance and flexible beta linkage method at -0.25 (McCune and Grace 2002). This cluster analysis technique was based on abundance (cover) values converted to seven different classes using the following modified Braun-Blanquet (1932) cover categories: 1=<1%, 2=1-5%, 3=>5-15%, 4=>15-25%, 5=>25-50%, 6=>50-75%, 7=>75%. The majority of the species values fell within the first four cover classes.

Prior to these analyses, data were screened for outliers (extreme values of sample units or species) using outlier analysis in PC-ORD. Outlier samples and species may be removed to reduce heterogeneity and increase normality in the dataset. For samples, Sorensen distance was used for the outlier analysis. Species in less than two samples were removed. Appendix C provides a complete list of species observed in the samples, with the species removed from the analysis noted with an asterisk. In this analysis no major outliers existed, so no samples or additional species were removed. However, as previously noted, two samples were dominated by species that we believed were misidentified in the field, and so we discarded these two samples after the analysis. A dendrogram was generated in the first-order cluster analysis run. This resulted in five main clusters. This dendrogram was interpreted at group levels 6, 55 and 150 to display the main ecological groupings: the generic alliance levels, and the finest association and phase levels, respectively.

After the main cluster analysis run, indicator species analysis (ISA) was employed to decide objectively at what group level to "cut" the dendrogram and explicitly interpret the groups. ISA was also used to designate the key diagnostic species for each of the different groups. ISA produced indicator values for each species in each of the groups within the dendrogram, and these species were tested for statistical significance using a Monte Carlo technique (Dufrêne and Legendre 1997). ISA was repeated at group levels for the 5 main groups of the dendrogram at 55 and 150 groups. At the 55 and 150 group levels, the analysis was evaluated to obtain the total number of significant indicator species (p-value < 0.05) within each group level and the

mean p-value for all species. A total of 108 species or pseudo-species out of the 357 used (33.9%) in the main analysis had some value as indicators ($p < 0.05$). These species were commonly used as part of either the alliance or association-level names developed for the formal classification.

Each sample was revisited within the context of the cluster to which it had been assigned to quantitatively define membership rules for each association. The membership rules were defined by species constancy, indicator species, and species cover values. Upon revisiting each sample, samples misclassified in earlier iterations of the cluster analysis were reclassified based on the membership rules.

The set of data collected throughout the study area was used as the principal means for defining the association composition and membership rules; however, pre-existing classifications and floras were consulted to locate analogous/similar classifications or descriptions of vegetation.

Naming conventions followed the National Vegetation Classification System (Grossman et al. 1998) and the California Native Plant Society (Sawyer and Keeler-Wolf 1995). An association is defined by a group of samples that have similar dominant and characteristic species in the overstory and other important or indicator species, whereby these species are distinctive for a particular environmental setting. Significant indicator species were drawn from the analysis and applied to the associations. A set of similar associations is grouped hierarchically to the next higher level in the classification, the alliance-level. For example, different types of valley oak (*Quercus lobata*) riparian forests are classified to the association level depending on the characteristic overstory and understory species (*e.g.*, *Quercus lobata/Rubus discolor* as compared to *Quercus lobata-Acer negundo*), while the overarching *Quercus lobata* Alliance is based on the characteristic presence of this tree in the overstory. Associations are usually differentiated by environmental factors as well as floristic characteristics.

Samples were classified first to the generic alliance-level, and then they were defined to the more specific association-level when at least two samples of similar species composition and cover were present. Samples were defined only at the alliance-level when less than five samples occurred in the study area. These alliances were described elsewhere in the nation or state, but we had insufficient data to either assign them to an existing association, or the data did not support even defining a preliminary association. With a few more samples, some types would probably become associations, including types represented by *Salix gooddingii* and *Salix lucida* sampled stands.

Sue Bainbridge provided relevé data from the Antioch Dunes portion of the Delta. They were not analyzed with the Rapid Assessment data, but her data were used to define several associations unique to the Antioch Dunes. Likewise, Carol Witham provided data from the Tule Ranch (Witham 2003 and personal communication), and her defined associations are included in our final classification.

All associations described based on fewer than 10 samples are designated as provisional associations.

Development of Diagnostic Key to the Alliances and Associations

A key was produced to identify all vegetation types classified based on the fieldwork. The key provides general choices and information on the physiognomy of the vegetation and in some cases the different environments of the vegetation. This approach in the key was chosen: 1) to reduce the length and redundancy that is common in dichotomous keys, and 2) to be a guide that can be easily used by non-botanists/plant ecologists. The vegetation key can be used as a stand-alone product, allowing anyone with some basic ecology background and knowledge of

the main characteristic plant species to identify the vegetation. It is written from two perspectives: (1) a field team attempting to identify vegetation and (2) an office team attempting to place field samples into the proper category. Thus, heavy reliance is placed on correct identification of characteristic plant species and estimation of cover of these species.

Description Writing, Standards and Definitions

Following the classification analysis of field data, brief association-level descriptions were written based on field data and available literature. If alliances or habitats were defined without any associations, these also have brief descriptions in a slightly different format from the association descriptions. In these descriptions, scientific names of plants follow Hickman (1993) and Jepson Online Interchange (2006). Common names follow these sources and NRCS (2006). When writing the descriptions, the following standards and definitions were used:

Dominant or codominant species: Must be in at least 80 percent of the samples, with at least 30 percent relative cover in all samples.

Consistent/Characteristic/Diagnostic species: Must be in at least 80 percent of the samples, with no restriction on cover.

Abundant species: Must be in at least 50 percent of the samples, with an average of at least 30 percent relative cover in all samples.

Frequently/often/usually occurring species: Must be in at least 50 percent of the samples, with no restriction on cover.

Infrequently occurring: Present in less than 25 percent of the samples.

Minimum sample size for classification and description: n = 2. Descriptions of associations with fewer than ten samples were attempted if (a) the association was sampled and described by previous authors or (b) the vegetation was confirmed as distinctive and repeatedly encountered based on field reconnaissance or by photo-interpretation signature.

Open: Used to describe individual layers of vegetation (tree, shrub, or herb) where the cover is generally less than 33 percent absolute cover.

Intermittent: Used to describe individual layers of vegetation (tree, shrub, or herb) where there is 33-66 percent absolute cover.

Continuous: Used to describe individual layers of vegetation (tree, shrub, or herb) where there is greater than 66 percent absolute cover.

Relative cover: Refers to the amount of the surface of the stand sampled that is covered by one species (or physiognomic group) as compared to (relative to) the amount of surface of the stand covered by all species (in that group). Thus, 50 percent relative cover means that half of the total cover of all species or physiognomic groups is composed of the single species or group in question. Relative cover values are proportional numbers and, if added, total 100 percent for each stand (sample).

Absolute cover: Refers to the actual percentage of the ground (surface of the stand) that is covered by a species or group of species. For example, *Populus fremontii* covers between 5 percent and 10 percent of the stand. Absolute cover of all species or groups if added in a stand may total greater or less than 100 percent because it is not a proportional number. Unless stated otherwise, cover refers to absolute cover.

Stand: Refers to the basic physical unit of vegetation in a landscape. It has no set size. Some vegetation stands are very small, such as wetland seeps, and some may be several square kilometers in size, such as desert or forest types. A stand is defined by two main unifying characteristics:

A. 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 gradual.

B. It has *structural* integrity. It has a similar history or environmental setting, affording relatively similar horizontal and vertical spacing of plant species. For example, a riparian forest formerly dominated by the same species, but that has burned in one part but not in the other, is divided into two stands. Likewise, a sparse woodland occupying a more recent terrace is considered a different stand from an adjacent older terrace with a denser woodland/forest of the same species.

Woody plant: Refers to any species of plant that has noticeably woody stems. It does not include herbaceous species with woody underground portions such as tubers, roots, or rhizomes.

Tree: Refers to a one-stemmed woody plant that normally grows to be greater than 5 meters tall.

Shrub: Refers to what is normally a multi-stemmed woody plant that is usually between 0.2 meters and 5 meters tall. Definitions are blurred at the low and the high ends of the height scales. At the tall end, shrubs may approach trees based on disturbance frequencies (*e.g.*, *Salix exigua* may frequently attain "tree size"). At the short end, woody perennial herbs or sub-shrubs of various species are often difficult to categorize into a consistent life form.

Herbaceous plant: Refers to any species of plant that has no main woody stem development, and includes grasses, forbs, and perennial species that die back seasonally.

Forest: In the National Vegetation Classification, a forest is defined as a tree-dominated stand of vegetation with 60 percent or greater cover of trees.

Woodland: In the National Vegetation Classification, a woodland is defined as a tree-dominated stand of vegetation with between 25 percent and 60 percent cover of trees.

Emergent: A vegetation stratum is considered emergent if it includes a sparse cover of species, which rise above the predominant vegetation layer and would be considered members of the next tallest layer, but has an absolute cover < 10%. For example, individual *Salix gooddingii* trees may comprise an emergent tree layer over a denser layer of *Salix exigua* shrubs, but the stand would be considered a member of the *Salix exigua* shrub alliance because the total tree cover is less than 10%. In this report tall shrubs are not considered emergent over shorter shrubs, but short trees are considered emergent over tall shrubs.

Rare and endangered plants: Listed as per CNPS (2006) Online Inventory of Rare and Endangered Plants.

Conservation rank: Listed by the state Nature Conservancy Heritage Programs. All communities were ranked, though ones without much information were ranked with a "?" after the rank to denote that this rank may change with more information, but that the best knowledge to date (sometimes personal) was used in these situations. Otherwise, hard references were used to place rank. These ranks are the "Global" and "State" ranks as seen below:

G1 and S1: Fewer than 6 viable occurrences worldwide and/or 2000 acres
G2 and S2: 6-20 viable occurrences worldwide and/or 2000-10,000 acres
G3 and S3: 21-100 viable occurrences worldwide and/or 10,000-50,000 acres

G4 and S4: Greater than 100 viable occurrences worldwide and/or greater than 50,000 acres
G5 and S5: Community demonstrably secure due to secure worldwide and statewide abundance

Sample(s): Listed by their survey numbers from the vegetation databases, and indicated using the alpha-code SSJD (an abbreviation for Sacramento-San Joaquin Delta). Successive numeric codes follow each of the alpha-prefixes.

Con, Avg, Min, Max: A species table is provided at the end of each alliance description. The Con column provides the overall constancy value for each species within all Rapid Assessments classified as that alliance. The constancy values are between 0 and 100. Trees, shrubs, and herbs that occurred with at least 10% constancy are listed in the table. The Avg column provides the average cover value for each species, as calculated across all samples in that alliance. The Min and Max values denote the minimum and maximum cover values of species listed in the table.

Ecological Management Units (EMUs): The descriptions include the CALFED EMU(s) in which the samples occurred (see Figure 7).

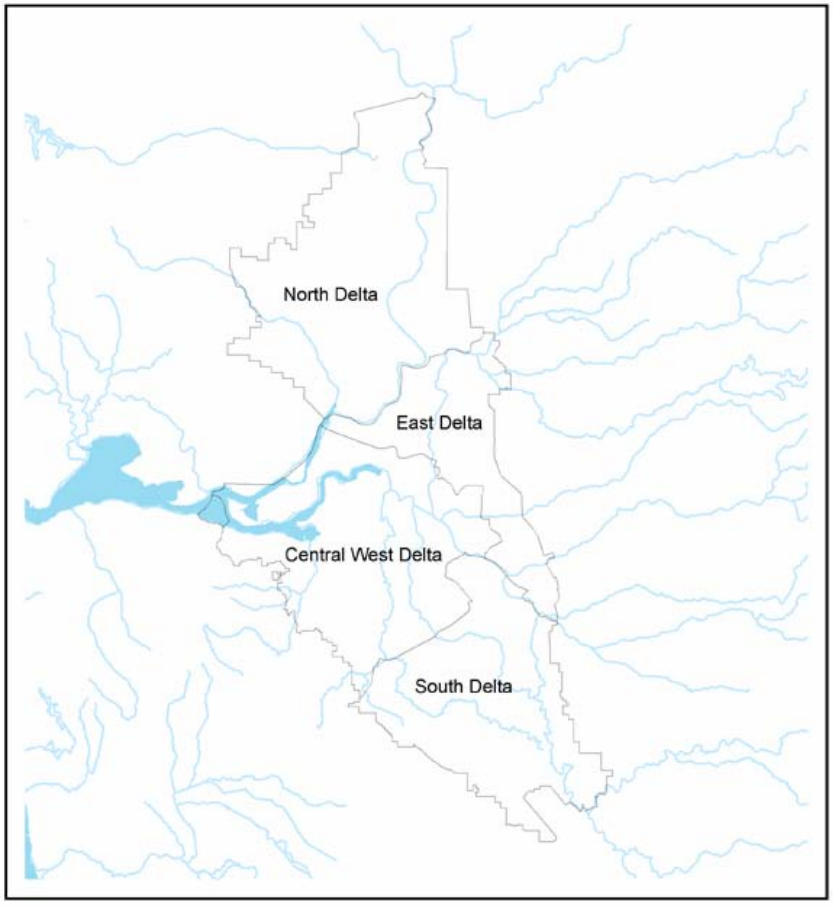

Figure 7. CALFED Ecological Management Units (EMUs)

Note that the site impacts in the descriptions do not include potential impacts from the introduced form of *Phragmites australis*, since we did not distinguish it from the native form.

Mapping

Numerous techniques are available for fine-scale mapping. Among the most promising are those relying on delineation and attribution using expert interpretation of digital geo-referenced aerial photography. This method was employed by the photo interpretation team, Aerial Information Services, Inc. (AIS).

AIS used two sets of true color orthorectified base imagery to produce the land use and vegetation map. For most of the study area, they used U.S. Geological Survey High Resolution Orthoimagery for the Sacramento Delta, Sacramento, and Stockton areas. This was flown in 2002 at a 0.3 meter (approximately 1 foot) ground sample distance (GSD) rectified to National Mapping Standards at 1:12,000 scale. This one-foot resolution imagery does not cover the entire Legal Delta, however, and so for the rest of the area AIS used 2005 National Agricultural Imagery Program (NAIP) imagery flown at a one meter GSD and rectified to the national standards at 1:24,000 scale. Figure 8 shows the area of the Delta covered by each set of imagery.

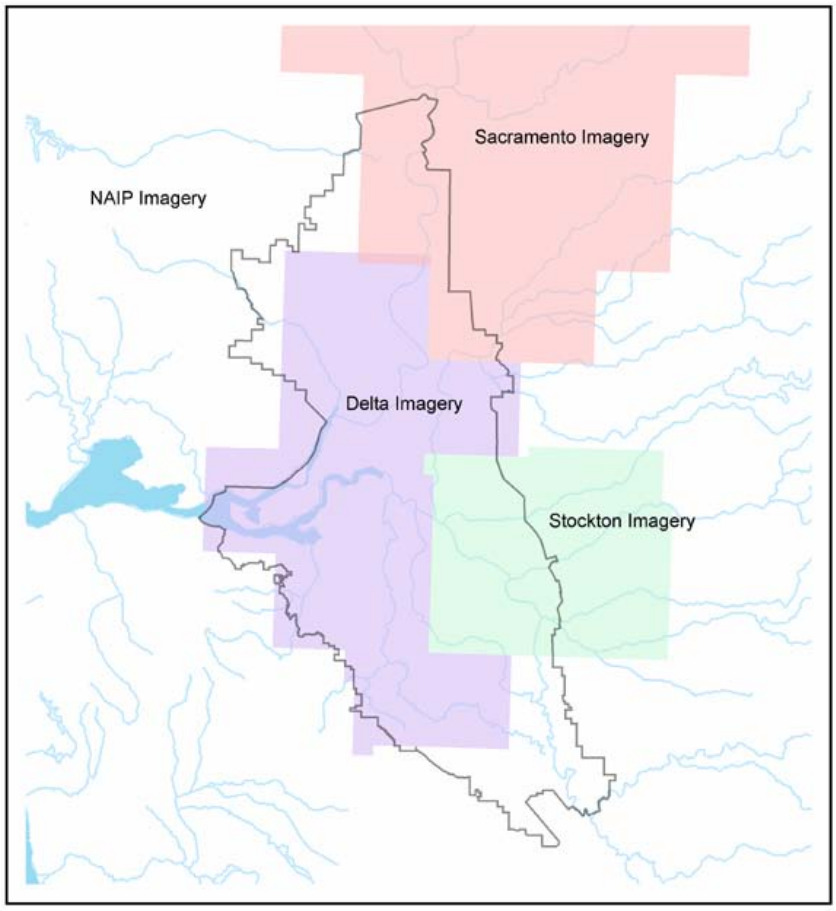

Figure 8. Imagery coverage of the study area

AIS coded each mapped polygon with a Land Use code and a Vegetation code. Delineation and attribution of land use was completed using the Anderson Level II classification. For natural vegetation, the photo interpreters and DFG staff met to agree upon a mapping classification derived from the vegetation classification, based on the ability to discern vegetation types on the photos. In some cases, vegetation can only be mapped to alliance level, or to “sub-alliance” level, meaning some aggregation or combination of associations.

In addition to the vegetation type, photo interpreters attributed each natural vegetation polygon with type, height code, primary stratum cover (density), and site quality information. AIS made general assumptions for height code based on 10 height classes that were based on norms for height categories for each vegetation type, except in unusual instances.

For complete details on mapping methodology, including attribute category descriptions and criteria such as minimum widths for linear features and attribution of high quality polygons, see Appendix D.

Accuracy Assessment

Once the draft map was completed, DFG staff reviewed preliminary labels and compared them to the accuracy assessment field data, and ranked the accuracy of each polygon using fuzzy logic rules.

Using a traditional method of accuracy assessment, only one possible answer (considered to be the best answer by an 'expert' in the field) is compared to the map label. However, vegetation map classes do not always lend themselves to unambiguous measurements. While a map label of *Quercus lobata/Rubus discolor* Woodland/Forest may be considered absolutely correct for a particular site, a user might consider acceptable a map label of *Quercus lobata*, or if translating to a more general category, Woodland/Forest might be considered accurate. An alternative method for evaluating map accuracy, and the one chosen for use in this assessment, is based on the use of fuzzy sets, first developed by Gopal and Woodcock (1994). With the fuzzy logic method of accuracy assessment, for each evaluation site, all map classes including the map label are assigned a ranking based on their degree of ecological similarity with the ground data. The ecological similarity is derived from the actual analysis of plot data defined by similarity values in the cluster analysis as well as similarities in life form. The numeric scoring, used in this assessment, is shown below:

0 = Completely wrong life form and very low ecological similarity
1 = Same life form (*e.g.*, shrub, tree, or herb-grass), not ecologically related in cluster analysis
2 = Same sub-life form (*e.g.*, tall wetland herb, short annual grass), but not necessarily ecologically related in cluster analysis or could be different life form, but share diagnostic species or somewhat ecologically related (same super cluster)
3 = Same alliance or similar alliance within same meso-cluster, but diagnostic species not shared for association
4 = Same alliance or similar alliance within same meso-cluster and diagnostic species shared, but doesn't meet key definitions of the type
5 = Perfect, meets key definitions for the vegetation type or mapping unit

Using the ground-collected data with a set of decision rules, a ranking of 0 to 5 was assigned to all map classes at each evaluation site.

RESULTS

Floristics

Over all the field surveys, 339 vascular plant taxa were identified. Generic names were given to vascular plant species that were not identified to the species level. Appendix C provides a complete list of scientific and common names for all taxa identified and analyzed in the vegetation surveys. Table 1 identifies the seven rare and endangered plants observed in the vegetation surveys within the study area, their status, and the vegetation types in which they were observed.

Table1. Rare and endangered plants
Table includes taxa that were observed during the field sampling effort and the vegetation types in which they were observed. (Table includes species from S. Bainbridge's survey data from Antioch Dunes).

Species	Status*	Alliance	Association
Suisun marsh aster (*Aster lentus*)	"r", CNPS List 1B.2, DFG Rank S2.2	*Alnus rhombifolia*	*Alnus rhombifolia*
		Alnus rhombifolia	*Alnus rhombifolia/Cornus sericea*
		Alnus rhombifolia	*Alnus rhombifolia/Salix exigua(-Rosa californica)*
		Cornus sericea	*Cornus sericea-Salix lasiolepis*
		Deschampsia caespitosa	*Deschampsia caespitosa-Lilaeopsis masonii*
		Distichlis spicata	*Distichlis spicata-Salicornia virginica*
		Quercus lobata	*Quercus lobata/Rubus discolor*
		Quercus lobata	*Quercus lobata-Alnus rhombifolia*
		Salix gooddingii	(Alliance only)
		Salix gooddingii	*Salix gooddingii-Populus fremontii*
		Schoenoplectus acutus(-S. tabernaemontani)	*Schoenoplectus acutus-Phragmites australis*
		Schoenoplectus californicus	*Schoenoplectus californicus-Schoenoplectus acutus*
Contra Costa wallflower (*Erysimum capitatum* ssp. *angustatum*)	"R", State- and Federally-listed Endangered, CNPS List 1B.1	*Lotus scoparius*	*Lotus scoparius* Antioch Dunes
		Lupinus albifrons	*Lupinus albifrons* Antioch Dunes
California rose-mallow *(Hibiscus lasiocarpus)*	CNPS List 2.2, DFG Rank S2.2	*Alnus rhombifolia*	*Alnus rhombifolia/Salix exigua(-Rosa californica)*
		Cornus sericea	*Cornus sericea-Salix exigua*
		Cornus sericea	*Cornus sericea-Salix lasiolepis*
		Salix exigua	*Salix exigua(-Salix lasiolepis)-Rubus discolor*
		Salix lasiolepis	*Salix lasiolepis Great Valley*
		Salix lucida	(Alliance only)

Species	Status*	Alliance	Association
		Schoenoplectus acutus(-S. tabernaemontani)	Schoenoplectus acutus-Phragmites australis
		Schoenoplectus acutus(-S. tabernaemontani)	Schoenoplectus acutus-Typha latifolia
		Schoenoplectus californicus	*Schoenoplectus californicus-Schoenoplectus acutus*
		Typha latifolia	*Typha latifolia-pure*
Delta tule pea (*Lathyrus jepsonii* var. *jepsonii*)	"r", CNPS List 1B.2, DFG Rank S2.2	*Cornus sericea*	*Cornus sericea-Salix lasiolepis*
		Deschampsia caespitosa	*Deschampsia caespitosa-Lilaeopsis masonii*
		Quercus lobata	*Quercus lobata-Alnus rhombifolia*
		Salix exigua	*Salix exigua(-Salix lasiolepis)-Rubus discolor*
		Salix lucida	(Alliance only)
		Schoenoplectus acutus(-S. tabernaemontani)	(Alliance only)
		Schoenoplectus californicus	*Schoenoplectus californicus-Schoenoplectus acutus*
Mason's lilaeopsis (*Lilaeopsis masonii*)	"R", State-listed Rare, CNPS List 1B.1	*Alnus rhombifolia*	*Alnus rhombifolia/Cornus sericea*
		Alnus rhombifolia	*Alnus rhombifolia/Salix exigua(-Rosa californica)*
		Cornus sericea	*Cornus sericea-Salix lasiolepis*
		Deschampsia caespitosa	*Deschampsia caespitosa-Lilaeopsis masonii*
		Schoenoplectus acutus(-S. tabernaemontani)	*Schoenoplectus acutus-Phragmites australis*
		Schoenoplectus californicus	*Schoenoplectus californicus-Schoenoplectus acutus*
Antioch Dunes evening-primrose (*Oenothera deltoides* ssp. *howellii*)	"R", State- and Federally-listed Endangered, CNPS List 1B.1	*Lotus scoparius*	*Lotus scoparius* Antioch Dunes
		Lupinus albifrons	*Lupinus albifrons* Antioch Dunes
		Baccharis pilularis	*Baccharis pilularis*/Annual Grass-Herb
Sanford's arrowroot *(Sagittaria sanfordii)*	CNPS List 1B.2, DFG Rank S3.2	*Sagittaria sanfordii*	(Alliance only)

* Status:

"R": Plants designated for recovery in the CALFED MultiSpecies Conservation Strategy
"r": Plants designated as "contribute to recovery" species in the CALFED MultiSpecies Conservation Strategy
CNPS List 1B.1 Included in the California Native Plant Society's *Inventory of Rare and Endangered Plants of California* (CNPS 2006) as seriously endangered in California and elsewhere (over 80% of occurrences threatened with a high degree and immediacy of threat).
CNPS List 1B.2: Included in the *Inventory* as fairly endangered in the state and elsewhere (20-80% of occurrences threatened).
CNPS List 2.2: Included in the *Inventory* as fairly endangered in the state (20-80% of occurrences threatened), but occurs outside the state.
DFG Rank S2.2, DFG Rank S3.1, DFG Rank S3.2: see http://www.dfg.ca.gov/bdb/pdfs/SPPlants.pdf for rank descriptions.

Classification

The cluster analysis of sample data produced five main ecological groupings including the following vegetation assemblages: 1) valley oak *(Quercus lobata)* and coast live oak *(Q. agrifolia)* riparian woodlands and forests, 2) black willow *(Salix gooddingii)* and Fremont cottonwood *(Populus fremontii)* riparian forests, 3) red-osier dogwood *(Cornus sericea)*, arroyo willow *(Salix lasiolepis)* and narrowleaf willow *(Salix exigua)* riparian thickets, 4) fresh-to-brackish water emergent wetland herbaceous vegetation *(Typha, Phragmites, Schoenoplectus),* and submerged and floating aquatics), and 5) upland annual - saline-alkaline native and non-native herbaceous vegetation.

Figures 9 and 10 are examples of the cluster analysis output showing (from right to left) the arrangement and relationship of surveys in the clustering diagram and their final association names. In the diagram, splits closer to the left are ecologically more closely related than splits to the right, and the different shadings in the diagram indicate different vegetation types.

The final analysis substantiated 95 vegetation types to the alliance level or below, including 53 types that have been defined in this project (Table 2). Specifically, 51 different alliances, 45 associations, and 10 phases were classified, including 14 tree-dominated alliances, 10 shrub-dominated alliances, and 27 herbaceous-dominated alliances.

Alliance	Association	Plot Number	Sorensen's Cluster Diagram
Salix lasiolepis	*Salix lasiolepis* Great Valley	SSJD0210	
Salix lasiolepis	*Salix lasiolepis* Great Valley	SSJD0239	
Salix lasiolepis	*Salix lasiolepis* Great Valley	SSJD0294	
Salix lasiolepis	*Salix lasiolepis* Great Valley	SSJD0220	
Salix lasiolepis	*Salix lasiolepis* Great Valley	SSJD0293	
Salix lasiolepis	*Salix lasiolepis* Great Valley	SSJD0282	
Salix exigua	*Salix exigua(-Salix lasiolepis)-Rubus discolor*	SSJD0089	
Salix exigua	*Salix exigua(-Salix lasiolepis)-Rubus discolor*	SSJD0275	
Salix exigua	*Salix exigua(-Salix lasiolepis)-Rubus discolor*	SSJD0234	
Salix exigua	*Salix exigua(-Salix lasiolepis)-Rubus discolor*	SSJD0281	
Salix exigua	*Salix exigua(-Salix lasiolepis)-Rubus discolor*	SSJD0331	
Salix exigua	*Salix exigua(-Salix lasiolepis)-Rubus discolor*	SSJD0170	
Salix exigua	*Salix exigua(-Salix lasiolepis)-Rubus discolor*	SSJD0286	
Salix exigua	*Salix exigua(-Salix lasiolepis)-Rubus discolor*	SSJD0248	
Salix exigua	*Salix exigua(-Salix lasiolepis)-Rubus discolor*	SSJD0209	
Salix exigua	*Salix exigua(-Salix lasiolepis)-Rubus discolor*	SSJD0283	
Salix exigua	*Salix exigua(-Salix lasiolepis)-Rubus discolor*	SSJD0284	
Salix exigua	*Salix exigua(-Salix lasiolepis)-Rubus discolor*	SSJD0237	
Salix exigua	*Salix exigua(-Salix lasiolepis)-Rubus discolor*	SSJD0329	
Salix exigua	*Salix exigua(-Salix lasiolepis)-Rubus discolor*	SSJD0261	
Quercus lobata	*Quercus lobata* alliance only	SSJD0034	
Cornus sericea	*Cornus sericea-Salix lasiolepis*	SSJD0035	
Cornus sericea	*Cornus sericea-Salix exigua*	SSJD0082	
Cornus sericea	*Cornus sericea-Salix lasiolepis*	SSJD0241	
Cornus sericea	*Cornus sericea-Salix lasiolepis*	SSJD0270	
Cornus sericea	*Cornus sericea-Salix lasiolepis*	SSJD0343	
Cornus sericea	*Cornus sericea-Salix lasiolepis*	SSJD0342	
Cornus sericea	*Cornus sericea-Salix lasiolepis*	SSJD0175	
Cornus sericea	*Cornus sericea-Salix lasiolepis*	SSJD0344	
Cornus sericea	*Cornus sericea-Salix lasiolepis*	SSJD0345	
Cornus sericea	*Cornus sericea-Salix exigua*	SSJD0062	
Cornus sericea	*Cornus sericea-Salix lasiolepis*	SSJD0174	
Cornus sericea	*Cornus sericea-Salix exigua*	SSJD0085	
Alnus rhombifolia	*Alnus rhombifolia/Cornus sericea*	SSJD0055	
Alnus rhombifolia	*Alnus rhombifolia/Cornus sericea*	SSJD0169	
Alnus rhombifolia	*Alnus rhombifolia/Cornus sericea*	SSJD0296	
Alnus rhombifolia	*Alnus rhombifolia/Cornus sericea*	SSJD0226	
Alnus rhombifolia	*Alnus rhombifolia/Cornus sericea*	SSJD0176	

Figure 9. Example of cluster analysis (part of the *Cornus sericea* – *Salix exigua* – *Salix lasiolepis* group)

Alliance	Association	Plot Number	Sorensen's Cluster Diagram
Schoenoplectus acutus	*Schoenoplectus acutus* - pure	SSJD0009	
Schoenoplectus acutus	*Schoenoplectus acutus* - pure	SSJD0037	
Schoenoplectus acutus	*Schoenoplectus acutus* - pure	SSJD0126	
Schoenoplectus acutus	*Schoenoplectus acutus-Typha latifolia*	SSJD0043	
Schoenoplectus acutus	*Schoenoplectus acutus-Xanthium strumarium*	SSJD0288	
Schoenoplectus acutus	*Schoenoplectus acutus* - pure	SSJD0271	
Schoenoplectus acutus	*Schoenoplectus acutus-Typha latifolia*	SSJD0090	
Schoenoplectus acutus	*Schoenoplectus acutus-Typha angustifolia*	SSJD0300	
Schoenoplectus acutus	*Schoenoplectus acutus-Xanthium strumarium*	SSJD0177	
Schoenoplectus acutus	*Schoenoplectus acutus-Phragmites australis*	SSJD0219	
Schoenoplectus acutus	*Schoenoplectus acutus-Phragmites australis*	SSJD0240	
Schoenoplectus acutus	*Schoenoplectus acutus-Phragmites australis*	SSJD0242	
Schoenoplectus acutus	*Schoenoplectus acutus-Xanthium strumarium*	SSJD0218	
Cornus sericea	*Cornus sericea-Salix lasiolepis*	SSJD0221	
Schoenoplectus acutus	*Schoenoplectus acutus-Phragmites australis*	SSJD0232	
Schoenoplectus acutus	*Schoenoplectus acutus-Phragmites australis*	SSJD0269	
Schoenoplectus acutus	*Schoenoplectus acutus-Phragmites australis*	SSJD0236	
Schoenoplectus acutus	*Schoenoplectus acutus-Phragmites australis*	SSJD0267	
Schoenoplectus acutus	*Schoenoplectus acutus-Phragmites australis*	SSJD0095	
Schoenoplectus acutus	*Schoenoplectus acutus-Phragmites australis*	SSJD0304	
Schoenoplectus californicus	*Schoenoplectus californicus-Schoenoplectus acutus*	SSJD0214	
Schoenoplectus californicus	*Schoenoplectus californicus-Schoenoplectus acutus*	SSJD0215	
Schoenoplectus acutus	*Schoenoplectus acutus* alliance only	SSJD0276	
Schoenoplectus acutus	*Schoenoplectus acutus-Typha angustifolia*	SSJD0358	
Schoenoplectus californicus	*Schoenoplectus californicus-Eichhornia crassipes*	SSJD0011	
Schoenoplectus californicus	*Schoenoplectus californicus-Schoenoplectus acutus*	SSJD0162	
Schoenoplectus californicus	*Schoenoplectus californicus alliance only*	SSJD0059	
Schoenoplectus californicus	*Schoenoplectus californicus alliance only*	SSJD0118	
Schoenoplectus californicus	*Schoenoplectus californicus-Schoenoplectus acutus*	SSJD0129	
Schoenoplectus californicus	*Schoenoplectus californicus-Schoenoplectus acutus*	SSJD0299	
Schoenoplectus californicus	*Schoenoplectus californicus-Schoenoplectus acutus*	SSJD0303	
Schoenoplectus californicus	*Schoenoplectus californicus-Schoenoplectus acutus*	SSJD0302	
Alnus rhombifolia	*Alnus rhombifolia/Salix exigua(-Rosa californica)*	SSJD0135	
Schoenoplectus californicus	*Schoenoplectus californicus-Schoenoplectus acutus*	SSJD0018	
Schoenoplectus californicus	*Schoenoplectus californicus-Schoenoplectus acutus*	SSJD0235	
Schoenoplectus californicus	*Schoenoplectus californicus-Eichhornia crassipes*	SSJD0019	
Schoenoplectus californicus	*Schoenoplectus californicus-Eichhornia crassipes*	SSJD0022	
Schoenoplectus californicus	*Schoenoplectus californicus-Eichhornia crassipes*	SSJD0233	

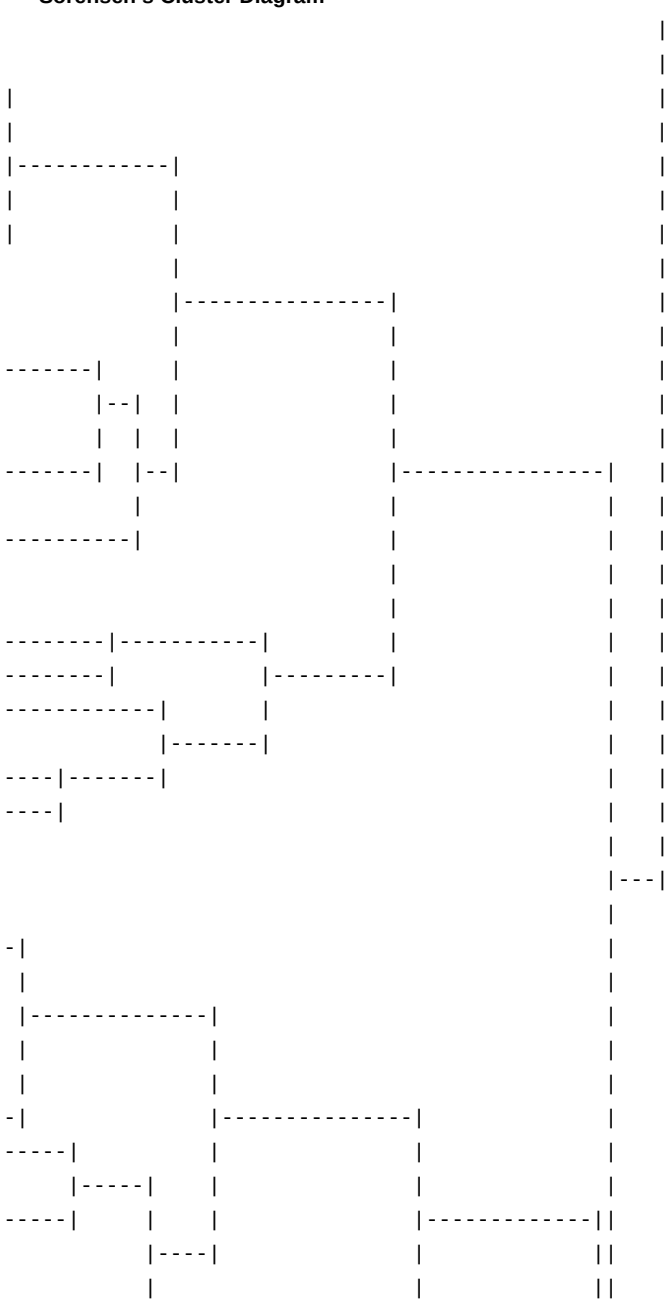

Figure 10. Example of cluster analysis (part of the *Schoenoplectus – Phragmites – Typha* spp. group)

Table 2. Classified vegetation types based on field data from the Delta

Class	Hierarchy code	Formation Name	Alliance Code	Alliance	Association	Phase/Mapping Unit/Stands	N=	D
I. Forest								
	I.A.6.N.b	Lowland or submontane winter-rain evergreen sclerophyllous forest						
			A.84	*Eucalyptus* (includes multiple species) Forest				
						Eucalyptus globulus mapping unit	/2	
	I.B.2.N.a	Lowland or submontane cold-deciduous forest						
			A.221	*Ailanthus altissima* Forest				
						Ailanthus altissima mapping unit	/1	
			A.256	*Robinia pseudoacacia* Woodland/Forest	Alliance only		1/10	
	I.B.2.N.d	Temporarily flooded cold-deciduous forest						
			A.278	*Acer negundo* Woodland/Forest	Alliance only		3/3	
					Acer negundo-Salix gooddingii Provisional		9/3	N
			A.306	*Alnus rhombifolia* Woodland/Forest				
					Alnus rhombifolia		10/1	N
					Alnus rhombifolia/Salix exigua(Rosa californica)		/4	N
						Alnus rhombifolia/Salix exigua Phase	11	N
						Alnus rhombifolia/Rosa californica Phase	6	N
					Alnus rhombifolia/Cornus sericea Provisional		6	N
						Alnus rhombifolia/Salix lucida-Cornus sericea Phase	3	N
			A.307	*Fraxinus latifolia* Woodland/Forest	Alliance only		1	
			none	*Juglans* X *hindsii* Woodland/Forest	Alliance only		1/1	
			A.313	*Populus fremontii* Woodland/Forest	Alliance only		3/6	
	I.B.2.N.e	Seasonally flooded cold-deciduous forest						
			A.333	*Salix lucida* Shrubland/Forest	Alliance only		3	
	II.B.2.N.b	Temporarily flooded cold-deciduous woodland						

Class	Hierarchy code	Formation Name	Alliance Code	Alliance	Association	Phase/Mapping Unit/Stands	N=	D
			A.640	*Salix gooddingii* Woodland/Forest	Alliance only		6/3	
					Salix gooddingii/wetland herb Provisional		5/4	N
					Salix gooddingii-Populus fremontii		26/12	N
					Salix gooddingii-Quercus lobata/wetland herb Provisional		8	N
II. Woodland								
	II.A.5.N.a	Sclerophyllous extremely xeromorphic evergreen woodland						
			A.589	*Quercus agrifolia* Woodland/Forest				
						Largely represented by a phase of an unknown association characterized by *Quercus agrifolia/Equisetum hyemale*	3/1	N
	II.B.2.N.a	Cold-deciduous woodland						
			A.618	*Quercus lobata* Woodland/Forest	Alliance only		4/6	
					Quercus lobata/Rubus discolor		13/5	N
						Quercus lobata/Rosa californica Phase	4	N
						Quercus lobata/Rubus discolor/Carex barbarae Phase	11	N
					Quercus lobata-Acer negundo Provisional		4/1	N
					Quercus lobata-Alnus rhombifolia		25/4	N
					Quercus lobata-Fraxinus latifolia/Vitis californica		10	N
						Quercus lobata-Fraxinus latifolia Phase	5	N
	II.B.2.N.b	Temporarily flooded cold-deciduous woodland						
			A.639	*Salix exigua* Woodland/Forest	Alliance only		3/6	
					Salix exigua-(Salix lasiolepis)-Rubus discolor		22/17	N
						Salix exigua-Rosa californica Phase	5	N
						Salix lasiolepis-Rubus discolor Phase	11	N
			A.977	*Salix lasiolepis* Woodland/Forest				
					Salix lasiolepis Great Valley Provisional		8/4	N

Class	Hierarchy code	Formation Name	Alliance Code	Alliance	Association	Phase/Mapping Unit/Stands	N=	D
III. Shrubland								
	III.A.2.N.a	Temperate broad-leaved evergreen shrubland						
			A.2601	*Lupinus albifrons* Shrubland				
					Lupinus albifrons Antioch Dunes		(B= 3)	N
	III.A.4.N.a	Lowland microphyllous evergreen shrubland						
			A.836	*Baccharis pilularis* Shrubland	Alliance only		1	
					Baccharis pilularis/Annual Grass-Herb		(B= 1)	
	III.A.5.N.b	Facultatively deciduous extremely xeromorphic subdesert shrubland						
			A.866	*Allenrolfea occidentalis* Shrubland	Alliance only		3	
	III.B.2.N.c	Intermittently flooded cold-deciduous shrubland						
			none	*Rosa californica* Shrubland	Alliance only		/2	
			none	*Rubus discolor* Shrubland	Alliance only		/2	
			A.935	*Sambucus mexicana* Shrubland	Alliance only		1	
			A.941	*Suaeda moquinii* Shrubland	Alliance only		1	
	III.B.2.N.d	Temporarily Flooded Shrubland						
			A.968	*Cornus sericea* Shrubland	Alliance only		/1	
					Cornus sericea-Salix exigua Provisional		3/3	N
					Cornus sericea-Salix lasiolepis		5/4	N
						Cornus sericea-Salix lasiolepis/Phragmites australis Phase	10	N
	III.B.2.N.e	Seasonally Flooded Shrubland						
			A.988	*Cephalanthus occidentalis* Shrubland	Alliance only		1/1	
IV. Dwarf Shrubland								
	IV.A.2.N.b	Facultatively deciduous subdesert dwarf-shrubland						
			none	*Lotus scoparius* Shrubland				

Class	Hierarchy code	Formation Name	Alliance Code	Alliance	Association	Phase/Mapping Unit/Stands	N=	D
					Lotus scoparius Antioch Dunes		/1 (B= 5)	N
V. Herbaceous Vegetation								
	V.A.5.N.b	Tall bunch temperate grassland						
			A.1203	*Cortaderia (selloana, jubata)* Semi-natural Herbaceous	Alliance only		1	
	V.A.5.N.e.	Short sod temperate or subpolar grassland						
			A.1279	*Cynodon dactylon* Grassland	Alliance only		2	
	V.A.5.N.i	Intermittently flooded temperate or subpolar grassland						
			A.1332	*Distichlis spicata* Grassland	Alliance only		2	
					Distichlis spicata-Annual grasses Provisional		2	N
					Distichlis spicata-Salicornia virginica Provisional		2/1	N
					Distichlis spicata-Juncus balticus (from Suisun Marsh)		/1	
	V.A.5.N.j	Temporarily flooded temperate or subpolar grassland						
			A.1339	*Arundo donax* Herbaceous	Alliance only		1/2	
			A.1353	*Leymus triticoides* Grassland	Alliance only		/1	
	V.A.5.N.k	Seasonally flooded temperate or subpolar grassland						
			A.1393	*Typha latifolia* Herbaceous				
					Typha latifolia-pure Provisional		6/8	N
	V.A.5.N.l	Semipermanently flooded temperate or subpolar grassland						
			A.1432	*Schoenoplectus americanus* Tidal Herbaceous	Alliance only		1	
			A.1443	*Schoenoplectus acutus - (Schoenoplectus tabernaemontani)* Herbaceous	Alliance only		1	
					Schoenoplectus acutus – pure Provisional		4/13	N

Class	Hierarchy code	Formation Name	Alliance Code	Alliance	Association	Phase/Mapping Unit/Stands	N=	D
					Schoenoplectus acutus-Typha angustifolia Provisional		2	N
					Schoenoplectus acutus-Typha latifolia Provisional		2	N
					Schoenoplectus acutus-Phragmites australis		10/4	N
					Schoenoplectus acutus-Xanthium strumarium Provisional		4/1	N
			A.2004	*Schoenoplectus californicus* Herbaceous	Alliance only		3/5	
					Schoenoplectus californicus-Eichhornia crassipes Provisional		5/3	N
					Schoenoplectus californicus-Schoenoplectus acutus Provisional		9/4	N
	V.A.5.N.n	Tidal temperate or subpolar grassland						
			A.1472	*Typha (angustifolia, domingensis)* Tidal Herbaceous				
					Typha angustifolia-Distichlis spicata Provisional		2	N
			A.2623	*Deschampsia caespitosa* Tidal Herbaceous				
					Deschampsia caespitosa-Lilaeopsis masonii Provisional		5	N
			A.1196	*Phragmites australis* Herbaceous	Alliance only		2/3	
	V.A.5.N.i	Intermittently flooded temperate or subpolar grassland						
			none	*Carex barbarae* Herbaceous			1	N
	V.B.2.N.	Intermittently flooded perennial herbaceous vegetation						
			none			Managed wetland vegetation; Non-specific introduced graminoid and forb mixed stands	8/2	N
	V.B.2.N.d	Temporarily flooded temperate perennial forb vegetation						
			A.1658	*Polygonum* spp. - Mixed Forbs Temporarily Flooded Herbaceous				
					Polygonum amphibium (lapathifolium) Provisional		6/4	N
	V.B.2.N.e	Semipermanently flooded temperate perennial forb vegetation						

Class	Hierarchy code	Formation Name	Alliance Code	Alliance	Association	Phase/Mapping Unit/Stands	N=	D
			A.1928	*Ludwigia peploides* Semipermanently Flooded Herbaceous				
					Ludwigia peploides Provisional		6/6	N
			A.3539	*Equisetum (arvense, variegatum, hyemale)* Herbaceous	Alliance only		/4	
	V.B.2.N.g.	Tidal temperate perennial forb vegetation						
			none	*Frankenia salina* Tidal Herbaceous	Alliance only		2	
			A.2618	*Salicornia virginica* Tidal Herbaceous	Alliance only			
					Salicornia virginica-Distichlis spicata Provisional		2	
					Salicornia virginica-Cotula coronopifolia Provisional		1	N
			none	*Lepidium latifolium* Semi-natural Herbaceous	Alliance only		/4	
					Lepidium latifolium-Salicornia virginica-Distichlis spicata Provisional		2	N
	V.C.1.N.a	Permanently flooded tropical or subtropical hydromorphic-rooted vegetation						
			A.1716	*Eichhornia crassipes* Permanently Flooded Herbaceous				
					Eichhornia crassipes – pure Provisional		2/7	N
	V.C.2.N.a	Permanently flooded temperate or subpolar hydromorphic-rooted vegetation						
			A.1741	*Azolla (filiculoides, mexicana)* Permanently Flooded Herbaceous	Alliance only		1	
			A.3542	*Myriophyllum spp.* Permanently Flooded Herbaceous				
					Egeria-Cabomba-Myriophyllum spp. Provisional		5/3	N
			A.1754	*Potamogeton spp. - Ceratophyllum spp. - Elodea spp.* Permanently Flooded Herbaceous				
					Potamogeton pectinatus – pure Provisional		1/1	N

Class	Hierarchy code	Formation Name	Alliance Code	Alliance	Association	Phase/Mapping Unit/Stands	N=	D
			none	*Hydrocotyle ranunculoides* Permanently Flooded Herbaceous	Alliance only		/1	N
			none			*Sagittaria sanfordii* Permanently Flooded Herbaceous unique stands	/1	N
	V.D.2.N.	Temperate or subpolar annual grasslands or forb vegetation						
			none	California Annual Grassland/Herbaceous				
					Bromus diandrus-Bromus hordeaceus Provisional		6/3	N
			none	*Lolium multiflorum* Grassland	Alliance only		1	
					Lolium multiflorum-Convolvulus arvensis Provisional		6/2	N
					Lolium multiflorum-Triphysaria eriantha		(W= 11)	
					Lolium multiflorum-Lasthenia glabrata ssp. *glabrata*		(W= 11)	
					Lolium multiflorum-Blennosperma nanum		(W= 5)	
			none	*Lasthenia californica* Herbaceous	Alliance only		2	
	V.D.2.N.b	Tall temperate or subpolar annual forb vegetation						
			none			Ruderal Herbaceous Mapping Unit Includes all tall weedy forb stands such as *Silybum, Brassica, Conium*, etc.	1/5	
	V.D.2.N.g	Seasonally flooded temperate annual grassland						
						Juncus bufonius non-classified stands	1	N
						Vernal Pool stands	1 (w= 10)	

Notes:

Hierarchy Code	Code indicating location of the type in the National Vegetation Classification System hierarchy (NatureServe 2006)
Alliance Code	Unique alliance code assigned by NatureServe (2006)
N=	Number of Rapid Assessments/Number of Reconnaissance stands sampled
D=	"N" if newly described from the Delta project
B=	Number of relevés from Sue Brainbridge
W=	Number of relevés from Carol Witham

A number of rare vegetation types exist in the region with respect to the state and national classification. Rarity in vegetation is primarily based on the number of occurrences worldwide and statewide and/or the amount of area covered worldwide and statewide. Table 3 provides a list of vegetation types that are of highest rarity in the study area.

Table 3. Vegetation types of highest rarity in the Delta

Vegetation Classification	**Polys**	**Acreage**	**Rarity code**
Tree types			
Alnus rhombifolia/Cornus sericea Provisional	20	32	G2S2
Alnus rhombifolia/Salix lucida-Cornus sericea phase	Mapped with above		G2S2
Acer negundo Alliance only	0	0	G5S2
Acer negundo-Salix gooddingii Provisional	11	35	G2S2
Salix gooddingii-Quercus lobata/wetland herb Provisional	103	433	G2S2
Quercus lobata-Acer negundo Provisional	22	68	G2S2
Quercus lobata-Fraxinus latifolia/Vitis californica	35	318	G2S2
Quercus lobata-Fraxinus latifolia phase	Mapped with above		G2S2
Shrub Types			
Lotus scoparius Antioch Dunes	3	5	G1S1
Cornus sericea-Salix exigua Provisional	64	122	G2S2?
Cephalanthus occidentalis Alliance only	9	8	G5S2
Lupinus albifrons Antioch Dunes	2	15	G1S1
Herbaceous Types			
Carex barbarae Alliance	5	15	G1S1?
Typha latifolia-pure Provisional	152	363	G4S2?
Deschampsia caespitosa Tidal Herbaceous Alliance	0	0	G4S2
Deschampsia caespitosa-Lilaeopsis masonii Provisional	2	0.5	G1S1
Sagittaria sanfordii unique stands	0	0	G1S1

Rarity Code

G= Global Ranking (G-rank), a reflection of the overall condition of an element throughout its global range.

G1 = Less than 6 viable element occurrences (EOs) or less than 2,000 acres.
G2 = 6-20 EOs or 2,000-10,000 acres.
G3 = 21-80 EOs or 10,000-50,000 acres.
G4 = Apparently secure; this rank is clearly lower than G3 but factors exist to cause some concern; *i.e.*, there is some threat, or somewhat narrow habitat.
G5 = Type demonstrably secure to ineradicable due to being commonly found in the world.

S= State Ranking (S-rank), assigned much the same way as the global rank

S1 = Less than 6 EOs or less than 2,000 acres.
S2 = 6-20 EOs or 2,000-10,000 acres.
S3 = 21-80 EOs or 10,000-50,000 acres.
S4 = Apparently secure within California; this rank is clearly lower than S3 but factors exist to cause some concern; *i.e.* there is some threat, or somewhat narrow habitat.
S5 = Demonstrably secure to ineradicable in California.

Notes:
Other considerations used when ranking a natural community include the pattern of distribution of the element on the landscape, fragmentation of the population/stands, and historical extent as compared to its modern range. It is important to take a bird's eye or aerial view when ranking sensitive elements rather than simply counting element occurrences.

?= Uncertainty about the rank of an element is expressed in this report by adding a "?" to the rank.

While some alliances and associations may have little data available for the classification and description, they have been provisionally defined here in case they are found to occur in future projects. By providing as much information as possible in the classification and descriptions, we hope that future research and management efforts can build upon this framework of vegetation classification in the Central Valley wetlands.

Vegetation and Land Use Map

The final Vegetation and Land Use map for the Delta is available as a shapefile with detailed metadata including attribute values and mapping criteria. The land use map classification is presented in Table 4, while the vegetation map classification is presented in Appendix E.

Table 4. Land use mapping classification

Map Code	Definition
1000	Urban or built-up Land
1100	Residential
1200	Commercial and Services
1271	Military – Built Up
1272	Military – Not Built Up
1300	Industrial
1400	Transportation, Communications, and Utilities
1410	Transportation Corridor
1500	Industrial and Commercial Complexes
1700	Other Urban or Built-up Land
2000	Agricultural Land
2100	Cropland and Pasture
2110	Flooded Agriculture
2200	Orchards, Groves, Vineyards, Nurseries, and Ornamental Horticultural Land
2210	Nurseries and Ornamental Horticultural Land
2220	Deciduous Orchards
2230	Evergreen Orchards
2240	Vineyards
2300	Confined Feeding Operations
2400	Other Agricultural Land
3000	Natural Vegetation
3100	Vacant
5000	Water
5100	Streams - Rivers

Map Code	Definition
5200	Lakes, Reservoirs and Ponds
5300	Canals
5400	Areas of Inundation
7000	Barren Land
7500	Strip Mines, Quarries, and Gravel Pits
7600	Transitional Areas – Construction – Scraped Ground

A summary of the acreage by broad categories of land use and vegetation is presented in Table 5. The dual coding system in which each polygon is attributed by both land use and by vegetation type results in the apparent discrepancy in acreage between the two systems. For example, a polygon may be designated “Cropland and Pasture” in the land use attribute field and some type of annual grass-dominated grassland in the vegetation field, or “military – not built up” in the land use field and “vernal pools” in the vegetation field. The map in Figure 11 is based on general land use categories, while the map of natural vegetation in Figure 12 shows all vegetated areas based on the vegetation field. Examination of the central portion of the Delta on these two maps shows the dual coding of the Cropland and Pasture vs. annual grassland example.

Table 5. Mapped acreage by land use type and by vegetation type

Land Use Attribution	Acres	% of Delta
Natural vegetation ("vacant")	104,637	14
Agriculture	485,902	67
Urban	65,224	9
Water/Inundated	65,850	9
Barren/Scraped/Quarry	3,982	1
Total	725,595	100
Vegetation Attribution		
Natural vegetation, upland	109,995	15
Natural vegetation, floating aquatic	4,164	1
Exotic vegetation (plantings)	5,939	1
Sparsely vegetated	8,312	1
Restoration-related vegetation	228	<1
Agriculture	473,971	65
Urban	62,220	9
Water	60,665	8
Unknown	100	<1
Total	725,595	100

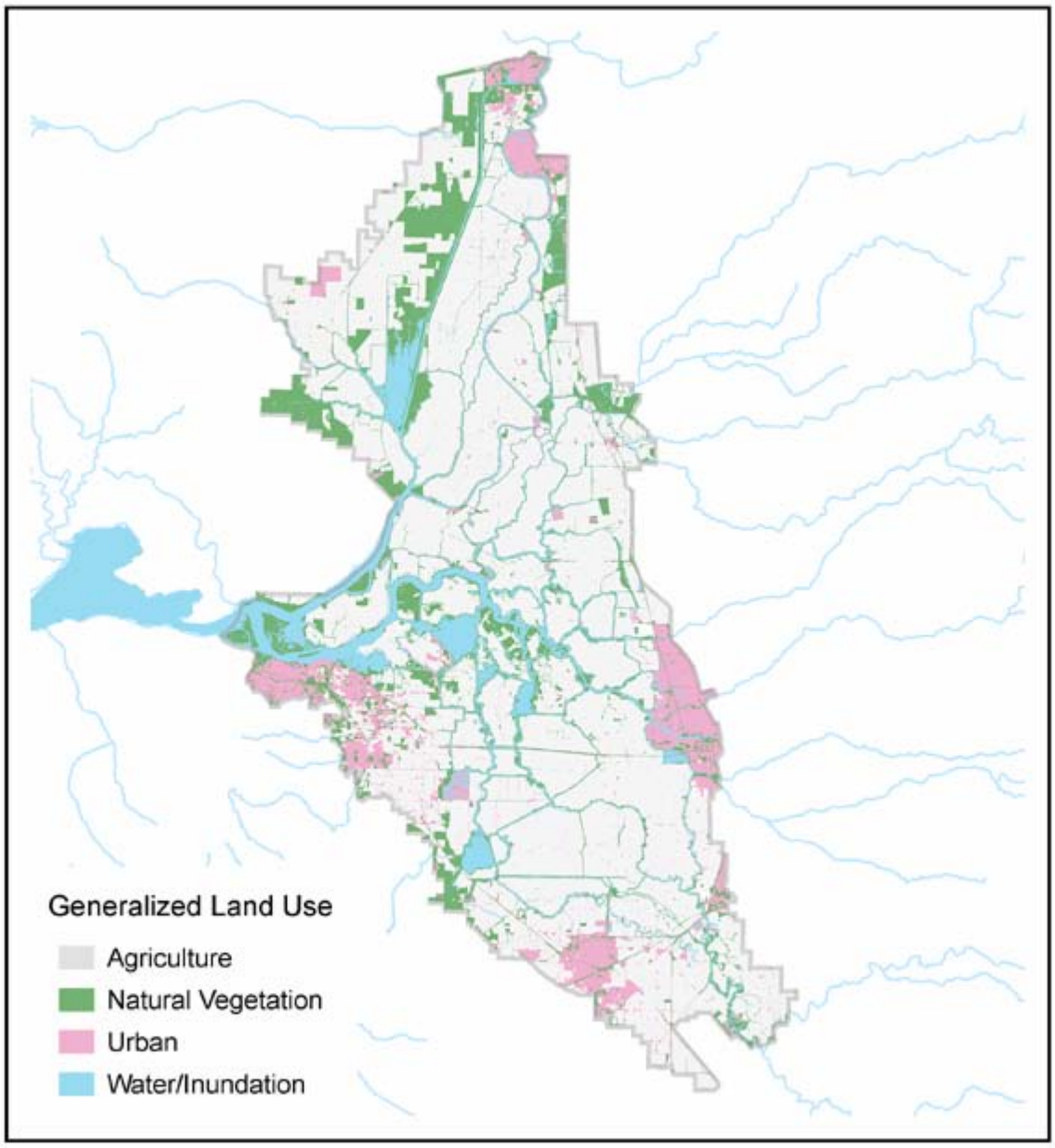

Figure 11. Broad categories of land use based on the land use coding in the map

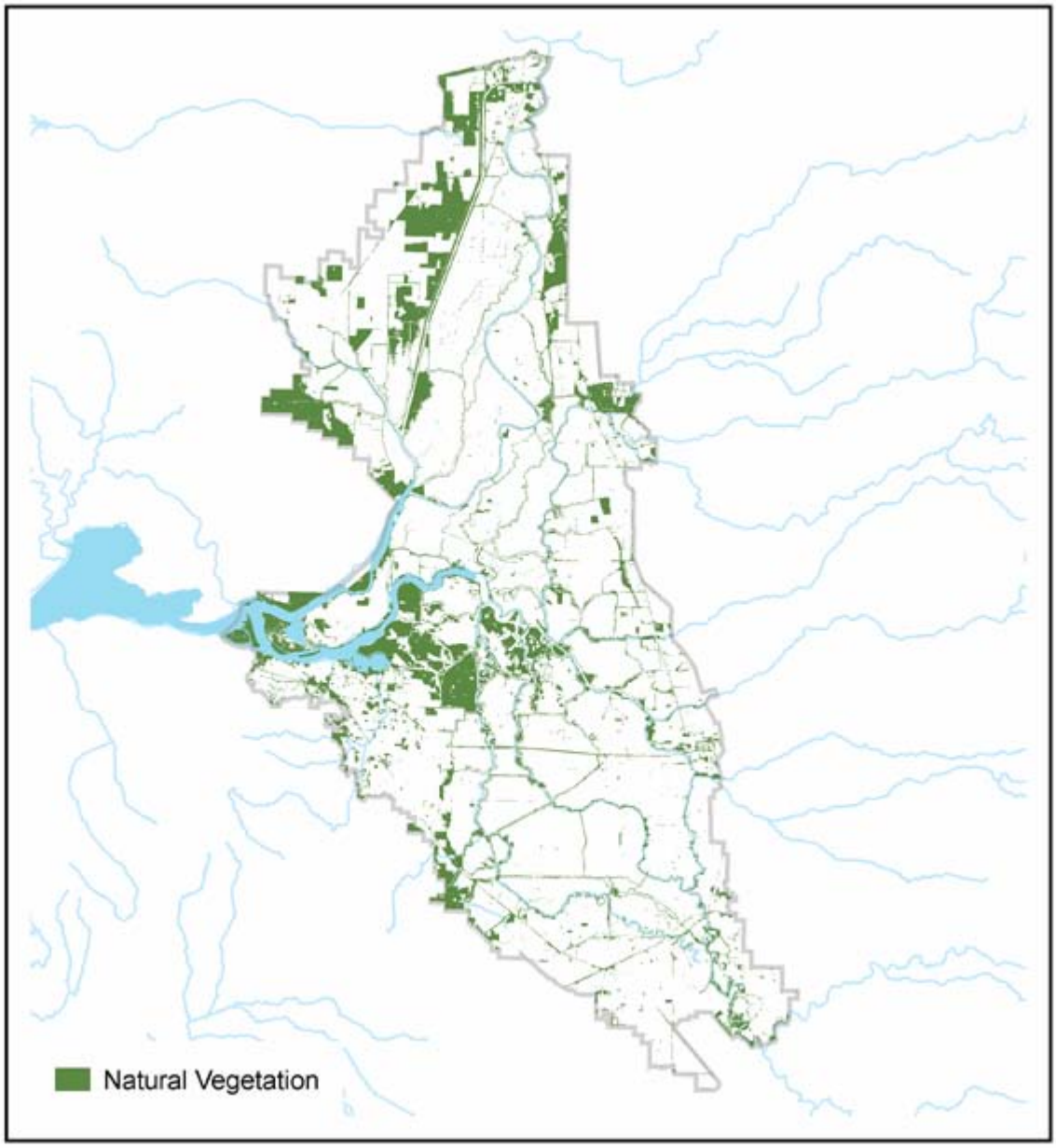

Figure 12. All areas of natural vegetation types as coded in the vegetation field

Vegetation Classification vs. Map Classification and Crosswalks

The concept of a crosswalk. The term “crosswalk” is commonly used in classification and mapping, referring to the development of relationships between different classification systems. The need for crosswalks arises when there is more than one classification system in use for a given area. It is important to note that crosswalks are never exactly precise. Assuming that classifications arise independently, the meaning of one classification unit may not always completely encompass or be nested within the other classification unit(s) to which it is being related. Choices need to be made about those classification units that are partially included within two or more types of another classification system. For example, CWHR’s classification type of “Fresh Emergent Wetland” includes many associations and alliances of herbaceous vegetation in the National Vegetation Classification. The complexity and

uncertainty of such relationships arise not only from independent evolution of classifications, but also from their imprecise definitions, without quantitative rules for proper interpretation. The best crosswalks are those that have been developed with a good understanding of the meaning and definitions of each classification system.

The vegetation classification vs. the mapping classification. The primary crosswalk in this project is between the vegetation classification and the vegetation map classification (*i.e.*, the map legend). The vegetation classification is based on floristic data collected in the field from stands that are independent of scale, and so some types identified from the analysis (alliances, associations or phases) may be below the minimum mapping unit. Such types are not included in the map classification. A more detailed map (*i.e.*, with a smaller mmu) might be able to include these types, however, it would require finer resolution (and very expensive) imagery.

Other differences between the two classifications arise because the differences between similar vegetation types are not discernible, no matter how good the imagery. Thus, some classified vegetation types can't be mapped to the finest level of the vegetation classification, and mapping units are an aggregation of these finer levels [*e.g.,* the *Cornus sericea - Salix lasiolepis / (Phragmites australis)* mapping unit combines both the *Cornus sericea - Salix lasiolepis* and *Cornus sericea - Salix lasiolepis / Phragmites australis* associations]. In some cases, often based on information from their own reconnaissance, the photo interpreters are able to discern types that were not sampled sufficiently, and so were not classified to the finest level (*e.g.*, the *Salix gooddingii / Rubus discolor* mapping unit).

Unique characteristics of the Delta, including its highly disturbed nature and the linearity of the patches of vegetation on levee banks, result in the need for mixed vegetation mapping units, just to meet the minimum mapping unit size. An example would be a long polygon of arroyo willow interspersed with below-mmu patches of pure Himalaya berry or California wild rose. Field crews would not see this as a homogeneous stand, and each patch would not be mapped by itself. For this example, the *Salix lasiolepis* - Mixed brambles *(Rosa californica - Vitis californica - Rubus discolor)* mapping unit would be used.

Finally, the mapping unit name sometimes contains additional species in parentheses [*e.g.,* the *Salix gooddingii - Populus fremontii* Association vs. the *Salix gooddingii - Populus fremontii - (Quercus lobata - Salix exigua - Rubus discolor)* mapping unit]. Species in parentheses may or may not be present, but are listed to better describe the mapping unit.

The crosswalk in Appendix E relates the vegetation classification produced in this project (which follows the National Vegetation Classification system as expressed for California in Sawyer and Keeler-Wolf 1995) to the mapping classification.

Other crosswalks. The crosswalk in Appendix F relates the mapping classification to the California Wildlife Habitat Relationships or CWHR (Mayer and Laudenslayer 1988).

Table 6 shows some of the relationships between the habitat types used in the CALFED Bay-Delta Program Multi-Species Conservation Strategy/Natural Communities Conservation Plan (MSCS/NCCP), the habitat types used in the Ecosystem Restoration Program Plan (ERPP), and the mapping categories used in the California Central Valley Wetlands and Riparian GIS.

Crosswalking the MSCS Habitats to the current vegetation types would be meaningless to impossible. MSCS types such as Tidal Perennial Aquatic, Lacustrine, and Tidal Perennial Aquatic are not necessarily vegetated, and other types, such as Valley/Foothill Riparian would crosswalk to numerous vegetation types, while some vegetation types would crosswalk back to more than one MSCS type (many-to-many relationships).

Table 6. Relationship of ERPP Habitats in the Delta Regional Area to other types

Relationship of ERPP Habitats in the Delta Regional Area to MSCS Habitats (Adapted from: CALFED (ERPP Vol. I) 2000) **and to California Central Valley Wetlands and Riparian GIS Map Categories**[1]		
MSCS/NCCP Habitat	ERPP Habitat	California Central Valley Wetlands and Riparian GIS Map Category in which the ERPP Habitat generally is included:
Tidal Perennial Aquatic	Tidal Perennial Aquatic	Open Water
Tidal Perennial Aquatic	Shoal	Open Water
Lacustrine	Nontidal Perennial Aquatic (deep open water)	Open Water
Lacustrine	Nontidal Perennial Aquatic (shallow open water)	Open Water
Tidal Perennial Aquatic	Delta Sloughs	Open Water
Tidal Perennial Aquatic	Midchannel Islands	Permanently Flooded Palustrine Emergents , Riparian Woody, Grass
Valley Riverine Aquatic[2]		
Valley/Foothill Riparian[3]		
Tidal Freshwater Emergent		
Tidal Freshwater Emergent	Fresh Emergent Wetland (tidal)	Permanently Flooded Palustrine Emergents
Nontidal Freshwater Permanent Emergent	Fresh Emergent Wetland (nontidal)	Permanently Flooded Palustrine Emergents
Natural Seasonal Wetland	Seasonal Wetland	Seasonally Flooded Palustrine Emergents, Grass
Managed Seasonal Wetland		
Valley Riverine Aquatic	Riparian and Riverine Aquatic	Riparian Woody
Valley/Foothill Riparian		
Inland Dune Scrub	Inland Dune Scrub	Grass, Other, Barren, Riparian Woody
Grassland	Perennial Grassland	Grass
Upland Cropland	Agricultural Lands[4]	Flooded Agriculture, Seasonally Flooded Agriculture, Non-Flooded Agriculture, Orchards/Vineyards
Seasonally Flooded Agricultural Land		
none[5]	Freshwater Fish Habitat	Open Water, Seasonally Flooded Palustrine Emergents, Permanently Flooded Palustrine Emergents, Riparian Woody

none[5]	Essential Fish Habitat	Open Water, Seasonally Flooded Palustrine Emergents, Permanently Flooded Palustrine Emergents, Riparian Woody

[1]This table is not designed to show the relationship of MSCS habitats to California Central Valley Wetlands and Riparian GIS Map Categories.

[2]The MSCS does not relate Valley Riverine Aquatic habitat to Midchannel Islands—perhaps because the MSCS specifies that Valley Riverine Aquatic habitat does not include tidally influenced areas. Although the Midchannel Islands are in tidal areas, some of them support woody riparian species and the associated shaded riverine aquatic habitat.

[3]The MSCS does not specifically relate Valley/Foothill Riparian habitat to the ERPP Riparian and Riverine Aquatic habitat. However, riparian vegetation is present on some Midchannel Islands.

[4]This category is not equivalent to the term Wildlife Friendly Agriculture, for which the ERP has specific targets. Whenever the management features prescribed in the Delta Regional Ecosystem Restoration ImplementationPlan (DRERIP) are committed to in perpetuity to be undertaken on agricultural lands they will be defined as “Wildlife Friendly Agricultural Land.”

[5]The MSCS addresses the dynamic environmental factors that are important to fish in the “NCCP Fish Groups” section of the MSCS, rather than in its “NCCP Habitats” section.

Source: Bay Delta Branch, CDFG.

Accuracy Assessment

Due to the three-year gap between the May 2002 aerial photos used for mapping much of the project site and the 2005 field sampling, several stands had undergone substantial change (for example, see Figures 13 and 14). In some cases, this produced a disparity between attribution by the photo interpreters and what was documented in the field. Many of these disparities could not be resolved, and so these AA points were eliminated from the accuracy assessment.

Figure 13. 2002 Imagery of Middle River.
Note that the main channel east of the bridge is mostly clear of water hyacinth (*Eichhornia crassipes*). Purple dots indicate location of photograph and sample point shown in next photo.

Figure 14. 2005 Ground photo of Middle River
View is looking east from bridge over Middle River showing increase in water hyacinth from 2002 aerial imagery.

The overall accuracy of the map was nearly 89%, while the average accuracy score per vegetation type was 83% (Table 7). Eleven of the 59 types assessed did not meet the National Vegetation Mapping Standards of 80% accuracy. It is notable that none of the types with less than 80% accuracy had sufficient sample size to adequately assess true accuracy. Usually at least 9 samples are needed to attain moderate certainty (Meidinger 2003). Conversely, all types represented by 9 or more samples attained greater than 80% accuracy.

Table 7. Summary of accuracy assessment

AIS Code	AIS Name	Number of Samples	Samples Used	Total Score Points	% Score
1321	Alnus rhombifolia / Salix exigua (Rosa californica)	8	6	24	80.0
1340	Box Elder Acer negundo	1	1	5	100.0
1350	California Walnut Juglans californica	2	2	4	40.0
1360	Fremont Cottonwood Populus fremontii	8	8	35	87.5
1380	Black Willow Salix gooddingii	11	11	53	96.4
1381	Salix gooddingii / wetland herbs	2	2	9	90.0
1382	Salix gooddingii - Populus fremontii - (Quercus lobata-Salix exigua-Rubus discolor)	26	26	124	95.4
1383	Salix gooddingii - Quercus lobata / Wetland Herbs	4	4	16	80.0

AIS Code	AIS Name	Number of Samples	Samples Used	Total Score Points	% Score
1384	Salix gooddingii/Rubus discolor	3	3	15	100.0
2110	Coast Live Oak Quercus agrifolia	5	5	21	84.0
2230	Valley Oak Quercus lobata	7	7	30	85.7
2231	Quercus lobata / Rosa californica (Rubus discolor - Salix lasiolepis / Carex spp.)	5	5	24	96.0
2232	Quercus lobata - Acer negundo	4	4	20	100.0
2233	Quercus lobata - Alnus rhombifolia (Salix lasiolepis - Populus fremontii - Quercus agrifolia)	1	0		n/a
3211	Baccharis pilularis / Annual Grasses & Herbs	3	3	4	26.7
3410	Blackberry Rubus Discolor	10	8	38	95.0
3420	California Wild Rose Rosa californica	2	1	1	20.0
3440	California Dogwood Cornus sericea	2	1	0	0.0
3442	Cornus sericea - Salix lasiolepis / (Phragmites australis)	11	11	44	80.0
3460	Arroyo Willow Salix lasiolepis	10	8	30	75.0
3461	Salix lasiolepis - Mixed brambles (Rosa californica - Vitis californica - Rubus discolor)	25	21	98	93.3
3462	Salix lasiolepis - (Cornus sericea) / Scirpus* spp.-(Phragmites australis - Typha spp.) complex unit	4	4	20	100.0
3480	Narrow-leaf Willow Salix exigua	3	3	15	100.0
3481	Salix exigua - (Salix lasiolepis - Rubus discolor - Rosa californica)	10	10	50	100.0
4211	Distichlis spicata - Annual Grasses	2	2	10	100.0
4310	Giant Cane Arundo donax	5	5	25	100.0
4320	Creeping Wild Rye Grass Leymus triticoides	1	0		n/a
4340	Broad-leaf Cattail Typha latifolia	5	4	17	85.0
4402	Vernal Pools	2	2	10	100.0
4501	Mixed Scirpus Mapping Unit	3	3	15	100.0
4502	Mixed Scirpus / Floating Aquatics (Hydrocotyle-Eichhornia) Complex	7	7	35	100.0
4503	Mixed Scirpus/ Submerged Aquatics (Egeria-Cabomba-Myriophyllum spp.) complex	6	6	28	93.3
4511	Scirpus acutus Pure	22	21	93	88.6
4513	Scirpus acutus -Typha latifolia	17	16	69	86.3
4514	Scirpus acutus - (Typha latifolia) - Phragmites australis	18	18	83	92.2
4520	California Bulrush Scirpus californicus	3	3	15	100.0
4522	Scirpus californicus - Scirpus acutus	1	1	5	100.0
4530	American Bulrush Scirpus americanus	1	0		n/a
4630	Common Reed Phragmites australis	6	6	19	63.3
4701	Ruderal Herbaceous Grasses & Forbs	12	11	46	83.6
4710	California Annual Grasslands - Herbaceous	13	11	53	96.4
4720	Italian Rye-grass Lolium multiflorum	2	2	10	100.0
4730	Polypogon maritimus (Rabbitsfoot grass) monspeliensis	1	1	5	100.0
5120	Poison Hemlock Conium maculatum Alliance	3	3	11	73.3
5204	Managed alkali wetland (Crypsis grass)	1	1	3	60.0
5206	Scirpus spp. in managed wetlands	4	4	20	100.0

AIS Code	AIS Name	Number of Samples	Samples Used	Total Score Points	% Score
5301	Smartweed Polygonum spp. - Mixed Forbs	1	1	1	20.0
5411	Ludwigia peploides	3	2	10	100.0
5420	Horsetail Equisetum spp.	1	1	5	100.0
5502	Allenrolfea occidentalis Mapping Unit	3	3	15	100.0
5503	Suaeda moquinii-(Lasthenia californica) Mapping unit	4	4	19	95.0
5511	Frankenia salina - Distichlis spicata	1	1	5	100.0
5520	Pickleweed Salicornia virginica	1	1	5	100.0
5530	Perennial Pepperweed Lepidium latifolium	3	1	4	80.0
6101	Generic Floating Aquatics	3	3	15	100.0
6211	Brazilian Waterweed Egeria -Myriophyllum Submerged	12	6	30	100.0
7000	Algae	6	5	9	36.0
9000	water	1	0		n/a
9200	Agriculture	4	4	20	100.0
9300	Exotic Vegetation Stands	9	9	44	97.8
9310	Eucalyptus	1	1	3	60.0
9400	Sparsely or Unvegetated Areas; Abandoned orchards	1	1	5	100.0
9401	Levee Rock Riprap	4	1	0	0.0
9402	Salt scalds and associated sparse vegetation	1	0		n/a
9800	Water	3	0		n/a
	Totals	364	325	1442	
	Overall accuracy of all samples assessed (1,442 points out of possible 325x5=1,625)				**88.7**
	Average accuracy by type of the 59 types at least partially assessed				**83.3**
	Of the 59 types checked for accuracy: 48 types met or exceeded 80% accuracy 2 types had greater than 70 but less than 80% accuracy (light gray shading) 9 types fell below 70% (dark gray shading)				

*Note: AIS used the name *Scirpus* in the map classification, whereas we have used the revised name, *Schoenoplectus* in the vegetation classification.

Photo interpretation of the area covered by the 1-foot imagery is likely more accurate than that covered by the 1-meter imagery (see Figure 15). However, we did not test the accuracy of mapping in the different areas.

After the accuracy assessment was completed, DFG provided AIS the complete accuracy assessment (Appendix G) and comments to help them to correct types that they had mis-attributed. AIS incorporated these corrections into the final map. See page 9 of Appendix D for a summary of AIS's efforts to address the accuracy problems.

Figure 15. Comparison of the 2002 1-foot imagery and the 2005 1-meter imagery

Assessment of the Associated Mapping Efforts

Appendix H presents a comparison between the mapping approach used in this study and the approach used for mapping the Suisun Marsh in Solano County, California, which is further downstream than the Legal Delta. In general, this comparison shows that the minimum mapping unit can regularly be set at 0.5 acre for both the 1:9600 and 1:12000 digital orthophoto approach. This would be useful in representing the typically small riparian stringers and other wetlands. The Delta project benefited from the experience of the Suisun project, in that firm guidelines for minimum dimensions of linear features to be mapped were established based on problems encountered with the Suisun project. Establishing these rules allowed for consistent interpretation of these features throughout the project area. Although the average polygon size for the Delta project was smaller than for the Suisun project, this is not necessarily useful. The Suisun project, probably because of inexperienced delineators, tended to be over-delineated, and many of the delineations didn't reflect true vegetation patterns. Comparatively, all levels of the Delta project were run more efficiently, which equated to less time consumed on a per unit (polygon) basis.

Diagnostic Vegetation Key and Descriptions

Table 8 contains the key for distinguishing the classified vegetation types. Due to the diversity of vegetation in the fine-scale mapping area, and to avoid an excessively long document, a series of paired statements (or couplets) was not developed for each option. Instead, sets of characteristics with choices beneath them are provided. The key will first lead the user to the general options, and the individual selections for the vegetation associations will be listed beneath these options. The user will need to work through the numbered list of types from the more general to the most specific options until the best fit is reached. The choices are identified by a combination of alphanumeric codes, using capital letters, numerals, upper- and lowercase letters, and decimal points to distinguish the different key levels. The most basic, general levels in the key are on the left side of the alphanumeric code, and the most specific are on the right side. This coding system in the key relates to a series of left indentations. Thus, down the left-hand side of the pages are the major groupings; nested within them are the sub-groupings. The preliminary key will direct you to the major groups, such as forest/woodland, shrubland, and herbaceous, with the more

specific choices beneath them. The more specific lists within these are generally based on presence/absence or dominance/sub-dominance of species until arriving at the optimum choice. ***Please note: since there may be more than two alternatives in a group, be sure to work through all of the options in a list before you decide on the best choice.***

Vegetation descriptions follow the key, in which the alliances and associations are nested within the following groupings: tree-overstory (forest/woodland), shrub-overstory, and herbaceous. The key and descriptions hopefully will afford further refinement to the understanding of the project area's vegetation, both from the standpoint of classification and mapping.

Table 8. Key for distinguishing classified vegetation types in the Delta

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KEY FOR DISTINGUISHING CLASSIFIED VEGETATION TYPES IN THE DELTA

Class A. Vegetation with an overstory of trees (at least 5 m tall). Absolute tree canopy cover is generally greater than 10%, but occasionally may be less than 10% over a denser understory of shrub and/or herbaceous species. If the latter, trees are evenly distributed across the stand and are ecologically significant members of the stand (stand is thus "characterized" by trees, even if not "dominated" by them) = **Tree-Overstory Vegetation**

Class B. Vegetation characterized by woody shrubs or subshrubs in the canopy. Tree species, if present, generally total less than 10% absolute cover. Herbaceous species may total higher cover than shrubs. Shrubs are usually at least 10% cover, except for Iodine bush *(Allenrolfea occidentalis)* and Mojave seablite *(Suaeda moquinii)*, which may have cover as low as 5% = **Shrub-Overstory Vegetation**

Class C. Vegetation characterized by non-woody, herbaceous species or perennial subshrubs in the canopy including grass, graminoid, and broad-leaved herbaceous species. Shrubs, if present, usually comprise <10% absolute cover. Trees, if present, generally compose <5% absolute cover = **Herbaceous Vegetation**

Class A. Tree-Overstory Vegetation

Group I. Woodlands and forests characterized by evergreen (non-winter deciduous) trees.

I.A. Overstory is dominated by one or more species of the non-native tree, Eucalyptus (*Eucalyptus*)…

***Eucalyptus* Alliance**

I.B. Overstory is dominated by coast live oak (*Quercus agrifolia*). In the Delta, largely represented by a phase of an unknown association characterized by *Quercus agrifolia/Equisetum hyemale…*

***Quercus agrifolia* Alliance**

Group II. Woodlands and forests characterized by winter-deciduous species.

II.A. Overstory is dominated by non-native trees.

IIA.1. Tree-of-Heaven *(Ailanthus altissima)* dominates the overstory. In the Delta, these are planted groves…

***Ailanthus altissima* Alliance**

IIA.2. Black locust *(Robinia pseudoacacia)* dominates the overstory. In the Delta, these are planted groves...

***Robinia pseudoacacia* Alliance**

II.B. Overstory is dominated by native trees.

IIB.1. White alder *(Alnus rhombifolia)* comprises 10% or more cover in these stands. Other major woody species may include willows (*Salix* spp.), which may have significantly higher cover than white alder, but not other hardwood trees such as valley oak *(Quercus lobata)…*

***Alnus rhombifolia* Alliance**

IIB1.a. White alder *(Alnus rhombifolia*) is typically the strongly dominant tree, with the presence of narrowleaf willow *(Salix exigua)* and California wild rose *(Rosa californica)* at 1% or greater; no red-osier dogwood *(Cornus sericea)* present…

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

Two phases of this Association occur in the Delta, one with a significant amount of narrowleaf willow *(Salix exigua)* in the tree or shrub layer, and the other without much narrowleaf willow but with an understory containing California wild rose *(Rosa californica)…*

***Alnus rhombifolia / Salix exigua* phase**
***Alnus rhombifolia / Rosa californica* phase**

IIB1.b. White alder *(Alnus rhombifolia*) is typically the strongly dominant tree with an understory of red-osier dogwood *(Cornus sericea).* Arroyo willow *(Salix lasiolepis)* may be a dominant in the shrub layer…

***Alnus rhombifolia / Cornus sericea* Provisional Association**

One phase of this association is present in the Delta, characterized by over 10% cover of both shining willow *(Salix lucida)* and red-osier dogwood *(Cornus sericea)…*

***Alnus rhombifolia / Salix lucida-Cornus sericea* phase**

IIB1.c. White alder *(Alnus rhombifolia*) is typically the strongly dominant tree, and narrowleaf willow *(Salix exigua),* California wild rose *(Rosa californica),* and red-osier dogwood *(Cornus sericea)* are not significant in the understory…

***Alnus rhombifolia* Association**

IIB.2. Oregon ash (*Fraxinus latifolia*) makes up more than 50% of the overstory tree canopy…

***Fraxinus latifolia* Alliance**

IIB.3. Box-elder (*Acer negundo*) dominates the tree layer or codominates with Oregon ash (*Fraxinus latifolia*), Fremont cottonwood *(Populus fremontii)*, or Goodding's willow *(Salix gooddingii).* Valley oak has 5% or less cover…

***Acer negundo* Alliance**

IIB3.a. Box-elder (*Acer negundo*) dominates the tree layer or codominates with Oregon ash (*Fraxinus latifolia*) or Fremont cottonwood *(Populus fremontii)*, and Goodding's willow *(Salix gooddingii)* is present…

***Acer negundo - Salix gooddingii* Provisional Association**

IIB.4. Northern California Black Walnut hybrids *(Juglans X hindsii)* strongly dominate the overstory…

***Juglans X hindsii* Alliance**

IIB.5. Fremont cottonwood *(Populus fremontii)* is the sole dominant or is strongly dominant over white alder *(Alnus rhombifolia),* and Goodding's willow *(Salix gooddingii)* is absent…

***Populus fremontii* Alliance**

IIB.6. Valley oak *(Quercus lobata)* is the sole dominant in the overstory or it codominates the overstory with box-elder *(Acer negundo),* white alder *(Alnus rhombifolia)*, Oregon ash *(Fraxinus latifolia)*, Fremont cottonwood *(Populus fremontii)*, or California sycamore *(Platanus racemosa)…*

***Quercus lobata* Alliance**

IIB6.a. Valley oak *(Quercus lobata)* is the sole dominant in the overstory or it codominates the overstory with Fremont cottonwood *(Populus fremontii)* or Oregon ash *(Fraxinus latifolia).* Himalaya berry *(Rubus discolor)* usually dominates the understory, although when absent it is replaced by California wild rose *(Rosa californica)* or Pacific blackberry *(Rubus ursinus)* …

***Quercus lobata / Rubus discolor* Association**

Two phases of this association occur in the Delta, one in which California wild rose *(Rosa californica)* is present in equal or greater cover than Pacific blackberry *(Rubus ursinus).* The second phase must have at least 5% cover of Santa Barbara sedge *(Carex barbarae)* and either wild rose or Pacific blackberry are present*…*

***Quercus lobata / Rosa californica* phase**
***Quercus lobata / Rubus discolor / Carex barbarae* phase**

IIB6.b. Valley oak *(Quercus lobata)* occurs as the dominant species, with box elder *(Acer negundo)* as a codominant or subdominant…

***Quercus lobata - Acer negundo* Provisional Association**

IIB6.c. Valley oak *(Quercus lobata)* generally occurs at 20% cover and white alder *(Alnus rhombifolia)* is present but averages >5% cover...

***Quercus lobata - Alnus rhombifolia* Association**

IIB.6.d. Valley oak *(Quercus lobata)* and Oregon ash *(Fraxinus latifolia)* generally codominate, although the latter may have low cover. White alder

(Alnus rhombifolia) and box elder *(Acer negundo)* is largely absent. California grape *(Vitis californica)* averages 10% cover, but may be absent…

***Quercus lobata - Fraxinus latifolia / Vitis californica* Association**

In addition there is one phase of this association in the Delta, in which the California grape *(Vitis californica)* is largely absent.

***Quercus lobata - Fraxinus latifolia* phase**

IIB.7. One or more willow species are the primary tree(s) in the riparian overstory. If Goodding's willow *(Salix gooddingii)* and Fremont cottonwood *(Populus fremontii)* are present, then either may dominate. (Note: although most willows may be considered shrubs in this area, they can also be tall enough to be identified as tree willows and therefore are included in both the tree overstory key and the shrub overstory portions of this key. However, other true trees in this section (IIB) take precedence over the usual shrub-like narrowleaf willow (*Salix exigua)* and arroyo willow (*Salix lasiolepis)* in this portion of the key).

IIB7.a. The stand is strongly dominated (over 40% cover) by shining willow *(Salix lucida)* with no other strong dominants; most stands have high cover of Cornus sericea as an understory shrub…

***Salix lucida* Alliance**
(Classified into shrubland for mapping purposes)

IIB7.b. Goodding's willow *(Salix gooddingii)* has the highest cover in the tree layer; stands that do not classify into one of the three described associations are typically strongly dominated by *S. gooddingii* and are classified to Alliance level only…

***Salix gooddingii* Alliance**

IIB7b.1. Goodding's willow *(Salix gooddingii)* dominates the tree layer and there is no woody understory, just wetland herbaceous plants…

***Salix gooddingii* / wetland herb Provisional Association**

IIB7b.2. Goodding's willow *(Salix gooddingii)* is the dominant tree or may codominate with valley oak *(Quercus lobata).* Stands may rarely have Fremont cottonwood *(Populus fremontii)* as a codominant. The understory is characterized by Bermuda grass *(Cynodon dactylon),* ryegrass *(Lolium multiflorum),* willow-herbs *(Polygonum* spp.*)*, cocklebur *(Xanthium* sp.*)*, and other wetland species…

***Salix gooddingii - Quercus lobata* / wetland herb Provisional Association**

IIB7b.3. Either Goodding's willow *(Salix gooddingii)* or Fremont cottonwood *(Populus fremontii)* dominate, and understory species do not include wetland herbs listed in IIB7b.2…

***Salix gooddingii - Populus fremontii* Association**

IIB7.c. Narrowleaf willow *(Salix exigua)* is the dominant shrub/tree species, or it may be replaced by arroyo willow *(Salix lasiolepis),* or both may be present. If only arroyo willow is present, then Himalaya berry *(Rubus discolor)* is over 5%

cover. If red-osier dogwood *(Cornus sericea)* has > 10% cover, see red-osier dogwood shrub alliance...

***Salix exigua* Alliance**
(Classified into shrubland for mapping purposes)

IIB7c.1 Narrowleaf willow *(Salix exigua)* is the dominant shrub/tree species, or it may be replaced by arroyo willow *(Salix lasiolepis),* or both may be present. If only arroyo willow is present, then Himalaya berry *(Rubus discolor)* is over 5% cover

***Salix exigua - (Salix lasiolepis)- Rubus discolor* Association**

This association has two phases in the Delta, one in which arroyo willow and Himalaya berry are largely absent but California wild rose codominates with narrowleaf willow, and the other in which arroyo willow and Himalaya berry codominate…

***Salix exigua - Rosa californica* Phase**
***Salix lasiolepis - Rubus discolor* Phase**

IIB7.d. Arroyo willow *(Salix lasiolepis)* cover is over 50% and no other willows are dominant or subdominant, and Himalaya berry *(Rubus discolor)* is less than 5% cover…

***Salix lasiolepis* Alliance**
***Salix lasiolepis* Great Valley Provisional Association**

Class B. Shrub-Overstory Vegetation

I.A. One or more willow species *(Salix spp.)* dominate the shrub layer, generally considered to be 5 m or less in height. (Note: although most willows may be considered shrubs in this area, they can also be tall enough to be identified as tree willows and therefore are included in both the tree overstory key and the shrub overstory portions of this key.)…

IA.1. The stand is strongly dominated (over 40% cover) by shining willow *(Salix lucida)* with no other strong dominants…

***Salix lucida* Alliance**
(Classified into shrubland for mapping purposes)

IA.2. Narrowleaf willow *(Salix exigua)* is the dominant shrub species, or it may be replaced by arroyo willow *(Salix lasiolepis),* or both may be present. If only arroyo willow is present, then Himalaya berry *(Rubus discolor)* is over 5% cover. If red-osier dogwood *(Cornus sericea)* has > 10% cover, see red-osier dogwood alliance...

***Salix exigua* Alliance**
(Classified into shrubland for mapping purposes)

IA2.i. Narrowleaf willow *(Salix exigua)* is the dominant shrub species, or it may be replaced by arroyo willow *(Salix lasiolepis),* or both may be present. If only arroyo willow is present, then Himalaya berry *(Rubus discolor)* is over 5% cover

***Salix exigua - (Salix lasiolepis)- Rubus discolor* Association**

This association has two phases in the Delta, one in which arroyo willow and Himalaya berry are largely absent but California wild rose codominates with narrowleaf willow, and the other in which arroyo willow and Himalaya berry codominate…

***Salix exigua - Rosa californica* Phase**
***Salix lasiolepis - Rubus discolor* Phase**

IA.3. Arroyo willow *(Salix lasiolepis)* cover is over 50% and no other willows are dominant or subdominant, and Himalaya berry *(Rubus discolor)* is less than 5% cover…

***Salix lasiolepis* Great Valley Provisional Alliance**
(Classified into shrubland for mapping purposes)

I.B. Silver bush lupine *(Lupinus albifrons)* is the most prevalent species in the overstory shrub layer, which may be very sparse, represented locally by the …

***Lupinus albifrons* Antioch Dunes Association**

I.C. Coyote bush *(Baccharis pilularis)* dominates the shrub layer or codominates with arroyo willow *(Salix lasiolepis)* or Himalaya berry *(Rubus discolor)…*

***Baccharis pilularis* Alliance**

I.C.1. Coyote bush dominates the shrub layer, with an understory of annual grasses and herbs…

***Baccharis pilularis* / Annual Grass-Herb Association**

I.D. Himalaya berry *(Rubus discolor)* is the sole dominant of the shrub layer…

***Rubus discolor* Alliance**

I.E. California wild rose *(Rosa californica)* is the sole dominant of the shrub layer…

***Rosa californica* Alliance**

I.F. Elderberry *(Sambucus mexicana)* dominates the shrub layer…

***Sambucus mexicana* Alliance**

I.G. Red-osier dogwood *(Cornus sericea)* dominates the shrub layer or codominates it with shrubby arroyo willow *(Salix lasiolepis)* or narrowleaf willow *(Salix exigua)*…

***Cornus sericea* Alliance**

IG.1. Red-osier dogwood *(Cornus sericea)* codominates the shrub layer with narrowleaf willow *(Salix exigua).* Shining willow *(Salix lucida)* may also codominate…

***Cornus sericea - Salix exigua* Provisional Association**

IG.2. Red-osier dogwood *(Cornus sericea)* codominates the shrub layer with arroyo willow *(Salix lasiolepis)…*

***Cornus sericea - Salix lasiolepis* Association**

This association has one phase in the Delta, characterized by the occurrence of common reed *(Phragmites australis)…*

***Cornus sericea-Salix lasiolepis / Phragmites australis* Phase**

I.H. Buttonwillow (*Cephalanthus occidentalis)* strongly dominates the shrub layer or codominates with Goodding's willow *(Salix gooddingii)* or Himalaya berry *(Rubus discolor)…*
***Cephalanthus occidentalis* Alliance**

I.I Deer brush *(Lotus scoparius)* is the most prevalent species in the shrub layer.

I.I.1. Occasional in weedy, sandy areas throughout Delta…
***Lotus scoparius* Alliance**

I.I.2 Occurs at Antioch Dunes…
***Lotus scoparius* Antioch Dunes Association**

I.J. Iodine bush *(Allenrolfea occidentalis)* comprises at least 5% cover…
***Allenrolfea occidentalis* Alliance**

I.K. Mojave seablite *(Suaeda moquinii)* comprises at least 5% cover…
***Suaeda moquinii* Alliance**

Class C. Herbaceous Vegetation

Group I: Vegetation dominated by grasses or grass-like species, and lacking a significant overstory of trees or shrubs.

I.A. Tall (generally 1.5 meter or more) grass and grass-like species are dominant …

IA.1. Stands have 30% or more cover of common reed…
***Phragmites australis* Alliance**

IA.2. Stands have at least 10% cover of hardstem bulrush (*Schoenoplectus acutus).* When giant bulrush *(Schoenoplectus californicus)* is present, it is much lower in cover than hardstem bulrush. Broadleaf cattail *(Typha latifolia)* occasionally codominates…
***Schoenoplectus acutus - (Schoenoplectus tabernaemontani)* Alliance**

IA2.a. Hardstem bulrush (*Schoenoplectus acutus)* makes up 50% or more cover, and no other species has greater than 5% cover…
***Schoenoplectus acutus* – pure Provisional Association**

IA2.b.Stands have at least 10% cover of hardstem bulrush (*Schoenoplectus acutus)* and narrowleaf cattail *(Typha angustifolia)* comprises at least 5% cover…
***Schoenoplectus acutus - Typha angustifolia* Provisional Association**

IA2.c. Broadleaf cattail *(Typha latifolia)* comprises 10% or greater cover, but not more than the cover of hardstem bulrush (*Schoenoplectus acutus).* No common reed *(Phragmites australis*) present…
***Schoenoplectus acutus - Typha latifolia* Provisional Association**

IA2.d. Hardstem bulrush (*Schoenoplectus acutus)* comprises 10% or greater cover, and common reed *(Phragmites australis*) is present. Broadleaf cattail *(Typha latifolia)* may be present…

Schoenoplectus acutus - Phragmites australis **Association**

IA2.e. Hardstem bulrush (*Schoenoplectus acutus)* comprises 10% or greater cover, and cocklebur *(Xanthium strumarium)* is present…

Schoenoplectus acutus - Xanthium strumarium **Provisional Association**

IA.3. Stands generally have at least 10% cover of giant bulrush *(Schoenoplectus californicus)*. If hardstem bulrush (*Schoenoplectus acutus)* is present, it has less cover than, or is a codominant with, giant bulrush…

Schoenoplectus californicus **Alliance**

IA3.a. Giant bulrush *(Schoenoplectus californicus)* generally codominates the stand with water hyacinth *(Eichhornia crassipes)* only…

Schoenoplectus californicus - Eichhornia crassipes **Provisional Association**

IA3.b. Hardstem bulrush (*Schoenoplectus acutus)* is subdominant or codominant with giant bulrush...

Schoenoplectus californicus - Schoenoplectus acutus **Provisional Association**

IA.4. Stand is dominated by American bulrush (*Schoenoplectus americanus*)…

Schoenoplectus americanus **Alliance**

IA.5. Stand has over 50% cover of broadleaf cattail *(Typha latifolia)* and common reed (*Phragmites australis*) is not present…

Typha latifolia **Alliance**

IA5.a. Stand has over 50% cover of broadleaf cattail *(Typha latifolia)* and common reed (Phragmites australis) is not present. Water fern *(Azolla filiculoides)* may be abundant…

Typha latifolia **- pure Provisional Association**

IA.6. Narrowleaf cattail *(Typha angustifolia)* is the sole dominant above 0.5 m tall…

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

IA.6.a. Narrowleaf cattail *(Typha angustifolia)* and saltgrass *(Distichlis spicata)* are the only species with at least 5% cover…

Typha angustifolia - Distichlis spicata **Provisional Association**

IA.7. Giant reed *(Arundo donax)* is the dominant species…

Arundo donax **Alliance**

IA.8. Pampas grass *(Cortaderia selloana, C. jubata)* is the dominant species…

Cortaderia (selloana, jubata) **Alliance**

I.B. Shorter (generally <1.5 meter or more) grass and grass-like species are dominants, with no grasses taller than 1.5 meter making up 20% or more cover (if this is the case, see IA)…

IB.1. Stands have at least 10% cover of tufted hairgrass…
***Deschampsia caespitosa* Tidal Herbaceous Alliance**

IB1.a. Stands have at least 10% cover of tufted hairgrass and the rare species Mason's Lilaeopsis *(Lilaeopsis masonii)* is present…
***Deschampsia caespitosa - Lilaeopsis masonii* Provisional Association**

IB.2. Santa Barbara sedge *(Carex barbarae)* is the dominant species…
***Carex barbarae* Alliance**

IB.3. Creeping wildrye *(Leymus triticoides)* is dominant species over 0.5m tall…
***Leymus triticoides* Alliance**

IB.4. Toadrush *(Juncus bufonius)* is the dominant species*…*
***Juncus bufonius* non-classified stands**

IB.5. Saltgrass *(Distichlis spicata)* has over 20% cover and perennial pepperweed *(Lepidium latifolium)*, if present, is lower in cover…
***Distichlis spicata* Alliance**

IB5.a. Saltgrass *(Distichlis spicata)* has over 20% cover and occurs with a high cover of non-native annual grasses such as soft chess *(Bromus hordeaceus),* ryegrass *(Lolium multiflorum),* rabbitsfoot grass *(Polypogon monspeliensis)* or rattail fescue *(Vulpia myuros)…*
***Distichlis spicata* - Annual grasses Provisional Association**

IB5.b. Saltgrass *(Distichlis spicata)* is codominant with pickleweed *(Salicornia virginica)…*
***Distichlis spicata - Salicornia virginica* Provisional Association**

IB5.c. Saltgrass *(Distichlis spicata)* is codominant with Baltic rush (*Juncus balticus*)…
***Distichlis spicata - Juncus spp.* Provisional Association**

IB.6. Annual ryegrass *(Lolium multiflorum)* is the dominant grass species and saltgrass *(Distichlis spicata)* is not above 10% cover. Some annual herbs may attain equal or higher cover depending on the time of year…
***Lolium multiflorum* Alliance**

IB6.a. Annual ryegrass *(Lolium multiflorum)* is the dominant species or is codominant with non-native brome species *(Bromus hordeaceus, B. diandrus),* and bindweed *(Convolvulus arvensis)* is present…
***Lolium multiflorum - Convolvulus arvensis* Provisional Association**

IB6.b. Annual ryegrass *(Lolium multiflorum)* is the dominant species and owl's-clover *(Triphysaria eriantha)* is generally codominant. An important indicator species is shining pepper-grass *(Lepidium nitidum)…*

***Lolium multiflorum - Triphysaria eriantha* Association (Witham 2003)**

IB6.c. Annual ryegrass *(Lolium multiflorum)* is the dominant species and smooth goldfields (*Lasthenia glabrata* ssp. *glabrata*) is generally codominant. The popcornflower *Plagiobothrys stipitatus* var. *stipitatus* is an important indicator of this type…

***Lolium multiflorum - Lasthenia glabrata* ssp. *glabrata* Association (Witham 2003)**

IB6.d. Annual ryegrass *(Lolium multiflorum)* is the dominant species and yellowcarpet *(Blennosperma nanum)* is an important indicator species***…***

***Lolium multiflorum - Blennosperma nanum* Association (Witham 2003)**

IB.7. Stands strongly dominated by Bermuda grass *(Cynodon dactylon)*, or codominant with Birdfoot trefoil *(Lotus corniculatus)…*

***Cynodon dactylon* Alliance**

IB.8. Stands strongly dominated by upland annual introduced grasses including soft chess *(Bromus hordeaceus)*, ripgut brome *(B. diandrus)*, wild oat *(Avena fatua),* barley (*Hordeum* spp.), rattail fescue *(Vulpia myuros)…*

California Annual Grassland / Herbaceous Alliance

IB8.a. Stands largely dominated by soft chess *(Bromus hordeaceus)* and ripgut brome *(B. diandrus)…*

***Bromus diandrus - Bromus hordeaceus* Association Provisional Association**

IB.9. Stands characterized by annual or perennial species associated with managed wetlands, such as Dallis grass *(Paspalum distichum)*, barnyardgrass *(Echinochloa crus-galli),* picklegrass (*Crypsis* spp.), or umbrella sedge *(Cyperus eragrostis)*…

Managed wetland vegetation (non-specific introduced graminoid and forb mixed stands)

Group II. Vegetation dominated by annual or perennial forbs and lacking a significant overstory of trees or shrubs.

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

IIA.1. Water primrose *(Ludwigia peploides* ssp. *montevidensis, L. p.* ssp*. peploides,* or *Ludwigia hexapetala)* dominates the stand…

***Ludwigia (peploides)* Provisional Association**

IIA.2. Water Hyacinth *(Eichhornia crassipes)* dominates the stand…

***Eichhornia crassipes* Alliance**

IIA2.a. Water Hyacinth *(Eichhornia crassipes)* is the sole (or almost sole) plant present…

***Eichhornia crassipes* - pure Provisional Association**

IIA.3. Parrotfeather (*Myriophyllum* sp.), fanwort *(Cabomba caroliniana)* or Brazilian elodea *(Egeria densa)* comprise at least 10% of the stand, often with water fern *(Azolla filiculoides)* or floating mats of algae dominating the stand…

***Egeria – Cabomba - Myriophyllum* spp. Provisional Association (temporarily placed within the National Classification under *Myriophyllum* spp. Permanently Flooded Herbaceous Alliance)**

IIA.4. Waterweed *(Potamogeton pectinatus)* dominates the stand …

***Potamogeton pectinatus* Provisional Association (temporarily placed within the National Classification under *Potamogeton* spp. - *Ceratophyllum* spp. - *Elodea* spp. Alliance)**

IIA.5. Water pennywort *(Hydrocotyle ranunculoides)* dominates the stand…

***Hydrocotyle ranunculoides* Alliance**

IIA.6. Valley arrowhead *(Sagittaria sanfordii)* dominates the stand …

***Sagittaria sanfordii* Alliance**

IIA.7. Water smartweed *(Polygonum amphibium)* or willow weed *(P. lapathifolium)* comprise over 50% cover of the stand…

***Polygonum amphibium (P. lapathifolium)* Provisional Association (temporarily placed within the National Classification under *Polygonum* spp. - Mixed Forbs Temporarily Flooded Herbaceous Alliance)**

IIA.8. Large mosquito-fern (*Azolla filiculoides*) is the sole dominant species…

***Azolla filiculoides* Alliance**

II.B. Annual or perennial forb vegetation not dominated by floating or submerged aquatic plants.

IIB.1. Vegetation dominated primarily by native species.

IIB1.a. Alkali heath *(Frankenia salina)* is the dominant species or codominates with saltgrass *(Distichlis spicata)*…

***Frankenia salina* Alliance**

IIB1.b. Pickleweed *(Salicornia virginica)* is the dominant species…

***Salicornia virginica* Alliance**

IIB1b.i. Pickleweed *(Salicornia virginica)* is the dominant species, with saltgrass *(Distichlis spicata)* at < 30% relative cover…

***Salicornia virginica - Distichlis spicata* Provisional Association**

IIB1b.ii. Vegetation dominated by pickleweed with an ephemeral annual component of brass buttons (Cotula coronopifolia), which may cover enough ground to codominate in the early growing season…

***Salicornia virginica - Cotula coronopifolia* Provisional Association**

IIB1.c. Scouring rush *(Equisetum arvense, E. hyemale)* is the sole dominant species over 0.5 meters in height…

***Equisetum (arvense, variegatum, hyemale)* Alliance**

IIB1.d. Whitehead navarretia *(Navarretia bakeri*) is the dominant spring annual (at bottom of drying vernal pools)…

Vernal pool stands

IIB1.e. California goldfields *(Lasthenia californica)* is the dominant early spring annual (associated with alkaline clay soils on west side of study area)…

***Lasthenia californica* Alliance**

IIB.2. Vegetation dominated primarily by non-native species.

IIB2.a. Fennel *(Foeniculum vulgare)* is the dominant species…

***Foeniculum vulgare* Alliance**

IIB2.b. Perennial pepperweed *(Lepidium latifolium)* is the dominant species…

***Lepidium latifolium* Alliance**

IIB2b.i. Perennial pepperweed *(Lepidium latifolium)* is the dominant species, with pickleweed *(Salicornia virginica)* and saltgrass *(Distichlis spicata)* present at less than 30% relative cover each…

***Lepidium latifolium - Salicornia virginica - Distichlis spicata* Provisional Alliance**

IIB2.c. Tall weedy forbs such as mustard (*Brassica* sp.), poison-hemlock (*Conium maculatum)*, and milk thistle *(Silybum marianum)* either dominate or codominate the stand…

Ruderal herbaceous (non-native annual forbland)

Tree-Overstory Vegetation

Acer negundo Alliance
Box-elder Alliance

The *Acer negundo* Alliance is represented in the Delta by one association, the *Acer negundo - Salix gooddingii* Provisional Association. In addition to this association, three sampled stands were not classified to association level (SSJD0048, 0097, and 0113). Two of these three stands were dominated by *Acer negundo* and one was codominated by *Populus fremontii*. All had low cover of *Quercus lobata* (3-5%), and none supported *Salix gooddingii,* as in the one association described from the Delta. These stands possibly represent unnaturally modified stands where components of more natural stands are missing.

Rank: G5S2

Global Distribution
This alliance is widespread throughout North America with both temporarily flooded and seasonally flooded woodland alliance records from AL, AR? KY, TN, VA?, NM, CO, UT, AZ?, NM, ID, MT, SD, UT, and WY. Seasonally flooded forest alliance records are from mostly the east and southeastern US including: AL, AR, GA, IA, KY, LA, MD, MO, MS, OK, SC, SD?, TN, TX?, VA, WV

References
NatureServe (2006)

***Acer negundo* Alliance Only** **n=** 3

Stratum Code		Species Name	Con	Avg	Min	Max
Tree Overstory						
	QULO-t	*Quercus lobata*	100	4.0	3	5
	ACNE2-t	*Acer negundo*	67	24.0	16	55
	POFR2-t	*Populus fremontii*	33	12.0	35	35
	JUCAH-t	*Juglans hindsii*	33	1.0	3	3
	ALRH2-t	*Alnus rhombifolia*	33	0.0	1	1
Tree Understory						
	ACNE2-m	*Acer negundo*	67	13.0	5	35
	ACNE2-l	*Acer negundo*	67	1.0	0.2	2
	FRLA-m	*Fraxinus latifolia*	33	5.0	15	15
Shrub						
	ROCA2-m	*Rosa californica*	100	10.0	0.2	20
	VICA5-m	*Vitis californica*	67	35.0	36	70
	RUUR-m	*Rubus ursinus*	67	12.0	15	20
	SAEX-m	*Salix exigua*	33	7.0	20	20
	RUDI2-m	*Rubus discolor*	33	4.0	13	13
	RIAU-m	*Ribes aureum*	33	1.0	2	2
	SALA6-m	*Salix lasiolepis*	33	1.0	3	3
	CEOC2-m	*Cephalanthus occidentalis*	33	0.0	0.2	0.2

	SAME5-t	*Sambucus mexicana*	33	0.0	1	1
Herb						
	APCA-l	*Apocynum cannabinum*	33	0.0	0.2	0.2
	CABA4-l	*Carex barbarae*	33	0.0	1	1
	CYER-l	*Cyperus eragrostis*	33	0.0	0.2	0.2
	JUEF-l	*Juncus effusus*	33	0.0	0.2	0.2
	LEMNA-l	*Lemna*	33	0.0	0.2	0.2
	LUPEM-l	*Ludwigia peploides ssp. montevidensis*	33	0.0	0.2	0.2
	URDI-m	*Urtica dioica*	33	0.0	0.2	0.2

***Acer negundo - Salix gooddingii* Provisional Association**
Box-elder - Goodding's willow Provisional Association

Local Vegetation Description
Stands of the *Acer negundo - Salix gooddingii* Provisional Association form an open to dense overstory tree layer (15-85%, mean 49%), with trees 5-10m tall. The shrub layer is also open to dense (6-75%, mean 32%) with low shrubs at 1-5m and tall shrubs/understory trees at 2-10m tall. The herbaceous layer is open (<1-20%, mean 7%) at 0-2m tall. Total vegetation cover is 50-95%, with a mean of 76.0%.

In this association, *Acer negundo* dominates the overstory tree layer at 10 to 85% cover, and *Salix gooddingii* is present or subdominant in the overstory and often shows regeneration with < 1% cover in the understory. *Acer negundo* frequently shows regeneration in the understory at < 1 to 5% cover. *Rubus ursinus* is frequent in the shrub layer at 2 to 60% cover. *Salix exigua* and *Vitis californica* are occasionally present at low cover.

This association was sampled in the following EMUs: North Delta, South Delta

Site Impacts
Two samples of this association had low impacts from non-native plant species. Recreational and trail use impacts ranged from low to moderate in four samples.

Samples Used to Describe Association (n=9)
Rapid Assessment(s): SSJD0071, 0072, 0073, 0099, 0100, 0101, 0102, 0279, 0374

Rank: G2S2

Global Distribution
This association is only known from the Sacramento-San Joaquin River Delta. It appears to be relatively rare locally.

References
NatureServe (2006) for the alliance. Other references include Sawyer et al. (2006 MS).

***Acer negundo - Salix gooddingii* Provisional Association** **n=** 9

Stratum	Code	Species Name	Con	Avg	Min	Max
Tree Overstory						
	ACNE2-t	*Acer negundo*	100	35.0	10	85
	SAGO-t	*Salix gooddingii*	89	8.0	4	20
	POFR2-t	*Populus fremontii*	67	9.0	0.2	26
	FRLA-t	*Fraxinus latifolia*	44	8.0	1	40
	QULO-t	*Quercus lobata*	33	0.0	0.2	1
	JUCAH-t	*Juglans hindsii*	22	0.0	0.2	3
Tree Understory						
	ACNE2-m	*Acer negundo*	89	2.0	0.2	5
	SAGO-m	*Salix gooddingii*	56	0.0	0.2	0.2
	FRLA-m	*Fraxinus latifolia*	33	0.0	1	2
Shrub						
	RUUR-m	*Rubus ursinus*	89	17.0	2	60
	SAEX-m	*Salix exigua*	44	2.0	3	5
	VICA5-m	*Vitis californica*	44	1.0	1	5
	ROCA2-m	*Rosa californica*	22	1.0	0.2	5
	SALA6-m	*Salix lasiolepis*	22	1.0	3	10
	SALU-t	*Salix lucida*	22	1.0	0.2	5
	CEOC2-m	*Cephalanthus occidentalis*	22	0.0	0.2	1
Herb						
	CABA4-l	*Carex barbarae*	44	2.0	0.2	10
	LASE-m	*Lactuca serriola*	33	0.0	0.2	0.2
	GAAP2-l	*Galium aparine*	22	1.0	0.2	10
	URDI-m	*Urtica dioica*	22	1.0	0.2	10
	ARDO3-m	*Artemisia douglasiana*	22	0.0	0.2	0.2
	XAST-l	*Xanthium strumarium*	22	0.0	0.2	0.2

***Ailanthus altissima* Alliance**
Tree-of-Heaven Alliance

The *Ailanthus altissima* Alliance was not adequately sampled in the Delta, but reconnaissance-level data collected from one stand validate its existence there. The non-native, invasive species *Ailanthus altissima* was the sole dominant species in the tree layer, with *Rubus discolor* dominating the understory layer. This alliance also occurs in AR, TN, KY, WV, VA, NC and PA (NatureServe 2006).

References
NatureServe (2006)

Alnus rhombifolia Alliance
White alder Alliance

The *Alnus rhombifolia* Alliance is represented in the Delta by the *Alnus rhombifolia* Association, *Alnus rhombifolia / Cornus sericea* Provisional Association and the *Alnus rhombifolia / Salix exigua (- Rosa californica)* Association.

Alnus rhombifolia Association
White alder Association

Stands of the *Alnus rhombifolia* Association were dominated by *Alnus rhombifolia* at up to 60% cover. If not in the overstory tree layer, *Alnus rhombifolia* was present in the understory tree layer at 15% cover or more. Other trees present included *Fraxinus latifolia, Acer negundo, Quercus lobata, Platanus racemosa, Populus fremontii,* and hybrids of *Juglans hindsii*, but not at cover levels high enough to place them in other alliances. The shrub layer often had *Rubus discolor* at <1 to 25% cover. The herb layer often contained *Carex barbarae*, at up to 68% cover.

This association was sampled in the following EMU: North Delta

Site Impacts
Nine stands had low to moderate impacts from non-native plant species. The non-native species with the highest cover was generally *Rubus discolor*.

Samples Used to Describe Association (n=10)
SSJD0197, 0199, 0211, 0247, 0249, 0250, 0253, 0255, 0265, 0336

Rank: G4S4

Global Distribution
The alliance is found throughout CA, mostly in foothill and lower montane locations. It is also known from ID, OR, WA, and northern Baja California.

References
NatureServe (2006), Sawyer et al. (2006 MS)

***Alnus rhombifolia* Association** **n=** 10

Stratum Code	Species Name	Con	Avg	Min	Max
Tree Overstory					
ALRH2-t	*Alnus rhombifolia*	100	30.0	5	60
FRLA-t	*Fraxinus latifolia*	90	6.0	0.2	33
ACNE2-t	*Acer negundo*	80	1.0	0.2	5
POFR2-t	*Populus fremontii*	40	5.0	0.2	22
JUCAH-t	*Juglans hindsii*	40	4.0	0.2	28
QULO-t	*Quercus lobata*	40	1.0	0.2	5
SAGO-t	*Salix gooddingii*	30	1.0	0.2	5

	PLRA-t	*Platanus racemosa*	30	0.0	0.2	2
	QUAG-t	*Quercus agrifolia*	30	0.0	0.2	1
	PLATA-t	*Platanus sp.*	20	0.0	0.2	0.2
	ROPS-t	*Robinia pseudoacacia*	20	0.0	0.2	4
Tree Understory						
	ALRH2-m	*Alnus rhombifolia*	60	3.0	0.2	15
	FRLA-m	*Fraxinus latifolia*	50	1.0	0.2	5
	ACNE2-m	*Acer negundo*	50	0.0	0.2	2
	JUCAH-m	*Juglans hindsii*	20	0.0	0.2	0.2
	QULO-m	*Quercus lobata*	20	0.0	0.2	2
Shrub						
	RUDI2-m	*Rubus discolor*	60	5.0	1	25
	SALA6-m	*Salix lasiolepis*	50	8.0	0.2	35
	CEOC2-m	*Cephalanthus occidentalis*	50	1.0	1	5
	ROCA2-m	*Rosa californica*	40	1.0	0.2	5
	RUUR-m	*Rubus ursinus*	30	0.0	1	3
	SAEX-m	*Salix exigua*	30	0.0	0.2	4
	VICA5-m	*Vitis californica*	30	0.0	0.2	0.2
Herb						
	CABA4-l	*Carex barbarae*	60	10.0	0.2	68
	BRDI3-l	*Bromus diandrus*	40	3.0	2	9
	ARDO3-m	*Artemisia douglasiana*	40	1.0	0.2	5
	CYDA-l	*Cynodon dactylon*	30	1.0	0.2	10
	EQHYA2-m	*Equisetum hyemale* ssp. *affine*	20	2.0	0.2	18
	EUOC4-m	*Euthamia occidentalis*	20	0.0	0.2	0.2
	JUEF-l	*Juncus effusus*	20	0.0	0.2	0.2
	LELA2-m	*Lepidium latifolium*	20	0.0	0.2	1
	LYAM-l	*Lycopus americanus*	20	0.0	0.2	1
	SIMA3-m	*Silybum marianum*	20	0.0	0.2	1

***Alnus rhombifolia / Cornus sericea* Provisional Association**
White alder / Red-osier dogwood Provisional Association

Local Vegetation Description
Stands of the *Alnus rhombifolia / Cornus sericea* Provisional Association form an open to intermittent overstory tree layer (11-60%, mean 28%), with trees 5-20m tall. The shrub layer is also open to dense (13-95%, mean 61%) with low shrubs at 1-5m and tall shrubs/understory trees at 2-10m tall. The herbaceous layer is open (<1-2%, mean 1%) at 0-2m tall. Total vegetation cover is 70-95%, with a mean of 83%.

In this association, *Alnus rhombifolia* dominates the overstory tree layer at 15 to 60% cover. The shrub layer is characterized by *Cornus sericea* at 5 to 30% cover. *Salix lasiolepis* was present in all samples at 5-30% cover, but was not as good an indicator of the association as *C. sericea*. *Salix exigua* and *Vitis californica* are often present.

Three of the nine samples were placed in the *Alnus rhombifolia / Salix lucida - Cornus sericea* phase, in which *Salix lucida* and *Cornus sericea* codominate the shrub layer.

At least 4 of the 9 sampled locations were on mid-channel islands.

This association was sampled in the following EMU: North Delta

Site Impacts
Only one sample of this association had impacts from non-native plant species, and that was at a low intensity.

Samples Used to Describe Association (n=9)
Rapid Assessment(s): SSJD0055, 0079, 0081, 0087, 0093, 0169, 0176, 0226, 0296

Rank: G2S2

Global Distribution
So far as known, this association is restricted to the Delta portion of the California Central Valley. Other associations of this alliance have been defined in the Sierra Foothills (Potter 2005) and in southern California (Evens and San 2005, Klein and Evens 2005, Keeler-Wolf and Evens 2006), but none contain *Cornus sericea* as a constant. This association is likely to be a local endemic to the Delta area and is particularly characteristic of mid-channel islands with little competition from invasive exotics, suggesting that it is relatively threatened.

References
No specific references.

***Alnus rhombifolia / Cornus sericea* Provisional Association** **n=** 9

Stratum	Code	Species Name	Con	Avg	Min	Max
Tree Overstory						
	ALRH2-t	*Alnus rhombifolia*	100	27.0	11	58
	POFR2-t	*Populus fremontii*	56	1.0	0.2	5
	QULO-t	*Quercus lobata*	33	1.0	0.2	8
	SAGO-t	*Salix gooddingii*	22	2.0	2	20
	ACNE2-t	*Acer negundo*	22	0.0	2	2
	FRLA-t	*Fraxinus latifolia*	22	0.0	0.2	0.2
Shrub						
	SALA6-m	*Salix lasiolepis*	100	27.0	3	44
	COSE16-m	*Cornus sericea*	100	21.0	2	30
	VICA5-m	*Vitis californica*	67	2.0	0.2	10
	SAEX-m	*Salix exigua*	67	1.0	0.2	3
	RUDI2-m	*Rubus discolor*	56	2.0	0.2	8
	SALU-t	*Salix lucida*	44	7.0	0.2	20
	RUUR-m	*Rubus ursinus*	44	5.0	0.2	30
	CEOC2-m	*Cephalanthus occidentalis*	44	0.0	0.2	2
	ROCA2-m	*Rosa californica*	33	3.0	7	10
	FICA-m	*Ficus carica*	33	0.0	0.2	2
	HOMA4-m	*Hoita macrostachya*	33	0.0	0.2	1

Herb

JUNCU-l	*Juncus*	33	0.0	0.2	0.2
ASLE17-m	*Aster lentus*	22	0.0	0.2	0.2

***Alnus rhombifolia / Salix exigua (- Rosa californica)* Association**
White alder / Narrowleaf willow (- California wild rose) Association

Local Vegetation Description
Stands of the *Alnus rhombifolia / Salix exigua (- Rosa californica)* Association form an open to dense overstory tree layer (<1-80%, mean 17%), with trees 5-20m tall. The shrub layer is also open to dense (15-92%, mean 70%) with low shrubs at 0.5-5m and tall shrubs/understory trees at 2-15m tall. The herbaceous layer is open to dense (1-65%, mean 18%) at 0-5m tall. Total vegetation cover is 65-92%, with a mean of 81%.

In this association, *Alnus rhombifolia* generally dominates or characterizes the overstory tree layer at 10 to 80% cover. If not in the overstory tree layer, *Alnus rhombifolia* is present in the understory tree layer.

Two phases of this association were sampled in the Delta. The *Alnus rhombifolia / Salix exigua* phase (n=11) is characterized by the presence of *Salix exigua* in the understory at 2% to over 50%, but always at a greater cover than *Rosa californica,* which may be absent. The *Alnus rhombifolia / Rosa californica* phase (n=6) is characterized by the presence of *Rosa californica* at roughly the same cover range, but always at a greater cover than *Salix exigua,* which may be absent. The herb layer occasionally contains *Carex barbarae, Artemisia douglasiana,* and *Paspalum dilatatum*.

This association was sampled in the following EMUs: East Delta, North Delta

Site Impacts
Ten samples of this association had low to moderate impacts from non-native plant species. The most frequent non-native species is *Rubus discolor.* Low to moderate impacts from road/trail construction were noted in 5 samples.

Samples Used to Describe Association (n=17)
Rapid Assessment(s): SSJD0133, 0135, 0136, 0137, 0138, 0139, 0157, 0159, 0198, 0201, 0202, 0222, 0264, 0295, 0297, 0335, 0337

Rank: G3S3

Global Distribution
This association is also likely to be restricted to the lower Central Valley, primarily in the Delta area. No other associations of the White Alder alliance have been described for California with a high constancy of *Salix exigua* and *Rosa californica*. Potter (2005) describes an *A. rhombifolia/S. exigua* association from the Sierra Nevada at elevations from 1000 to 4660 ft. However, the species composition and the environmental characteristics are much more closely associated with steeper stream gradients and higher percentage of coarse materials in the soil profile than are present in this Delta association.

References
No specific references. See Potter's (2005) *A. rhombifolia/S. exigua* association for comparison.

***Alnus rhombifolia / Salix exigua (- Rosa californica)* Association n=** 17

Stratum	Code	Species Name	Con	Avg	Min	Max
Tree Overstory						
	ALRH2-t	*Alnus rhombifolia*	94	33.0	0.2	80
	ACNE2-t	*Acer negundo*	41	2.0	0.2	20
	SAGO-t	*Salix gooddingii*	41	1.0	0.2	8
	FRLA-t	*Fraxinus latifolia*	29	1.0	0.2	13
	JUCAH-t	*Juglans hindsii*	29	0.0	0.2	1
	QULO-t	*Quercus lobata*	24	0.0	0.2	2
Tree Understory						
	ALRH2-m	*Alnus rhombifolia*	53	5.0	0.2	25
	FRLA-m	*Fraxinus latifolia*	35	0.0	0.2	3
	ACNE2-m	*Acer negundo*	29	0.0	0.2	1
	SAGO-m	*Salix gooddingii*	24	0.0	0.2	1
Shrub						
	RUDI2-m	*Rubus discolor*	82	12.0	0.2	65
	SAEX-m	*Salix exigua*	76	15.0	1	53
	ROCA2-m	*Rosa californica*	76	10.0	0.2	60
	CEOC2-m	*Cephalanthus occidentalis*	59	1.0	0.2	10
	SALA6-m	*Salix lasiolepis*	53	3.0	0.2	20
	RUUR-m	*Rubus ursinus*	29	1.0	0.2	10
Herb						
	CABA4-l	*Carex barbarae*	47	6.0	0.2	60
	ARDO3-m	*Artemisia douglasiana*	35	1.0	0.2	12
	PADI3-m	*Paspalum dilatatum*	35	0.0	0.2	1
	SCCA-m	*Schoenoplectus californicus*	24	4.0	0.2	55
	CIVU-m	*Cirsium vulgare*	24	0.0	0.2	1
	JUEF-m	*Juncus effusus*	24	0.0	0.2	2
	JUEF-l	*Juncus effusus*	24	0.0	0.2	3

***Eucalyptus* spp. Alliance**
Eucalyptus species Alliance

The *Eucalyptus* spp. Alliance was not adequately sampled in the Delta, but reconnaissance-level data collected from two stands validate its existence there. In the Delta, the sole dominant tree layer species in the stands that were sampled (and observed) was the non-native, invasive species *Eucalyptus globulus,* represented by a mapping unit for this classification. This alliance occurs elsewhere in California; see the Manual of California Vegetation, Second Edition (Sawyer et al. 2006 MS) for more information.

References
Sawyer et al. (2006 MS)

***Fraxinus latifolia* Alliance**
Oregon ash Alliance

Local Vegetation Description
In the Delta, one sample (SSJD0364), in the North Delta EMU, was classified to the *Fraxinus latifolia* Alliance. In it, there is a dense overstory tree layer (70%), with trees 2-5m tall. The shrub layer is nearly absent, with just 1% cover. The herbaceous layer is open (13%). Total vegetation cover was 80%. *Fraxinus latifolia* dominates the overstory tree layer at 55%, with *Acer negundo* and *Salix gooddingii* present at 15 and 2% cover respectively. The herb layer is characterized by *Lepidium latifolium* and *Distichlis spicata* at 8 and 5% cover each.

Site Impacts
Impacts to this sample include competition from non-native plant species, channelization, and altered flood regime, all at low levels.

Rank: G4S3

Global Distribution
The alliance has been described for OR, WA, as well as CA. In addition to stands sampled in the Sierra Nevada foothills, unclassified stands have been observed in the North Coast Ranges along permanent creeks and rivers (Keeler-Wolf pers. obs. 2003).

References
For the alliance see NatureServe (2006). For other CA associations see Potter (2005).

***Fraxinus latifolia* Alliance only** **n=** 1

Stratum	Code	Species Name	Con	Avg	Min	Max
Tree Understory						
	FRLA-m	*Fraxinus latifolia*	100	55.0	55	55
	ACNE2-m	*Acer negundo*	100	15.0	15	15
	SAGO-m	*Salix gooddingii*	100	2.0	2	2
Shrub						
	SALA6-m	*Salix lasiolepis*	100	1.0	1	1
Herb						
	LELA2-m	*Lepidium latifolium*	100	8.0	8	8
	DISP-l	*Distichlis spicata*	100	5.0	5	5
	CYER-l	*Cyperus eragrostis*	100	0.0	0.2	0.2
	DAGL2-l	*Datisca glomerata*	100	0.0	0.2	0.2
	JUEF-l	*Juncus effusus*	100	0.0	0.2	0.2

***Juglans X hindsii* Alliance**
Northern California black walnut hybrids Alliance

Local Vegetation Description
One stand of *Juglans X hindsii* Alliance was sampled, in the East Delta EMU, and therefore no associations have been described. In the one sampled stand (SSJD0322), there is an intermittent overstory tree layer (55%), with trees 15-20m tall. The shrub layer is dense (95%) with low shrubs at 1-2m and tall shrubs/understory trees at 5-10m. The herbaceous layer is open (3%) at 0.5-1m tall. Total vegetation cover is 85%.

In this sample, *Juglans hindsii* dominates the overstory tree layer at 35% cover and *Populus fremontii* and *Quercus lobata* are present at 12 and 3% cover. *Juglans hindsii* is regenerating in the understory. The shrub layer is characterized by *Rubus discolor* at nearly 60% cover. The herb layer supports non-natives including *Conium maculatum* and natives including *Artemisia douglasiana* at very low cover.

On the Sacramento River, perhaps all of the *Juglans hindsii* are non-native hybrid backcrosses between cultivated walnuts and *Juglans hindsii*. Regeneration of these hybrids has been documented on periodically flooded terraces protected from anthropogenic disturbance (Harris 1987, Jones 1997, Tu 2000, Vaghti 2003).

Site Impacts
The sampled stand has moderate impacts from non-native plant species and low impacts from road/trail construction.

Rank: G1S1 (applies to native stands only, non-native stands are considered introduced and not ranked)

Global Distribution
The stands of native Hind's walnut are limited to 3 known historic locations. Much of the current distribution of the species is an augmentation based largely upon the use of Hind's walnut as rootstock for cultivated English walnuts (*Juglans regia*) in the Central Valley. Although the town of Walnut Grove in the Delta may have been the location of one of the native stands, it is most likely that the stand sampled is the result of adventive transport of seeds from orchard rootstock. Many of the riparian individuals of *Juglans hindsii* along the Sacramento and San Joaquin rivers and their associated sloughs and channels are also likely to be hybrids with non-native *Juglans major*. Approximately one quarter of the naturalized *J. hindsii* sampled by Kirk (2003) showed gene flow from *J. major*. Kirk concluded that naturalized populations of *J. californica* var. *hindsii* do not need to be conserved in order to maintain the genetic heritage of native *J. hindsii*.

References
Harris (1987), Jones (1997), Tu (2000), Vaghti (2003)

***Juglans X hindsii* Alliance only** **n=** 1

Stratum Code	Species Name	Con	Avg	Min	Max
Tree Overstory					
JUCAH-t	*Juglans hindsii*	100	35.0	35	35

	POFR2-t	*Populus fremontii*	100	12.0	12	12
	QULO-t	*Quercus lobata*	100	3.0	3	3
Tree Understory						
	JUCAH-m	*Juglans hindsii*	100	5.0	5	5
	FRLA-m	*Fraxinus latifolia*	100	0.0	0.2	0.2
Shrub						
	RUDI2-m	*Rubus discolor*	100	59.0	59	59
	SAEX-m	*Salix exigua*	100	15.0	15	15
	ROCA2-m	*Rosa californica*	100	10.0	10	10
	SALA6-m	*Salix lasiolepis*	100	5.0	5	5
	VICA5-m	*Vitis californica*	100	5.0	5	5
	SAME5-m	*Sambucus mexicana*	100	2.0	2	2
	TODI-m	*Toxicodendron diversilobum*	100	1.0	1	1
	RUUR-m	*Rubus ursinus*	100	0.0	0.2	0.2
Herb						
	COMA2-m	*Conium maculatum*	100	1.0	1	1
	CYDA-l	*Cynodon dactylon*	100	1.0	1	1
	ARDO3-m	*Artemisia douglasiana*	100	0.0	0.2	0.2
	BRNI-m	*Brassica nigra*	100	0.0	0.2	0.2
	CABA4-l	*Carex barbarae*	100	0.0	0.2	0.2
	URDI-m	*Urtica dioica*	100	0.0	0.2	0.2

***Populus fremontii* Alliance**
Fremont cottonwood Alliance

Local Vegetation Description
Three stands of the *Populus fremontii* Alliance were sampled in the East Delta, North Delta, and South Delta EMUs. No associations have been described. In the three sampled stands (SSJD0105, 0150, and 0156), there is an intermittent overstory tree layer (35-60%, mean 45%), with trees 20-35m tall. The shrub layer is open to intermittent (4-25%, mean 12%) with low shrubs at 1-5m and tall shrubs/understory trees at 5-15m tall. The herbaceous layer is open to intermittent (2-35%, mean 14%) at 0.5-1m tall. Total vegetation cover is 57-85%, with a mean of 76%.

In the sampled stands, *Populus fremontii* dominates the overstory tree layer at 35 to 45% cover. *Fraxinus latifolia, Alnus rhombifolia* and *Salix gooddingii* are regenerating in the understory. Shrub species are variable. The herb layer is characterized by low cover of *Artemisia douglasiana.*

The classification philosophy in this report is to include stands mixed with *P. fremontii* and *Salix gooddingii* as part of the *S. gooddingii* alliance (See that alliance for further discussion). The only stands classified as *P. fremontii* alliance in this study are those that are very strongly dominated by Fremont Cottonwood in the tree layer. This is in contrast to Vaghti (2003) where she classified mixed *P. fremontii* and *S. gooddingii* stands as part of the *P. fremontii* alliance.

Site Impacts
Two samples of this alliance had low impacts from non-native plant species.

Rank: G5S3

Global Distribution
This alliance is widespread in southwestern North America including AZ, CA, CO, Chihuahua MX and Sonora MX, NM, NV, TX, and UT. In California, the largest intact stands occur along the main stem of the Sacramento River between Redding and Colusa (Vaghti and Greco in press).

References
NatureServe (2006), Vaghti (2003), Vaghti and Greco (in press).

***Populus fremontii* Alliance only** **n=** 3

Stratum	Code	Species Name	Con	Avg	Min	Max
Tree Overstory						
	POFR2-t	*Populus fremontii*	100	40.0	35	45
	ALRH2-t	*Alnus rhombifolia*	67	2.0	1	5
	FRLA-t	*Fraxinus latifolia*	67	1.0	0.2	3
	ACNE2-t	*Acer negundo*	67	0.0	0.2	0.2
	SAGO-t	*Salix gooddingii*	67	0.0	0.2	1
	PLRA-t	*Platanus racemosa*	33	1.0	2	2
	QULO-t	*Quercus lobata*	33	1.0	2	2
	QUAG-t	*Quercus agrifolia*	33	0.0	0.2	0.2
	ROPS-t	*Robinia pseudoacacia*	33	0.0	0.2	0.2
Tree Understory						
	FRLA-m	*Fraxinus latifolia*	100	0.0	0.2	1
	ALRH2-m	*Alnus rhombifolia*	67	4.0	1	10
	SAGO-m	*Salix gooddingii*	67	0.0	0.2	1
	ACNE2-m	*Acer negundo*	33	0.0	0.2	0.2
	FRLA-l	*Fraxinus latifolia*	33	0.0	0.2	0.2
	POFR2-m	*Populus fremontii*	33	0.0	0.2	0.2
Shrub						
	RUUR-m	*Rubus ursinus*	67	1.0	0.2	2
	SAEX-m	*Salix exigua*	67	1.0	2	2
	CEOC2-m	*Cephalanthus occidentalis*	67	0.0	0.2	1
	VICA5-m	*Vitis californica*	33	14.0	43	43
	ROCA2-m	*Rosa californica*	33	2.0	7	7
	SALA6-m	*Salix lasiolepis*	33	1.0	3	3
	RUDI2-m	*Rubus discolor*	33	0.0	1	1
Herb						
	ARDO3-m	*Artemisia douglasiana*	100	1.0	0.2	2
	JUEF-l	*Juncus effusus*	67	2.0	0.2	7
	CABA4-l	*Carex barbarae*	33	2.0	5	5
	FOVU-m	*Foeniculum vulgare*	33	2.0	7	7
	PADI3-l	*Paspalum dilatatum*	33	2.0	5	5
	EQHYA2-m	*Equisetum hyemale* ssp. *affine*	33	1.0	2	2

	AVENA-m	*Avena*	33	0.0	0.2	0.2
	GALIU-l	*Galium*	33	0.0	0.2	0.2
	HEPU2-m	*Helenium puberulum*	33	0.0	0.2	0.2
	JUXI-m	*Juncus xiphioides*	33	0.0	1	1
	LETR5-l	*Leymus triticoides*	33	0.0	0.2	0.2
	PIMI3-m	*Piptatherum miliaceum*	33	0.0	0.2	0.2
	RUCR-m	*Rumex crispus*	33	0.0	0.2	0.2
	URDI-m	*Urtica dioica*	33	0.0	0.2	0.2
	XAST-l	*Xanthium strumarium*	33	0.0	1	1
Epiphyte						
	PHMA18-m	*Phoradendron*	33	0.0	1	1
	PHMA18-t	*Phoradendron*	33	0.0	0.2	0.2

***Quercus agrifolia* Alliance**
Coast live oak Alliance

Local Vegetation Description
Three stands of the *Quercus agrifolia* Alliance were sampled (SSJD0244, 0246, and 0254), all in the North Delta EMU. One provisional phase of an unknown association was classified. *Quercus agrifolia* forms an intermittent overstory tree layer (40-60%, mean 50%), with trees 10-15m tall. The shrub layer is open to intermittent (2-42%, mean 22%) with low shrubs at 0.5-2m and tall shrubs/understory trees at 2-10m. The herbaceous layer is open (22-25%, mean 24%) at 0-1m tall. Total vegetation cover is 6-90%, with a mean of 73%.

In this alliance, *Quercus agrifolia* dominates the overstory tree layer at 20 to 52% cover. *Quercus lobata* is constant with <1 to 20% cover, and *Populus fremontii* and *Fraxinus latifolia* sometimes occur at low cover. *Quercus agrifolia* and *Fraxinus latifolia* are regenerating in the understory. The shrub layer is variable and sometimes contains *Toxicodendron diversilobum, Rosa californica, Rubus ursinus* and *Vitis californica*. The herb layer is characterized by *Equisetum hyemale* at <1 to 20% cover; the two samples with 16 and 20% cover of *Equisetum* were put into the provisional *Quercus agrifolia/Equisetum hyemale* phase (n=2).

Site Impacts
All samples of this alliance had low impacts from non-native plant species. Non-native species with highest cover mainly include annual *Hordeum, Avena*, and *Bromus* species. Two samples had low impacts from road/trail construction.

Rank: G4S4

Global Distribution
The *Quercus agrifolia* Alliance is endemic to the California Floristic Province, where it is common in upland woodlands and forests from Sonoma and southern Mendocino counties south to NW Baja California (Sawyer et al. 2006 MS). It is not found in the Sierra Foothills, and the only sites it occupies in the Central Valley are in the Delta. Thus, these stands are somewhat unique for their distribution. The local stands are all in riparian settings.

References
Sawyer et al. (2006 MS)

***Quercus agrifolia* Alliance only** **n=** 3

Stratum	Code	Species Name	Con	Avg	Min	Max
Tree Overstory						
	QUAG-t	*Quercus agrifolia*	100	40.0	20	52
	QULO-t	*Quercus lobata*	100	10.0	0.2	20
	FRLA-t	*Fraxinus latifolia*	67	1.0	0.2	2
	POFR2-t	*Populus fremontii*	67	0.0	0.2	0.2
	ALRH2-t	*Alnus rhombifolia*	33	7.0	22	22
	ROPS-t	*Robinia pseudoacacia*	33	2.0	7	7
	PLRA-t	*Platanus racemosa*	33	0.0	1	1
Tree Understory						
	QUAG-l	*Quercus agrifolia*	100	1.0	0.2	1
	FRLA-m	*Fraxinus latifolia*	100	0.0	0.2	0.2
	QUAG-m	*Quercus agrifolia*	100	0.0	0.2	0.2
	JUCAH-m	*Juglans hindsii*	67	0.0	0.2	0.2
	ACNE2-m	*Acer negundo*	33	0.0	0.2	0.2
	POFR2-m	*Populus fremontii*	33	0.0	0.2	0.2
	QULO-m	*Quercus lobata*	33	0.0	0.2	0.2
	QULO-l	*Quercus lobata*	33	0.0	0.2	0.2
	ROPS-m	*Robinia pseudoacacia*	33	0.0	0.2	0.2
Shrub						
	ROCA2-m	*Rosa californica*	67	0.0	0.2	1
	RUUR-m	*Rubus ursinus*	67	0.0	0.2	1
	VICA5-m	*Vitis californica*	67	0.0	0.2	0.2
	TODI-m	*Toxicodendron diversilobum*	33	5.0	15	15
	CEOC2-m	*Cephalanthus occidentalis*	33	0.0	0.2	0.2
	SALA6-m	*Salix lasiolepis*	33	0.0	0.2	0.2
	VICA5-t	*Vitis californica*	33	0.0	0.2	0.2
Herb						
	EQHYA2-m	*Equisetum hyemale ssp. affine*	100	12.0	0.2	20
	CABA4-l	*Carex barbarae*	67	4.0	0.2	12
	BRDI3-l	*Bromus diandrus*	67	3.0	0.2	8
	ARDO3-m	*Artemisia douglasiana*	67	0.0	0.2	0.2
	GAAP2-l	*Galium aparine*	67	0.0	0.2	1
	HORDE-l	*Hordeum*	67	0.0	0.2	0.2
	CYDA-l	*Cynodon dactylon*	33	3.0	9	9
	ANCA14-l	*Anthriscus caucalis*	33	0.0	1	1
	AVENA-m	*Avena*	33	0.0	0.2	0.2
	AVFA-m	*Avena fatua*	33	0.0	1	1
	GLLE3-l	*Glycyrrhiza lepidota*	33	0.0	0.2	0.2
	LASE-m	*Lactuca serriola*	33	0.0	0.2	0.2
	LAJEC2-m	*Lathyrus jepsonii var. californicus*	33	0.0	0.2	0.2
	LELA2-m	*Lepidium latifolium*	33	0.0	0.2	0.2

***Quercus lobata* Alliance**
Valley oak Alliance

Local Vegetation Description

The *Quercus lobata* Alliance is represented in the Delta by the *Quercus lobata / Rubus discolor*, *Quercus lobata - Acer negundo*, *Quercus lobata - Alnus rhombifolia,* and *Quercus lobata - Fraxinus latifolia / Vitis californica* associations. In addition to these associations, four stands, which occurred in the East Delta, North Delta, and South Delta EMUs, were not classified to association level: SSJD0034, 0065, 0106, and 0252. These stands were dominated by *Quercus lobata* at 10-53% cover, with either a shrub understory dominated by *Salix lasiolepis* or codominated by *Cephalanthus occidentalis* and *Cornus sericea,* or simply an herb understory dominated by *Equisetum hymale* or non-native herbs.

Rank: G3S3

Global Distribution
This alliance is restricted to the California Floristic Province and ranges from Shasta and Humboldt Counties south to Kern and Los Angeles counties. It occurs in both upland and riparian settings. The latter is particularly well developed in the Central Valley (Sawyer et al. 2006 MS).

References
Sawyer et al. (2006 MS)

***Quercus lobata* Alliance only** **n=** 4

Stratum	Code	Species Name	Con	Avg	Min	Max
Tree Overstory						
	QULO-t	*Quercus lobata*	100	33.0	10	53
	PLATA-t	*Platanus*	25	0.0	1	1
	POFR2-t	*Populus fremontii*	25	0.0	0.2	0.2
Tree Understory						
	SAGO-m	*Salix gooddingii*	25	1.0	5	5
	QULO-m	*Quercus lobata*	25	0.0	0.2	0.2
	QULO-l	*Quercus lobata*	25	0.0	0.2	0.2
Shrub						
	COSE16-m	*Cornus sericea*	25	15.0	60	60
	CEOC2-m	*Cephalanthus occidentalis*	25	8.0	30	30
	SALA6-m	*Salix lasiolepis*	25	2.0	10	10
	VICA5-t	*Vitis californica*	25	1.0	5	5
	NIGL-m	*Nicotiana glauca*	25	0.0	2	2
	ROCA2-m	*Rosa californica*	25	0.0	1	1
	RUDI2-m	*Rubus discolor*	25	0.0	2	2
	RUUR-m	*Rubus ursinus*	25	0.0	1	1

	SAEX-m	*Salix exigua*	25	0.0	0.2	0.2
Herb						
	CABA4-l	*Carex barbarae*	25	4.0	15	15
	CYER-l	*Cyperus eragrostis*	25	3.0	13	13
	EQHYA2-m	*Equisetum hyemale* ssp. *affine*	25	3.0	11	11
	CYDA-l	*Cynodon dactylon*	25	2.0	9	9
	FOVU-m	*Foeniculum vulgare*	25	2.0	8	8
	SIMA3-m	*Silybum marianum*	25	2.0	10	10
	BRDI3-l	*Bromus diandrus*	25	1.0	5	5
	CAPY2-m	*Carduus pycnocephalus*	25	1.0	5	5
	HIIN3-m	*Hirschfeldia incana*	25	1.0	5	5
	XASP2-l	*Xanthium spinosum*	25	1.0	3	3
	AVFA-m	*Avena fatua*	25	0.0	0.2	0.2
	BRNI-m	*Brassica nigra*	25	0.0	0.2	0.2
	ERSE3-l	*Eremocarpus setigerus*	25	0.0	2	2
	LOTUS-l	*Lotus*	25	0.0	0.2	0.2
	LYAM-m	*Lycopus americanus*	25	0.0	1	1
	NICOT-l	*Nicotiana*	25	0.0	0.2	0.2
	PIEC-m	*Picris echioides*	25	0.0	0.2	0.2
	POLA4-l	*Polygonum lapathifolium*	25	0.0	0.2	0.2
	RUCO2-m	*Rumex conglomeratus*	25	0.0	0.2	0.2
	RUCR-m	*Rumex crispus*	25	0.0	0.2	0.2
	URDI-m	*Urtica dioica*	25	0.0	0.2	0.2
Epiphyte						
	PHMA18-m	*Phoradendron*	25	0.0	0.2	0.2

Quercus lobata / Rubus discolor **Association**
Valley oak / Himalaya berry Association

Local Vegetation Description

Stands of *Quercus lobata / Rubus discolor* Association form an open to dense overstory tree layer (10-80%, mean 40%), with trees 10-35m tall. The shrub layer is absent to dense (0-74%, mean 38%) with low shrubs at 0.5-5m and tall shrubs/understory trees at 1-15m tall. The herbaceous layer is also absent to dense (0.0-70%, mean 19%) at 0-2m tall. Total vegetation cover is 47-98%, with a mean of 81%.

In this association, *Quercus lobata* dominates the overstory tree layer at 10 to 70% cover. *Quercus lobata* is also often regenerating in the understory. The shrub layer is characterized by *Rubus discolor* at 1 to over 50% cover. The herb layer occasionally supports *Carex barbarae* at 2 to 70% cover.

Two phases of this association occur in the Delta. The *Quercus lobata / Rosa californica* phase (n=4) has *Rosa californica* at 5 to 90% cover, with less than 5% cover of *Rubus discolor* and no *Carex barbarae*. The *Quercus lobata / Rubus discolor / Carex barbarae* phase has *Rubus discolor* and *Rosa californica* at varying cover, but always supports *Carex barbarae,* at 2 to 70% cover (n=11).

This association was sampled in the following EMUs: North Delta, South Delta. It is the most common and widespread of the Valley oak associations in the Delta. Prior to the introduction of Himalaya berry, these stands were likely to have an understory characterized by native brambles such as *Rosa californica* and *Rubus ursinus*. Compared to the other associations of Valley oak, this type occurs on raised levees (natural and unnatural) and occurs, on average, farther away from the regular influence of flooding and year-round water associated with rivers and sloughs.

Site Impacts
Eighteen stands of this association had low to heavy impacts from non-native plant species. Non-native species with highest cover mainly include *Rubus discolor*, *Bromus diandrus* and *Lolium multiflorum*. Additional site impacts are road/trail construction, which was a low impact in 3 samples.

Samples Used to Describe Association (n=28)
Rapid Assessment(s): SSJD0001, 0015, 0016, 0017, 0020, 0021, 0023, 0025, 0027, 0028, 0038, 0039, 0040, 0061, 0110, 0119, 0121, 0122, 0124, 0153, 0155, 0185, 0216, 0225, 0257, 0280, 0326, 0327

Rank: G3S3

Global Distribution
This association is known only from the Delta, defined for the first time in this study. However, it is likely to occur elsewhere along rivers and streams in the Central Valley and up into the lower foothill belt. Stands summarized in Vaghti and Greco (in press) for the Sacramento River are similar to this association. Preliminary analysis of numerous *Q. lobata* alliance stands in the N Sierra Foothills suggests the same association occurs there (J. Evens and A. Klein, personal communication 2006).

References
Vaghti and Greco (in press)

***Quercus lobata* / *Rubus discolor* Association** **n=** 28

Stratum Code		Species Name	Con	Avg	Min	Max
Tree Overstory						
	QULO-t	*Quercus lobata*	96	34.0	10	70
	FRLA-t	*Fraxinus latifolia*	29	1.0	1	7
	JUCAH-t	*Juglans hindsii*	21	0.0	0.2	2
Tree Understory						
	QULO-m	*Quercus lobata*	75	3.0	0.2	25
	QULO-l	*Quercus lobata*	43	0.0	0.2	1
	SAGO-m	*Salix gooddingii*	21	0.0	0.2	1
Shrub						
	RUDI2-m	*Rubus discolor*	86	14.0	1	53
	ROCA2-m	*Rosa californica*	71	13.0	0.2	90
	CEOC2-m	*Cephalanthus occidentalis*	50	1.0	0.2	10
	RUUR-m	*Rubus ursinus*	43	3.0	0.2	40
	SAEX-m	*Salix exigua*	39	3.0	0.2	35

	SALA6-m	*Salix lasiolepis*	32	2.0	0.2	10
	COSE16-m	*Cornus sericea*	25	3.0	0.2	32
	TODI-m	*Toxicodendron diversilobum*	25	2.0	1	15
	VICA5-m	*Vitis californica*	25	0.0	0.2	5
	FICA-m	*Ficus carica*	21	0.0	0.2	2
Herb						
	CABA4-l	*Carex barbarae*	39	11.0	2	70
	BRDI3-l	*Bromus diandrus*	39	2.0	0.2	15
	LETR5-l	*Leymus triticoides*	29	1.0	0.2	22

***Quercus lobata - Acer negundo* Provisional Association**
Valley oak - Box-elder Provisional Association

Local Vegetation Description
Stands of the *Quercus lobata - Acer negundo* Provisional Association form an open to intermittent overstory tree layer (12-55%, mean 34%), with trees 10-35m tall. The shrub layer is intermittent (35-58%, mean 48%) with low shrubs at 1-5m and tall shrubs/understory trees at 5-10m tall. The herbaceous layer is open (2-5%, mean 3%) at 0.5-2m tall. Total vegetation cover is 70-78%, with a mean of 74%.

In this association, *Quercus lobata* characterizes the overstory tree layer at 10 to 30% cover, with *Acer negundo* present at 8-20% cover. *Juglans X hindsii* is also frequent at low cover (1-3%). All three species, plus *Fraxinus latifolia*, are regenerating in the understory. The shrub layer is characterized by *Rosa californica* at 3 to 26% cover. *Rubus ursinus* is often present at 1 to 43% cover. The herb layer sometimes supports *Arundo donax, Leymus triticoides* or *Brassica nigra* at 1 to several percent cover.

This association was sampled in the following EMU: South Delta. It is clearly related to the *Q. lobata/Rubus discolor* association, occupying similar moisture regimes in sites not immediately adjacent to permanent water. However, it likely reflects more mature and less regularly disturbed conditions where other trees become subdominant to the dominant *Q. lobata*. The relative rarity of this type compared to the *Q. lobata/R. discolor* type suggests that in the Delta, most stands of *Q. lobata* in mesic settings are disturbed, sufficiently instable to allow for development of additional subdominant tree species and open to “invasion” by *R. discolor.*

Site Impacts
Two samples of this association had moderate impacts from non-native plant species. The non-native species with highest cover in these samples was *Rubus discolor*.

Samples Used to Describe Association (n=4)
Rapid Assessment(s): SSJD0098, 0112, 0116, 0278

Rank: G2S2

Global Distribution
So far this association is only known from the Delta. However, it is likely to be found elsewhere along the major waterways in the Central Valley. Some stands sampled along the Sacramento River between Redding and Colusa (CVIS 1995) suggest this association.

References
CVIS (1995).

***Quercus lobata - Acer negundo* Provisional Association** **n=** 4

Stratum	Code	Species Name	Con	Avg	Min	Max
Tree Overstory						
	QULO-t	*Quercus lobata*	100	22.0	10	30
	ACNE2-t	*Acer negundo*	100	12.0	8	20
	JUCAH-t	*Juglans hindsii*	75	1.0	1	3
	FRLA-t	*Fraxinus latifolia*	25	2.0	9	9
	SAGO-t	*Salix gooddingii*	25	1.0	4	4
	ALRH2-t	*Alnus rhombifolia*	25	0.0	1	1
	JURE80-t	*Juglans regia*	25	0.0	0.2	0.2
	POFR2-t	*Populus fremontii*	25	0.0	2	2
	ULMUS-t	*Ulmus*	25	0.0	0.2	0.2
Tree Understory						
	ACNE2-m	*Acer negundo*	100	2.0	1	5
	QULO-m	*Quercus lobata*	75	2.0	0.2	5
	FRLA-m	*Fraxinus latifolia*	75	0.0	0.2	1
	JUCAH-m	*Juglans hindsii*	75	0.0	0.2	0.2
	ACNE2-l	*Acer negundo*	25	0.0	0.2	0.2
	JUCAH-l	*Juglans hindsii*	25	0.0	0.2	0.2
	PRCE2-m	*Prunus cerasifera*	25	0.0	0.2	0.2
Shrub						
	ROCA2-m	*Rosa californica*	100	12.0	3	26
	RUUR-m	*Rubus ursinus*	75	13.0	1	43
	RUDI2-m	*Rubus discolor*	50	18.0	20	50
	SAEX-m	*Salix exigua*	50	7.0	8	20
	SAME5-m	*Sambucus mexicana*	50	1.0	0.2	5
	CEOC2-m	*Cephalanthus occidentalis*	50	0.0	1	1
	VICA5-m	*Vitis californica*	25	4.0	17	17
	SALA6-m	*Salix lasiolepis*	25	2.0	10	10
	RIAU-m	*Ribes aureum*	25	1.0	3	3
	BAPI-m	*Baccharis pilularis*	25	0.0	0.2	0.2
Herb						
	ARDO4-m	*Arundo donax*	50	1.0	1	3
	BRNI-m	*Brassica nigra*	50	0.0	0.2	1
	LETR5-l	*Leymus triticoides*	50	0.0	0.2	0.2
	CAPY2-m	*Carduus pycnocephalus*	25	0.0	1	1
	CABA4-l	*Carex barbarae*	25	0.0	2	2
	CUSCU-l	*Cuscuta*	25	0.0	0.2	0.2
	GAAP2-l	*Galium aparine*	25	0.0	0.2	0.2

LELA2-m	*Lepidium latifolium*	25	0.0	0.2	0.2
LOPU3-l	*Lotus purshianus*	25	0.0	2	2
OEBI-m	*Oenothera biennis*	25	0.0	0.2	0.2
PADI3-m	*Paspalum dilatatum*	25	0.0	0.2	0.2
URDI-m	*Urtica dioica*	25	0.0	1	1

***Quercus lobata - Alnus rhombifolia* Association**
Valley oak - White alder Association

Local Vegetation Description
Stands of the *Quercus lobata-Alnus rhombifolia* Association form an open to dense overstory tree layer (3-70%, mean 49%), with trees 5-35m tall. The shrub layer is also open to dense (2-95%, mean 40%) with low shrubs at 0.5-5m and tall shrubs/understory trees at 2-15m tall. The herbaceous layer is open to intermittent (<1-35%, mean 8%) at 0-2m tall. Total vegetation cover is 65-90%, with a mean of 82%.

In this association, *Quercus lobata* dominates/codominates the overstory tree layer at 11 to 31% cover. *Alnus rhombifolia* is present in the tree layer at <1 to 40% cover. *Populus fremontii* and *Fraxinus latifolia* are often in the tree layer, averaging less than 5% cover. If *Alnus* is not in the tree layer, it is present in the understory tree or tall shrub layer. The shrub layer is characterized by *Salix lasiolepis* at <1 to 40% cover and *Rubus discolor* at <1 to 60% cover. The herb layer supports a variety of species.

This association was sampled in the following EMUs: East Delta, North Delta. This association represents the most hydric version of the Valley Oak alliance in the Delta. Most stands form narrow strips immediately adjacent to permanent water either on instream islands or on margins of quiet sloughs where there is light to moderate shoreline disturbance. Compared to other local *Q. lobata* associations, the relative increase and diversity of local wetland indicators such as *S. gooddingii, P. fremontii,* and most characteristically *A. rhombifolia,* support this contention.

Site Impacts
Seventeen samples of this association had low to heavy impacts from non-native plant species. The most common non-native species is *Rubus discolor.* Additional site impacts include low to heavy impacts from road/trail construction in seven samples and low to heavy impacts from rip-rap/bank protection in five samples.

Samples Used to Describe Association (n=25)
Rapid Assessment(s): SSJD0056, 0057, 0060, 0063, 0080, 0084, 0086, 0088, 0094, 0140, 0149, 0151, 0152, 0161, 0212, 0217, 0223, 0251, 0256, 0259, 0260, 0262, 0263, 0323, 0324

Rank: G3S3

Global Distribution
Similar stands have been provisionally identified in the Northern Sierra Foothills (J. Evens and A. Klein personal communication 2006). The association is likely restricted to the Central Valley of California and surrounding foothills along permanent streams and rivers.

References
No specific references.

***Quercus lobata - Alnus rhombifolia* Association** **n=** 25

Stratum	Code	Species Name	Con	Avg	Min	Max
Tree Overstory						
	QULO-t	*Quercus lobata*	100	31.0	11	62
	ALRH2-t	*Alnus rhombifolia*	92	15.0	0.2	40
	POFR2-t	*Populus fremontii*	64	4.0	0.2	25
	FRLA-t	*Fraxinus latifolia*	56	2.0	0.2	20
	SAGO-t	*Salix gooddingii*	40	1.0	0.2	6
	QUAG-t	*Quercus agrifolia*	24	2.0	0.2	17
	JUCAH-t	*Juglans hindsii*	20	1.0	0.2	11
Tree Understory						
	ALRH2-m	*Alnus rhombifolia*	48	1.0	0.2	11
	FRLA-m	*Fraxinus latifolia*	40	0.0	0.2	1
	ACNE2-m	*Acer negundo*	36	0.0	0.2	2
	QULO-m	*Quercus lobata*	32	1.0	0.2	10
	SAGO-m	*Salix gooddingii*	28	0.0	0.2	4
	JUCAH-m	*Juglans hindsii*	20	0.0	0.2	1
	QULO-l	*Quercus lobata*	20	0.0	0.2	2
Shrub						
	RUDI2-m	*Rubus discolor*	80	15.0	0.2	60
	SALA6-m	*Salix lasiolepis*	76	7.0	0.2	40
	CEOC2-m	*Cephalanthus occidentalis*	68	1.0	0.2	3
	VICA5-m	*Vitis californica*	64	2.0	0.2	13
	ROCA2-m	*Rosa californica*	44	2.0	0.2	15
	SAEX-m	*Salix exigua*	44	2.0	0.2	15
	COSE16-m	*Cornus sericea*	24	3.0	2	50
	RUUR-m	*Rubus ursinus*	24	1.0	1	25
	FICA-m	*Ficus carica*	24	0.0	0.2	2
	VICA5-t	*Vitis californica*	20	0.0	0.2	3
Herb						
	CABA4-l	*Carex barbarae*	32	0.0	0.2	4
	ARDO3-m	*Artemisia douglasiana*	24	0.0	0.2	2
	EQHYA2-m	*Equisetum hyemale* ssp. *affine*	20	2.0	0.2	30

***Quercus lobata - Fraxinus latifolia / Vitis californica* Association**
Valley oak - Oregon ash / California grape Association

Local Vegetation Description
Stands of the *Quercus lobata - Fraxinus latifolia / Vitis californica* Association form an intermittent to dense overstory tree layer (35-75%, mean 52%), with trees 10-35m tall. The shrub layer is open to dense (6-85%, mean 48%) with low shrubs at 0.5-5m and tall

shrubs/understory trees at 1-10m tall. The herbaceous layer is also open to dense (<1-70%, mean 19%) at 0-1m tall. Total vegetation cover is 57-95%, with a mean of 83%.

In this association, *Quercus lobata* is generally dominant at 9 to 73% cover, with *Fraxinus latifolia* codominant or subdominant at 2-35% cover. Both species are also frequently in the tall shrub/understory tree layer. *Vitis californica* characterizes the shrub layer (often climbing into the tree layer) at 1-40%, along with *Rubus ursinus* at <1-45% cover. The herb layer often supports *Carex barbarae*, at <1 to 67% cover.

Samples with very low cover of *Vitis californica* (0-1%) were put into the *Quercus lobata-Fraxinus latifolia* phase (n=5).

This association was sampled in the following EMUs: East Delta, North Delta. It is similar to the *Q. lobata - Acer negundo* association in its environmental setting but is likely to be somewhat more regularly flooded and relatively more moist during the later portion of the growing season. It thus occupies an ecological setting between *Q. lobata-Acer negundo* (drier) and *Q. lobata - A. rhombifolia* (wetter) associations. This association has the greatest structural diversity of all of the Valley oak types locally. Tree individuals may be large and tree diversity is relatively high. The liana *Vitis californica* is characteristic, regularly festooning the trees, and the understory herb layer is commonly well developed with native graminoids and forbs.

Site Impacts
Seven samples of this association had low to heavy impacts from non-native plant species. The non-native species with highest cover is *Rubus discolor*. Eight samples had low to heavy impacts from foot traffic and road/trail construction.

Samples Used to Describe Association (n=15)
Rapid Assessment(s): SSJD0030, 0045, 0049, 0050, 0051, 0064, 0207, 0227, 0228, 0229, 0230, 0243, 0325, 0328, 0372

Rank: G2S2

Global Distribution
Likely endemic to the Central Valley, but only known positively from the Delta, defined first in this project. Similar stands have been sampled farther upstream along the Sacramento River between Redding and Hamilton City (CVIS 1995).

References
CVIS (1994)

***Quercus lobata - Fraxinus latifolia / Vitis californica* Association** **n=** 15

Stratum	Code	Species Name	Con	Avg	Min	Max
Tree Overstory						
	QULO-t	*Quercus lobata*	100	43.0	9	73
	FRLA-t	*Fraxinus latifolia*	73	8.0	2	35
	POFR2-t	*Populus fremontii*	40	4.0	0.2	20
	ACNE2-t	*Acer negundo*	40	1.0	0.2	5
	ALRH2-t	*Alnus rhombifolia*	27	0.0	0.2	3

	QUAG-t	*Quercus agrifolia*	20	1.0	0.2	10
Tree Understory						
	FRLA-m	*Fraxinus latifolia*	80	11.0	0.2	50
	QULO-l	*Quercus lobata*	60	0.0	0.2	0.2
	QULO-m	*Quercus lobata*	53	1.0	0.2	3
	ACNE2-m	*Acer negundo*	40	1.0	0.2	8
	FRLA-l	*Fraxinus latifolia*	33	1.0	0.2	8
Shrub						
	RUUR-m	*Rubus ursinus*	87	10.0	0.2	45
	VICA5-m	*Vitis californica*	80	11.0	1	40
	RUDI2-m	*Rubus discolor*	53	10.0	2	55
	ROCA2-m	*Rosa californica*	53	3.0	0.2	10
	SALA6-m	*Salix lasiolepis*	47	1.0	0.2	10
	TODI-m	*Toxicodendron diversilobum*	47	1.0	0.2	5
	CEOC2-m	*Cephalanthus occidentalis*	40	0.0	0.2	2
	SAME5-m	*Sambucus mexicana*	27	1.0	1	4
Herb						
	CABA4-l	*Carex barbarae*	73	11.0	0.2	67
	CYER-l	*Cyperus eragrostis*	47	3.0	0.2	29
	ARDO3-m	*Artemisia douglasiana*	47	0.0	0.2	1
	LETR5-l	*Leymus triticoides*	27	0.0	0.2	1
	CIIN-m	*Cichorium intybus*	20	0.0	0.2	5
	GAAP2-l	*Galium aparine*	20	0.0	0.2	1

***Robinia pseudoacacia* Alliance**
Black locust Alliance

Local Vegetation Description
One stand of the *Robinia pseudoacacia* Alliance was sampled, in the East Delta EMU (SSJD0321). No associations have been described. The stand forms an open overstory tree layer (30%), with trees 10-15m tall. The shrub layer is absent. The herbaceous layer is intermittent (50%) at 0-0.5m tall. Total vegetation cover is 70%. In the stand, *Robinia pseudoacacia* dominates the overstory tree layer at 28% cover, and is regenerating in the understory. The herb layer is dominated by *Cynodon dactylon* at 44% cover.

Small groves are commonly planted throughout the delta and often signify locations of old residences and homesteads along the levees and sloughs.

Site Impacts
This is a non-native tree-dominated alliance with an understory herb layer also dominated by non-natives including *Cynodon dactylon* and *Bromus diandrus.*

Rank: Unranked, non-native invasive

Global Distribution
This species forms an alliance in the east and the Midwest of North America including: AR, IA, KY, MA, MS, NC, NJ, OK, PA, TN, VA, VT, WV (NatureServe 2006). However, all California stands are planted.

References
NatureServe (2006)

***Robinia pseudoacacia* Alliance only** **n=** 1

Stratum	Code	Species Name	Con	Avg	Min	Max
Tree Overstory						
	ROPS-t	*Robinia pseudoacacia*	100	28.0	28	28
	QULO-t	*Quercus lobata*	100	2.0	2	2
Tree Understory						
	ROPS-m	*Robinia pseudoacacia*	100	4.0	4	4
Shrub						
	ROCA2-m	*Rosa californica*	100	15.0	15	15
	RUDI2-m	*Rubus discolor*	100	13.0	13	13
	VICA5-m	*Vitis californica*	100	2.0	2	2
Herb						
	CYDA-l	*Cynodon dactylon*	100	44.0	44	44
	BRDI3-l	*Bromus diandrus*	100	4.0	4	4
	CABA4-l	*Carex barbarae*	100	1.0	1	1
	ASOF-m	*Asparagus officinalis*	100	0.0	0.2	0.2
	BRNI-m	*Brassica nigra*	100	0.0	0.2	0.2
	BRHO2-l	*Bromus hordeaceus*	100	0.0	0.2	0.2
	CAPY2-m	*Carduus pycnocephalus*	100	0.0	0.2	0.2
	COMA2-m	*Conium maculatum*	100	0.0	0.2	0.2
	HIIN3-m	*Hirschfeldia incana*	100	0.0	0.2	0.2
	LASE-m	*Lactuca serriola*	100	0.0	0.2	0.2
	RASA2-m	*Raphanus sativus*	100	0.0	0.2	0.2

***Salix gooddingii* Alliance**
Goodding's willow Alliance

Local Vegetation Description

The *Salix gooddingii* Alliance is represented in the Delta by the *Salix gooddingii* / wetland herb, *Salix gooddingii - Populus fremontii* and *Salix gooddingii - Quercus lobata* / wetland herb associations. In addition to these associations, there were six stands that were not classified to association level (SSJD0024, 0111, 0333, 0356, 0362, and 0375). These six stands occurred in the East, North, and South Delta EMUs. The tree layer in each stand is dominated by *Salix gooddingii.* One stand is codominated by *Fraxinus latifolia*, with no significant understory. The other five stands have a shrub understory dominated by *Cephalanthus occidentalis, Rubus discolor*, or *Rosa californica* (or codominated by a combination of these shrubs). It is likely that with a few more samples this expression of the

alliance would be classified as an association that might be called the *Salix gooddingii/Rubus discolor* association.

Rank: G4S4

Global Distribution
This alliance is known from the southwestern US (CA, NM, TX, NV, AZ) and adjacent Northern Mexico.

References
NatureServe (2006)

***Salix gooddingii* Alliance only** **n=** 6

Stratum	Code	Species Name	Con	Avg	Min	Max
Tree Overstory						
	SAGO-t	*Salix gooddingii*	100	31.0	8	50
	QULO-t	*Quercus lobata*	33	1.0	0.2	8
	JUCAH-t	*Juglans hindsii*	33	0.0	1	2
Tree Understory						
	SAGO-m	*Salix gooddingii*	50	3.0	0.2	10
	QULO-m	*Quercus lobata*	33	0.0	0.2	0.2
Shrub						
	RUDI2-m	*Rubus discolor*	67	34.0	23	95
	SAEX-m	*Salix exigua*	67	3.0	0.2	12
	CEOC2-m	*Cephalanthus occidentalis*	50	17.0	10	45
	ROCA2-m	*Rosa californica*	50	9.0	1	50
	SALA6-m	*Salix lasiolepis*	50	3.0	0.2	15
Herb						
	ASSUC-m	*Aster subulatus v*ar*. cubensis*	33	0.0	0.2	0.2
	JUEF-l	*Juncus effusus*	33	0.0	0.2	0.2
	POPU5-l	*Polygonum punctatum*	33	0.0	0.2	2
	SALA2-l	*Sagittaria latifolia*	33	0.0	0.2	0.2
	SCAC3-m	*Schoenoplectus acutus*	33	0.0	0.2	1
	URDI-m	*Urtica dioica*	33	0.0	0.2	0.2

***Salix gooddingii* / wetland herb Provisional Association**
Goodding's willow / wetland herb Provisional Association

Local Vegetation Description
Stands of the *Salix gooddingii / wetland herb* Provisional Association form an open to intermittent overstory tree layer (15-45%, mean 25%), with trees 5-20m tall. The shrub layer is absent to open (0-9%, mean 5%) with low shrubs at 1-5m and tall shrubs/understory trees at 2-10m tall. The herbaceous layer is open to intermittent (5-45%, mean 31%) at 0-0.5m tall. Total vegetation cover is 40-62%, with a mean of 52%.

In this association, *Salix gooddingii* dominates the overstory tree layer at 15-45% cover. *Salix gooddingii* and *Fraxinus latifolia* are sometimes regenerating in the understory. The shrub layer occasionally has very low cover of *Toxicodendron diversilobum*. The herb layer is characterized by various wetland herbs at low to intermittent cover, only one of which occurs frequently *(Cyperus eragrostis).* Other herbs include *Xanthium strumarium, Cynodon dactylon, Schoenoplectus acutus,* and *Ludwigia peploides* ssp. *montevidensis*. These last two suggest standing water during a significant portion of the growing season.

This association was sampled in the following EMUs: East Delta, North Delta and appears to develop in association with a management regime that favors human modification of adjacent emergent and ephemeral wetlands. Stands are commonly associated with adjacent managed wetland depressions where wildlife "friendly" plant species are sown or encouraged.

Site Impacts
Two samples of this association had low to moderate impacts from non-native plant species, primarily *Cynodon dactylon* and *Ludwigia peploides* ssp. *montevidensis.*

Samples Used to Describe Association (n=5)
Rapid Assessment(s): SSJD0068, 0142, 0181, 0289, 0290

Rank: G3S3?

Global Distribution
This association is only known from the Delta, and has been defined in this study. It is likely to occur in other parts of the Central Valley and perhaps elsewhere in southern California, wherever *S. gooddingii* forms stands over modified/disturbed understories of wetland forbs and herbs.

References
Klein and Evens (2005) discuss similar stands in W. Riverside County.

***Salix gooddingii / wetland herb* Provisional Association** **n=** 5

Stratum	Code	Species Name	Con	Avg	Min	Max
Tree Overstory						
	SAGO-t	*Salix gooddingii*	100	25.0	15	45
	FRLA-t	*Fraxinus latifolia*	20	1.0	5	5
	POFR2-t	*Populus fremontii*	20	0.0	0.2	0.2
Tree Understory						
	FRLA-m	*Fraxinus latifolia*	60	1.0	0.2	3
	SAGO-m	*Salix gooddingii*	40	0.0	0.2	2
	ACNE2-m	*Acer negundo*	20	0.0	2	2
Shrub						
	TODI-m	*Toxicodendron diversilobum*	40	1.0	0.2	3
	ROCA2-m	*Rosa californica*	20	1.0	3	3
	RUDI2-m	*Rubus discolor*	20	0.0	0.2	0.2
	SAEX-m	*Salix exigua*	20	0.0	1	1
Herb						
	CYER-l	*Cyperus eragrostis*	80	1.0	0.2	2

SCAC3-m	*Schoenoplectus acutus*	60	1.0	1	4
XAST-l	*Xanthium strumarium*	60	0.0	0.2	0.2
CYDA-l	*Cynodon dactylon*	40	9.0	15	30
LUPEM-l	*Ludwigia peploides ssp. montevidensis*	40	5.0	0.2	25
TYLA-m	*Typha latifolia*	40	1.0	0.2	3
ABTH-l	*Abutilon theophrasti*	40	0.0	0.2	0.2
ATRIP-l	*Atriplex*	40	0.0	0.2	0.2
MALE3-l	*Malvella leprosa*	40	0.0	0.2	1
MEAL2-l	*Melilotus albus*	40	0.0	0.2	0.2
PHNO2-l	*Phyla nodiflora*	40	0.0	0.2	1
POAM8-l	*Polygonum amphibium*	40	0.0	0.2	2
RUMEX-m	*Rumex*	40	0.0	0.2	0.2
POLA4-l	*Polygonum lapathifolium*	20	7.0	35	35
CABA4-l	*Carex barbarae*	20	5.0	25	25
LOMU-l	*Lolium multiflorum*	20	1.0	5	5
POLYG4-l	*Polygonum*	20	1.0	4	4
ANCO2-l	*Anthemis cotula*	20	0.0	0.2	0.2
ASSUC-m	*Aster subulatus var. cubensis*	20	0.0	0.2	0.2
AZFI-l	*Azolla filiculoides*	20	0.0	0.2	0.2
BIFR-m	*Bidens frondosa*	20	0.0	0.2	0.2
CUSCU-l	*Cuscuta*	20	0.0	0.2	0.2
ELEOC-l	*Eleocharis*	20	0.0	1	1
EPILO-m	*Epilobium*	20	0.0	0.2	0.2
EUOC4-m	*Euthamia occidentalis*	20	0.0	2	2
JUNCU-l	*Juncus*	20	0.0	0.2	0.2
LELA2-m	*Lepidium latifolium*	20	0.0	0.2	0.2
LYAM-m	*Lycopus americanus*	20	0.0	0.2	0.2
MEAL2-m	*Melilotus albus*	20	0.0	0.2	0.2
MEAR4-l	*Mentha arvensis*	20	0.0	0.2	0.2
PADI3-m	*Paspalum dilatatum*	20	0.0	0.2	0.2
SYLE2-l	*Symphyotrichum lentum*	20	0.0	0.2	0.2
XAST-m	*Xanthium strumarium*	20	0.0	0.2	0.2

***Salix gooddingii - Populus fremontii* Association**
Goodding's willow - Fremont cottonwood Association

Local Vegetation Description
Stands of the *Salix gooddingii - Populus fremontii* Association form an open to dense overstory tree layer (10-75%, mean 42%), with trees 5-35m tall. The shrub layer is open to dense (2-95%, mean 4%) with low shrubs at 0.5-10m and tall shrubs/understory trees at 2-15m tall. The herbaceous layer is also open to dense (<1-60%, mean 10%) at 0-5m tall. Total vegetation cover is 46-88%, with a mean of 74%.

In this association, *Salix gooddingii* characterizes the overstory tree layer at 5-75% cover, with *Populus fremontii* dominant, codominant, or subdominant at <1 to 65% cover. *Salix*

gooddingii is usually regenerating in the understory. The shrub layer usually supports *Salix exigua* and *Salix lasiolepis* at an average of 5 and 6% cover.

This association was sampled in the following EMUs: Central West Delta, East Delta, North Delta, South Delta. Associations with *Populus fremontii* and *Salix gooddingii* have been described in several regions of the western United States. These stands are typically considered part of the *Populus fremontii* alliance. In this study, we have decided that all of the local mixed stands have a greater affinity with *S. gooddingii* rather than *P. fremontii*, even though some of these stands are dominated by *P. fremontii*. Cluster analysis and indicator species analysis of all stands showed a stronger relationship with the presence of *S. gooddingii* rather than *P. fremontii*, and many stands had relatively low cover of *P. fremontii*. This fact may speak to the disturbed and artificially narrowed nature of many of these stands in the Delta area. However, at this point since this study provides the largest data set for these types of mixed riparian stands in California as yet, we feel the classification as *S. gooddingii* is a reasonable interpretation of these data.

Associations that have particular similarities include the *Populus fremontii - Salix gooddingii* (Vaghti 2003) and the *Populus fremontii - Salix gooddingii/Salix exigua* Forest defined from New Mexico (NatureServe 2006) . Vaghti (2003) comments on the co-dominance of *P. fremontii* and *S. gooddingii* in her samples. Interestingly, the highest Indicator Value (McCune and Grace 2002) for *P. fremontii* trees in Vaghti's samples was 16, versus 46 for *S gooddingii.* Similar results (*P. fremontii* 16, *S. gooddingii* 40) were calculated for this study. The highest IV score for any age class of *P. fremontii* in Vaghti's study was for saplings (IV 31), and this was in the same group where *S. gooddingii* attained highest value (IV 46). Thus, it seems that in both studies *Salix gooddingii* is the better indicator for samples that share these two trees. Perhaps it is tradition, rather than ecological significance, that has given the name *Populus fremontii* Alliance to many of the stands in the Central Valley of California.

Site Impacts
Eighteen samples of this association had low to heavy impacts from non-native plant species, primarily *Rubus discolor.* Road/trail construction had low impacts in six samples.

Samples Used to Describe Association (n=26)
Rapid Assessment(s): SSJD0002, 0005, 0010, 0052, 0054, 0115, 0128, 0147, 0158, 0160, 0172, 0203, 0204, 0205, 0208, 0245, 0272, 0291, 0332, 0334, 0338, 0339, 0357, 0359, 0361, 0366

Rank: G4S3

Global Distribution
Similar stands have been defined in California by Vaghti (2003), Evens and San (2005), and are listed in NatureServe (2006) for the following states or subnations: AZ, CA, CO, Chihuahua MX?, Sonora MX?, NM, TX, and UT.

References
Evens and San (2005), NatureServe (2006), Vaghti (2003)

***Salix gooddingii - Populus fremontii* Association** **n=** 26

Stratum	Code	Species Name	Con	Avg	Min	Max
Tree Overstory						
	SAGO-t	*Salix gooddingii*	96	22.0	3	75
	POFR2-t	*Populus fremontii*	96	17.0	0.2	65
	ACNE2-t	*Acer negundo*	38	2.0	0.2	12
	QULO-t	*Quercus lobata*	35	2.0	0.2	18
	ALRH2-t	*Alnus rhombifolia*	23	1.0	0.2	12
	JUCAH-t	*Juglans hindsii*	23	1.0	0.2	25
Tree Understory						
	SAGO-m	*Salix gooddingii*	65	2.0	0.2	15
	ACNE2-m	*Acer negundo*	42	0.0	0.2	2
	FRLA-m	*Fraxinus latifolia*	27	1.0	0.2	7
	POFR2-m	*Populus fremontii*	23	0.0	0.2	0.2
Shrub						
	SAEX-m	*Salix exigua*	69	5.0	0.2	31
	SALA6-m	*Salix lasiolepis*	65	6.0	0.2	40
	RUDI2-m	*Rubus discolor*	58	15.0	0.2	74
	CEOC2-m	*Cephalanthus occidentalis*	42	3.0	0.2	25
	ROCA2-m	*Rosa californica*	42	3.0	0.2	59
	RUUR-m	*Rubus ursinus*	31	1.0	0.2	25
Herb						
	CABA4-l	*Carex barbarae*	23	0.0	0.2	4

***Salix gooddingii - Quercus lobata* / wetland herb Provisional Association**
Goodding's willow - Valley oak / wetland herb Provisional Association

Local Vegetation Description
Stands of the *Salix gooddingii - Quercus lobata / wetland herb* Association form an open to dense overstory tree layer (8-70%, mean 33%), with trees 10-35m tall. The shrub layer is open to intermittent (2-32%, mean 18%) with low shrubs at 1-5m and tall shrubs/understory trees at 1-10m tall. The herbaceous layer is open to dense (15-76%, mean 40%) at 0-2m tall. Total vegetation cover is 60-95%, with a mean of 77%.

In this association, *Salix gooddingii* dominates the overstory tree layer at 3 to 35% cover, and *Quercus lobata* is codominant or sub-dominant at 3-40% cover. When *Salix gooddingii* is not in the tree overstory layer, it is in the tree understory layer. Both species are usually regenerating in the understory. The shrub layer usually supports *Rubus discolor* and *Rubus ursinus* up to 12% cover each. The herb layer often is dominated by wetland herbaceous species such as *Lolium multiflorum, Bidens* sp., *Xanthium strumarium*, and *Leymus triticoides*.

This association was sampled in the following EMUs: East Delta, North Delta, South Delta

Site Impacts
Six samples of this association had low to heavy impacts from non-native plant species including *Rubus discolor, Lolium multiflorum* and *Xanthium strumarium*. Three samples were lightly to moderately impacted by grazing.

Samples Used to Describe Association (n=8)
Rapid Assessment(s): SSJD0012, 0013, 0053, 0179, 0184, 0187, 0189, 0191

Rank: G2S2

Global Distribution
This association is likely restricted to the Central Valley of California. It has been reduced substantially by human activity in the last 150 years and likely exists only in relatively small isolated riparian patches. The introduction of the invasive *Rubus discolor* has changed the character of this association.

References
No specific references.

Salix gooddingii - Quercus lobata / wetland herb **Provisional** **n=** 8

Stratum	Code	Species Name	Con	Avg	Min	Max
Tree Overstory						
	QULO-t	*Quercus lobata*	100	9.0	0.2	33
	SAGO-t	*Salix gooddingii*	88	22.0	11	40
	POFR2-t	*Populus fremontii*	50	1.0	0.2	10
Tree Understory						
	SAGO-m	*Salix gooddingii*	62	2.0	0.2	8
	QULO-m	*Quercus lobata*	62	1.0	1	3
	POFR2-m	*Populus fremontii*	38	0.0	0.2	0.2
Shrub						
	RUDI2-m	*Rubus discolor*	75	4.0	1	12
	RUUR-m	*Rubus ursinus*	62	2.0	0.2	12
	SALA6-m	*Salix lasiolepis*	50	4.0	3	12
	SAEX-m	*Salix exigua*	50	1.0	1	7
	VICA5-m	*Vitis californica*	38	1.0	1	7
	CEOC2-m	*Cephalanthus occidentalis*	25	0.0	1	2
Herb						
	LOMU-l	*Lolium multiflorum*	62	6.0	0.2	25
	BIDEN-m	*Bidens*	62	0.0	0.2	1
	XAST-l	*Xanthium strumarium*	50	3.0	0.2	22
	LETR5-l	*Leymus triticoides*	50	1.0	0.2	7
	CYDA-l	*Cynodon dactylon*	38	2.0	1	10
	POAM8-l	*Polygonum amphibium*	38	2.0	2	8
	CYER-l	*Cyperus eragrostis*	38	0.0	0.2	1
	AEGIL-l	*Aegilops*	25	12.0	30	65
	CABA4-l	*Carex barbarae*	25	6.0	5	44
	POLA4-l	*Polygonum lapathifolium*	25	2.0	0.2	12
	JUBA-l	*Juncus balticus*	25	1.0	0.2	5

CAPY2-m	*Carduus pycnocephalus*	25	0.0	1	1
CHENO-l	*Chenopodium*	25	0.0	0.2	2
MALE3-l	*Malvella leprosa*	25	0.0	0.2	2
MEAL2-l	*Melilotus albus*	25	0.0	0.2	0.2
RUCO2-m	*Rumex conglomeratus*	25	0.0	0.2	0.2
RUCO2-l	*Rumex conglomeratus*	25	0.0	0.2	0.2
SCAC3-m	*Schoenoplectus acutus*	25	0.0	0.2	0.2
URDI-m	*Urtica dioica*	25	0.0	0.2	0.2

Shrub-Overstory Vegetation

***Allenrolfea occidentalis* Alliance**
Iodine bush Alliance

Local Vegetation Description
Only three stands of the *Allenrolfea occidentalis* Alliance were sampled in the Delta (SSJD0377, 0381, 0382), and therefore no associations have been described here. In these stands, *Allenrolfea occidentalis* forms an open shrub cover (15%). The herbaceous cover is intermittent (50%) and is dominated by *Distichlis spicata, Hordeum* sp., and *Parapholis incurva*. Total vegetation cover is 50%.

This alliance was sampled in the following EMU: Central West Delta

Site Impacts
One of the sampled stands had moderate grazing impacts.

Rank: G4S3

Global Distribution
This alliance is widespread in the Great Basin (NatureServe 2006) and is known from the warm deserts, Great Basin deserts, the inner South Coast Ranges, and the San Joaquin Valley in California (Sawyer and Keeler-Wolf 1995).

References
NatureServe (2006), Sawyer and Keeler-Wolf (1995)

***Allenrolfea occidentalis* Alliance Only** **n=** 3

Stratum	Code	Species Name	Con	Avg	Min	Max
Shrub						
	ALOC2-m	*Allenrolfea occidentalis*	100	15.0	9	20
Herb						
	DISP-l	*Distichlis spicata*	100	12.0	1	25
	SCMA-l	*Schoenoplectus maritimus*	66	3.5	3	4
	SPMA-l	*Spergularia macrotheca*	66	0.2	0.2	1
	LACA7-l	*Lasthenia californica*	66	0.2	0.2	0.2
	HOMUL-l	*Hordeum murinum ssp. leporinum*	33	3.3	0.2	10
	PAIN-l	*Parapholis incurva*	33	2.7	0.2	8
	HOMAG-l	*Hordeum marinum ssp. gussoneanum*	33	2.3	0.2	7
	JUBU-l	*Juncus bufonius*	33	2.3	0.2	7

***Baccharis pilularis* Alliance**
Coyote bush Alliance

Local Vegetation Description
One stand of the *Baccharis pilularis* Alliance was sampled in the Delta (SSJD0355), and therefore no associations have been described here. In the one sample, *Baccharis pilularis* forms a dense shrub layer (80%). The herbaceous layer is open (18%) at 0.5-1m tall, with *Carduus pycnocephalus*, *Cynodon dactylon* and *Foeniculum vulgare* comprising most of the cover. *Populus fremontii* occurred as an emergent at <1% cover. Total vegetation cover was 70%.

This alliance was sampled in the following EMU: Central West Delta. Sue Bainbridge collected data from one stand at the Antioch Dunes. Additional similar stands have been described for Suisun Marsh (Keeler-Wolf and Vaghti 2000). These were called: *Baccharis pilularis*/Annual Grass and commonly had understories dominated by *Bromus diandrus, B. hordaceus*, and *Lolium multiflorum*.

Site Impacts
The one sample of this alliance had heavy impacts from non-native plant species, and moderate impacts from road/trail construction. Non-native species with highest cover were *Carduus pycnocephalus* and *Cynodon dactylon*.

Rank: G4S4

Global Distribution
The *Baccharis pilularis* Alliance ranges from coastal Oregon through the Northern California Coast, Central California Coast, Central California Coast Ranges, Southern California Coast, and parts of the Sierra Nevada Foothills and Central Valley. Stands in the Delta are generally small and are associated with recent human disturbance on levees or other upland settings.

References
Keeler-Wolf and Vaghti (2000), Sawyer et al. (2006 MS)

***Baccharis pilularis* Alliance only** **n=** 1

Stratum	Code	Species Name	Con	Avg	Min	Max
Tree Overstory						
	POFR2-t	*Populus fremontii*	100	0.0	0.2	0.2
Shrub						
	BAPI-m	*Baccharis pilularis*	100	20.0	20	20
	RUBUS-m	*Rubus*	100	20.0	20	20
	RUDI2-m	*Rubus discolor*	100	20.0	20	20
	SALA6-m	*Salix lasiolepis*	100	13.0	13	13
	ROCA2-m	*Rosa californica*	100	5.0	5	5
	SAEX-m	*Salix exigua*	100	2.0	2	2
Herb						
	CAPY2-m	*Carduus pycnocephalus*	100	8.0	8	8
	CYDA-l	*Cynodon dactylon*	100	5.0	5	5

FOVU-m	*Foeniculum vulgare*	100	3.0	3	3
LETR5-l	*Leymus triticoides*	100	2.0	2	2
ASOF-m	*Asparagus officinalis*	100	0.0	0.2	0.2
CIVU-m	*Cirsium vulgare*	100	0.0	0.2	0.2
PHAU7-m	*Phragmites australis*	100	0.0	0.2	0.2

***Cephalanthus occidentalis* Alliance**
Buttonwillow Alliance

Local Vegetation Description
One stand of the *Cephalanthus occidentalis* Alliance was sampled in the Delta (SSJD0032), and so no associations have been described. The sampled stand of *Cephalanthus occidentalis* alliance consists of an intermittent shrub layer (65%), with *Cephalanthus occidentalis* dominating at 2-5m tall. The herbaceous layer is open at 30% cover at 0-0.5m tall. Total vegetation cover is 90%.

This alliance was sampled in the following EMU: North Delta. Additional stands were observed, but not sampled, in the Central West Delta EMU. Some of the best developed stands occur just outside of the area in the Cosumnes River Preserve.

Site Impacts
The one sample of this alliance had low impacts from non-native plant species, particularly *Myriophyllum* sp.

Rank: G5S2

Global Distribution
This alliance has a broad distribution in wetlands and riparian settings throughout much of North America (NatureServe 2006). However, stands are restricted and local in the Sacramento and San Joaquin Valleys of California, and not known elsewhere in the state (Holland 1986, Sawyer and Keeler-Wolf 1995).

References
Holland (1986), NatureServe (2006), Sawyer and Keeler-Wolf (1995)

***Cephalanthus occidentalis* Alliance only** **n=** 1

Stratum	Code	Species Name	Con	Avg	Min	Max
Shrub						
	CEOC2-m	*Cephalanthus occidentalis*	100	60.0	60	60
Herb						
	MYRIO-l	*Myriophyllum*	100	17.0	17	17
	LUPEM-l	*Ludwigia peploides ssp. montevidensis*	100	13.0	13	13
	LEMNA-l	*Lemna*	100	0.0	0.2	0.2
	SALA2-l	*Sagittaria latifolia*	100	0.0	0.2	0.2
	TYPHA-m	*Typha*	100	0.0	0.2	0.2

Cornus sericea Alliance
Red-osier dogwood Alliance

Two associations of the *Cornus sericea* Alliance occur in the Delta: the *Cornus sericea-Salix exigua* Provisional Association and the *Cornus sericea-Salix lasiolepis* Association, described below. All samples of this alliance were classified into one of these two associations.

Cornus sericea - Salix exigua Provisional Association
Red-osier dogwood - Narrowleaf willow Provisional Association

Local Vegetation Description
Stands of the *Cornus sericea - Salix exigua* Provisional Association form a dense shrub layer (75-95%, mean 83%). Shrubs occur in two different strata, with low shrubs at 2-5m tall and tall shrubs/understory trees at 5-10m tall. The herbaceous layer is open (<1-10%, mean 4%) at 0-5m tall. Trees occur rarely as emergents (0-7%, mean 3%).Total vegetation cover is 85-95%, with a mean of 88%.

In this association, *Cornus sericea* is either codominant with *Salix exigua* or *Salix exigua* is sub-dominant. The sparse herb layer sometimes has *Juncus* sp. or *Schoenoplectus acutus* at very low cover. *Salix lucida* codominates in one stand.

This association was sampled in the following EMU: North Delta. This is the less common of the two *Cornus sericea* associations in the Delta. Compared to the more common *Cornus sericea - Salix lasiolepis* association, this type is ecologically more closely related to stands characterized by *Salix gooddingii, S. exigua,* and *Populus fremontii* using the Sorensen's cluster method, but very closely related to the other *C. sericea* association using the Ward's clustering method. Thus, these two *C. sericea* associations are somewhat ecologically ambiguous and we recommend more samples of the *C. sericea-Salix exigua* type before it becomes fully accepted as an association.

Site Impacts
No known impacts were recorded.

Samples Used to Describe Association (n=3)
Rapid Assessment(s): SSJD0062, 0082, 0085

Rank: G2S2?

Global Distribution
This association so far as known is limited to the Delta Region of California. This alliance is widespread throughout the Northeastern and Northwestern US and across much of Canada (NatureServe 2006). The only known stands in California prior to these described in the Delta are from the High Sierra. Those represent a different association with montane herbs (Potter 2005)

References
NatureServe (2006), Potter (2005)

***Cornus sericea - Salix exigua* Provisional Association** **n=** 3

Stratum	Code	Species Name	Con	Avg	Min	Max
Tree Overstory						
	QULO-t	*Quercus lobata*	100	0.0	0.2	0.2
	SAGO-t	*Salix gooddingii*	67	3.0	2	7
	ALRH2-t	*Alnus rhombifolia*	33	1.0	2	2
	ACNE2-t	*Acer negundo*	33	0.0	0.2	0.2
	FRLA-t	*Fraxinus latifolia*	33	0.0	0.2	0.2
Shrub						
	COSE16-m	*Cornus sericea*	100	42.0	25	65
	SAEX-m	*Salix exigua*	100	24.0	11	40
	RUDI2-m	*Rubus discolor*	100	4.0	1	10
	CEOC2-m	*Cephalanthus occidentalis*	67	1.0	1	2
	SALU-t	*Salix lucida*	33	9.0	26	26
	HILA6-m	*Hibiscus lasiocarpos*	33	0.0	0.2	0.2
	SALA6-m	*Salix lasiolepis*	33	0.0	1	1
Herb						
	JUNCU-l	*Juncus*	67	0.0	0.2	0.2
	SCAC3-m	*Schoenoplectus acutus*	67	0.0	0.2	1
	TYLA-m	*Typha latifolia*	33	3.0	8	8
	APCA-m	*Apocynum cannabinum*	33	0.0	0.2	0.2
Epiphyte						
	PHMA18-t	*Phoradendron*	33	0.0	0.2	0.2

***Cornus sericea - Salix lasiolepis* Association**
Red-osier dogwood - Arroyo willow Association

Local Vegetation Description
Stands of the *Cornus sericea - Salix lasiolepis* Association form an open to dense shrub layer (27-99%, mean 72%). Shrubs occur in two different strata, with low shrubs at 1-5m tall and tall shrubs/understory trees at 2-10m tall. The herbaceous layer is sparse to intermittent (<1-55%, mean 17%) at 0-5m tall. *Alnus rhombifolia* sometimes occurs as an emergent (0-5% cover, mean 0.9%). Total vegetation cover is 52-99%, with a mean of 82%.

In this association, *Cornus sericea* dominates at 20-88% cover or codominates the shrub layer with *Salix lasiolepis*, which occurs at 2-66% cover. The herb layer often supports *Phragmites australis* or *Schoenoplectus acutus,* or both species.

One phase of this association was identified in the Delta, the *Cornus sericea-Salix lasiolepis/Phragmites australis* phase, which is characterized by the presence of *Phragmites australis* at <1 to 20% cover (n=10).

The state-listed Rare species, *Lilaeopsis masonii*, occurred in 27% of the samples at <1% cover.

This association was sampled in the following EMUs: Central West Delta, North Delta. This association occupies regularly flooded margins of sloughs and channels within tidal influence. See the *Cornus sericea-Salix exigua* association for further comments on ecological relationships. For discussion of other *Cornus sericea* associations see Potter (2005) and NatureServe (2006).

Site Impacts
Three samples of this association had low impacts from non-native plant species.

Samples Used to Describe Association (n=15)
Rapid Assessment(s): SSJD0035, 0044, 0173, 0174, 0175, 0221, 0224, 0231, 0241, 0268, 0270, 0342, 0343, 0344, 0345

Rank: G3S3

Global Distribution
This is the more common of the two *Cornus sericea* associations in the Delta. It is still likely to be an endemic to the area.

References
NatureServe (2006), Potter (2005)

***Cornus sericea - Salix lasiolepis* Association** **n=** 15

Stratum	Code	Species Name	Con	Avg	Min	Max
Tree Overstory						
	ALRH2-t	*Alnus rhombifolia*	20	0.0	1	4
Tree Understory						
	ALRH2-m	*Alnus rhombifolia*	27	0.0	0.2	5
Shrub						
	COSE16-m	*Cornus sericea*	100	46.0	20	88
	SALA6-m	*Salix lasiolepis*	80	21.0	2	65
	CEOC2-m	*Cephalanthus occidentalis*	67	2.0	0.2	8
	RUDI2-m	*Rubus discolor*	40	1.0	0.2	15
	HILA6-m	*Hibiscus lasiocarpus*	27	0.0	0.2	1
	SAEX-m	*Salix exigua*	20	2.0	2	15
	ROCA2-m	*Rosa californica*	20	1.0	2	10
Herb						
	PHAU7-m	*Phragmites australis*	73	5.0	0.2	20
	SCAC3-m	*Schoenoplectus acutus*	73	4.0	0.2	35
	TYLA-m	*Typha latifolia*	47	1.0	0.2	5
	HYVE2-l	*Hydrocotyle verticillata*	40	0.0	0.2	0.2
	CYER-l	*Cyperus eragrostis*	33	0.0	0.2	0.2
	HEPU2-m	*Helenium puberulum*	27	0.0	0.2	0.2
	LIMA7-l	*Lilaeopsis masonii*	27	0.0	0.2	0.2
	JUEF-m	*Juncus effusus*	20	0.0	0.2	1

JUEF-l	*Juncus effusus*	20	0.0	0.2	0.2
LYAM-l	*Lycopus americanus*	20	0.0	0.2	0.2
PADI3-m	*Paspalum dilatatum*	20	0.0	0.2	0.2
POPU5-l	*Polygonum punctatum*	20	0.0	0.2	0.2
POPU5-m	*Polygonum punctatum*	20	0.0	0.2	1

***Lotus scoparius* Alliance**
Deerweed Alliance

The *Lotus scoparius* Alliance was not adequately sampled in the Delta during this project, but data collected by Susan Bainbridge in a stand at the Antioch Dunes National Wildlife Refuge and reconnaissance-level data also collected at Antioch Dunes NWR during this project validate its existence there. In both of these stands, *Lotus scoparius* was either the only shrub present or had the highest cover of all shrub species. This alliance was described in Western Riverside (Klein and Evens 2005) and Anza Borrego Desert State Park (Keeler-Wolf et al. 1998). See the Manual of California Vegetation, Second Edition, for further information (Sawyer et al. 2006 MS). At the Antioch Dunes, data collected by Susan Bainbridge in three stands shows these stands often support the endangered plants, Antioch Dunes Evening Primrose (*Oenothera deltoides* ssp. *howellii*) and Contra Costa wallflower (*Erysimum capitatum* ssp. *angustatum*).

References

Keeler-Wolf et al. (1998), Klein and Evens (2005), Sawyer et al. (2006 MS)

***Lupinus albifrons* Alliance**
Silver lupine Alliance

The *Lupinus albifrons* Alliance was not sampled in the Delta during this project, but data were collected by Susan Bainbridge in three stands at the Antioch Dunes National Wildlife Refuge. In these stands, *Lupinus albifrons* was either the only shrub present or had the highest cover of all shrub species. This alliance was described from Yosemite, Sequoia and Kings Canyon national parks and the central Coast Range (Evens et al. 2006) See also the Manual of California Vegetation, Second Edition, for further information (Sawyer et al. 2006 MS). At the Antioch Dunes, these stands sometimes support the endangered plants, Antioch Dunes Evening Primrose (*Oenothera deltoides* ssp. *howellii*) and Contra Costa wallflower (*Erysimum capitatum* ssp. *angustatum*).

References

Evens et al. (2006), Sawyer et al. (2006 MS)

***Rosa californica* Alliance**
California wild rose Alliance

The *Rosa californica* Alliance was not adequately sampled in the Delta, but reconnaissance-level data collected from two stands validate its existence there. In both of these stands, *Rosa californica* cover was at least 50% of the shrub cover. See the Manual of California Vegetation, Second Edition, for further information (Sawyer et al. 2006 MS).

References
Keeler-Wolf and Evens (2006), Keeler-Wolf and Vaghti (2000), Sawyer et al. (2006 MS)

***Rubus discolor* Alliance**
Himalaya berry Alliance

The *Rubus discolor* Alliance was not adequately sampled in the Delta, but reconnaissance-level data collected from two stands validate its existence there. In both of these stands, the non-native, invasive specie *Rubus discolor* was the sole dominant species. This alliance also occurs in Suisun Marsh (Keeler-Wolf and Vaghti 2000). See the Manual of California Vegetation, Second Edition, for further information (Sawyer et al. 2006 MS).

References
Keeler-Wolf and Vaghti (2000), Sawyer et al. (2006 MS)

***Salix exigua* Alliance**
Narrowleaf willow Alliance

Local Vegetation Description

The *Salix exigua* Alliance is represented in the Delta by one association, the *Salix exigua (-Salix lasiolepis) - Rubus discolor* Association. In addition to this association, there were three stands that were not classified to association level (SSJD0075, 0104, 0132), occuring in the Central West, North, and South Delta EMUs. These stands were dominated by *Salix exigua*, with two codominated by *Cephalanthus occidentalis* and one by *Rubus ursinus*.

Rank: G5S5 (Alliance level)

Global Distribution
The alliance is widely distributed throughout North America. NatureServe (2006) lists the temporarily flooded version of the alliance from the following states: CO, IA, ID, IL?, MB, MT, ND, NE, NM, OK, OR, SD, WA, WY, as well as adjacent Canada. Similar stands have been described by Vaghti (2003) for the Sacramento River and by Potter (2005) for the Sierra Nevada foothills.

References
NatureServe (2006), Potter (2005), Vaghti (2003)

***Salix exigua* Alliance only** **n=** 3

Stratum	Code	Species Name	Con	Avg	Min	Max
Tree Overstory						
	ALRH2-t	*Alnus rhombifolia*	33	1.0	2	2
	QULO-t	*Quercus lobata*	33	1.0	2	2
	FRLA-t	*Fraxinus latifolia*	33	0.0	0.2	0.2
	POFR2-t	*Populus fremontii*	33	0.0	0.2	0.2
	SAGO-t	*Salix gooddingii*	33	0.0	1	1
Tree Understory						
	ACNE2-m	*Acer negundo*	33	0.0	0.2	0.2
	ALRH2-m	*Alnus rhombifolia*	33	0.0	0.2	0.2
	SAGO-m	*Salix gooddingii*	33	0.0	1	1
Shrub						
	SAEX-m	*Salix exigua*	100	52.0	35	85
	CEOC2-m	*Cephalanthus occidentalis*	100	19.0	0.2	37
	RUUR-m	*Rubus ursinus*	33	7.0	21	21
	SALU-m	*Salix lucida*	33	1.0	2	2
	VICA5-t	*Vitis californica*	33	1.0	3	3
	PYAN-m	*Pyracantha angustifolia*	33	0.0	1	1
	RUDI2-m	*Rubus discolor*	33	0.0	1	1
Herb						
	SCAC3-m	*Schoenoplectus acutus*	33	7.0	20	20
	PHAU7-m	*Phragmites australis*	33	4.0	12	12
	JUEF-l	*Juncus effusus*	33	1.0	3	3
	CAREX-l	*Carex*	33	0.0	0.2	0.2
	TYPHA-m	*Typha*	33	0.0	1	1
	XAST-l	*Xanthium strumarium*	33	0.0	0.2	0.2
Epiphyte						
	PHMA18-t	*Phoradendron*	33	0.0	1	1

***Salix exigua (- Salix lasiolepis) - Rubus discolor* Association**
Narrowleaf willow (- Arroyo willow) - Himalaya berry Association

Local Vegetation Description
Stands of the *Salix exigua (- Salix lasiolepis) - Rubus discolor* Association form an open to dense shrub layer (30-90%, mean 82%). Shrubs occur in two different strata, with low shrubs at 0.5-5m tall and tall shrubs/understory trees at 2-15m tall. The herbaceous layer is open (<1-30%, mean 4%) at 0-2m tall. Trees including *Salix gooddingii, Alnus rhombifolia, Populus fremontii*, *Fraxinus latifolia,* and *Juglans X hindsii* occasionally occur as emergents (0-27% cover, mean 7%). Total vegetation cover is 55-90%, with a mean of 82%.

In this association, *Salix exigua* often codominates the overstory shrub layer at 6 to 70% cover. Other codominants are sometimes *Salix lasiolepis* at <1-77% cover and *Rubus discolor* at 1-80% cover. Herb species are variable. Approximately 20 percent of the stands supported low cover of *Artemisia douglasiana* or *Carex barbarae*.

Two phases of this association were noted in the Delta: the *Salix exigua - Rosa californica* phase (n=5), where those two shrubs codominate and *Rubus discolor* is of less importance, and the *Salix lasiolepis - Rubus discolor* phase (n=11), where those two shrubs codominate and *Rosa californica* is less important.

This association was sampled in the following EMUs: Central West Delta, East Delta, North Delta, South Delta. Due to the close relationship of all samples in the cluster analysis with dominance by the shrubby willows, *S. exigua* or *S. lasiolepis*, we took the conservative approach and lumped all stands that were either dominated by *S. exigua* with *S. lasiolepis* sub-dominant, codominated by *S. exigua* and *S. lasiolepis*, or dominated solely by *S. exigua* without any *S. lasiolepis*, as part of the *S. exigua* alliance. Such stands usually had a high cover of the non-native *Rubus discolor*, but occasionally had *Rosa californica* or *Rubus ursinus* instead. Locally, this is a very common riparian scrub in the Delta and likely signifies regular disturbance from such things as levee maintenance.

Site Impacts
Thirty-one samples of this association had low to high impacts from non-native plant species. The main non-native species with highest cover is *Rubus discolor*. Additional site impacts are road construction/maintenance and rip-rap/bank protection.

Samples Used to Describe Association (n=38)
Rapid Assessment(s): SSJD0058, 0089, 0092, 0103, 0108, 0109, 0117, 0134, 0154, 0164, 0165, 0167, 0168, 0170, 0171, 0194, 0195, 0196, 0200, 0209, 0234, 0237, 0248, 0261, 0275, 0281 0283, 0284, 0285, 0286, 0292, 0298, 0305, 0329, 0330, 0332, 0340, 0367

Rank: G5S4

Global Distribution
So far as is known, this association is endemic to California's Central Valley, though it is not known from along the main stem of the Sacramento River north of the Delta (Vaghti 2003).

References
None specific to the association. Vaghti (2003) reports a similar *Salix exigua* association farther north on the Sacramento River.

***Salix exigua (- Salix lasiolepis) – Rubus discolor* Association** **n=** 38

Stratum	Code	Species Name	Con	Avg	Min	Max
Tree Overstory						
	ALRH2-t	*Alnus rhombifolia*	61	2.0	0.2	9
	SAGO-t	*Salix gooddingii*	45	2.0	0.2	10
	POFR2-t	*Populus fremontii*	32	1.0	0.2	8
	FRLA-t	*Fraxinus latifolia*	21	0.0	0.2	5
	JUCAH-t	*Juglans hindsii*	21	0.0	0.2	7
Tree Understory						
	ALRH2-m	*Alnus rhombifolia*	21	0.0	0.2	2
Shrub						
	SAEX-m	*Salix exigua*	92	27.0	2	70
	RUDI2-m	*Rubus discolor*	82	32.0	1	80

	SALA6-m	*Salix lasiolepis*	79	24.0	0.2	77
	CEOC2-m	*Cephalanthus occidentalis*	50	1.0	0.2	12
	ROCA2-m	*Rosa californica*	37	7.0	0.2	66
	RUUR-m	*Rubus ursinus*	29	1.0	0.2	15
	VICA5-m	*Vitis californica*	29	0.0	0.2	4
Herb						
	ARDO3-m	*Artemisia douglasiana*	21	0.0	0.2	6
	CABA4-l	*Carex barbarae*	21	0.0	0.2	2

***Salix lasiolepis* Alliance**
Arroyo willow Alliance

One association of the *Salix lasiolepis* Alliance was described from the Delta: the S*alix lasiolepis* Great Valley Provisional Association, described below. All samples of this alliance were classified into this association.

***Salix lasiolepis* California Great Valley Provisional Association**
Arroyo willow California Great Valley Provisional Association

Local Vegetation Description
Eight stands of the S*alix lasiolepis* Great Valley Provisional Association were sampled in the Delta (SSJD0130, 0210, 0220, 0238, 0239, 0282, 0293, 0294). The sampled stands have a dense shrub layer (65-100%, mean 81%), where *Salix lasiolepis* dominates, and other typical, low-elevation Great Valley species are present, such as *Rosa californica* and *Cephalanthus occidentalis*. Shrubs occur in two different strata, with low shrubs at 0.5-5m tall and tall shrubs/understory trees at 2-10m tall. The herbaceous layer is open (<1-10%, mean 4%) at 0-5m tall. Trees including *Populus fremontii* and *Alnus rhombifolia* occur as emergents (0-8% cover, mean 1%). Total vegetation cover is 68-85%, with a mean of 78%.

In the sampled stands, *Salix lasiolepis* dominates the overstory shrub layer at 50 to 80% cover. The herb layer is variable and may include *Schoenoplectus acutus, Cyperus eragrostis*, or *Typha* sp., which indicate standing water during at least a portion of the year.

This association was sampled in the following EMUs: Central West Delta, North Delta.

Site Impacts
No known impacts were reported in these stands.

Rank: G3S3

Global Distribution
This association is limited to the western states including ID, NV, CA, OR, and UT. Interestingly, though widely distributed in the Coast Ranges (ABI 2003) and the Sierra Foothills (Potter 2005), no *Salix lasiolepis* stands are noted for the main stem of the Sacramento River by Vaghti (2003).

References
None specific to the association. For alliance, see Keeler-Wolf and Evens (2006), ABI (2003), Potter (2005), and Sawyer et al. (2006 MS)

***Salix lasiolepis* Great Valley Provisional Association** **n=** 8

Stratum	Code	Species Name	Con	Avg	Min	Max
Tree Overstory						
	POFR2-t	*Populus fremontii*	38	1.0	0.2	8
	ALRH2-t	*Alnus rhombifolia*	38	0.0	0.2	1
	JUCAH-t	*Juglans hindsii*	25	0.0	0.2	0.2
	QULO-t	*Quercus lobata*	25	0.0	0.2	0.2
	SAGO-t	*Salix gooddingii*	25	0.0	0.2	0.2
Shrub						
	SALA6-m	*Salix lasiolepis*	100	63.0	50	80
	CEOC2-m	*Cephalanthus occidentalis*	62	5.0	0.2	29
	RUUR-m	*Rubus ursinus*	50	2.0	1	10
	SAEX-m	*Salix exigua*	50	1.0	0.2	3
	ROCA2-m	*Rosa californica*	38	3.0	0.2	25
	SALU-t	*Salix lucida*	38	3.0	0.2	25
	HOMA4-m	*Hoita macrostachya*	38	1.0	0.2	5
	RUBUS-m	*Rubus*	25	3.0	0.2	20
	COSE16-m	*Cornus sericea*	25	1.0	1	5
	SAME5-m	*Sambucus mexicana*	25	0.0	0.2	0.2
Herb						
	SCAC3-m	*Schoenoplectus acutus*	25	2.0	4	8
	CYER-l	*Cyperus eragrostis*	25	0.0	0.2	0.2
	TYPHA-m	*Typha*	25	0.0	1	2

***Salix lucida* Alliance**
Shining willow Alliance

Local Vegetation Description
Three stands of the *Salix lucida* Alliance were sampled in the Delta (SSJD0074, 0076, and 0078), and no associations have been described. The sampled stands have a dense shrub layer (70-84%, mean 76%), where *Salix lucida* dominates. Shrubs occur in two different strata, with low shrubs at 2-5m tall and tall shrubs/understory trees at 5-10m tall. The herbaceous layer is open (<1-3%, mean 1%) at 0.5-2m tall. *Alnus rhombifolia*, and other trees less frequently, occur as emergents (1-12% cover, mean 5%). Total vegetation cover is 85%.

In the sampled stands, *Salix lucida* dominates the overstory shrub layer at 44 to 79% cover. The herb layer is variable. All three samples contain between 20 and 22% cover of *Cornus sericea*, and the cluster analysis grouped these samples in a larger cluster characterized by

the presence of *Cornus*, suggesting the relationship of these Delta stands to the *Cornus sericea* alliance.

With a few more samples, a *Salix lucida - Cornus sericea* Association could likely be described. Also, this is likely *Salix lucida* ssp. *lasiandra* (Pacific shining willow).

This alliance was sampled in the following EMU: North Delta

Site Impacts
One sample of this alliance had low impacts from non-native plant species, primarily *Rubus discolor*.

Rank: G4S3

Global Distribution
Assuming the local populations are all ssp. *lasiandra,* the *S. lucida* ssp. *lasiandra* alliance is restricted so far as known to CA, OR, WA, and adjacent British Columbia (NatureServe 2006). Vaghti (2003) reports on similar *S. lucida* stands with *Urtica urens* and *U. dioica* as understory diagnostics in the Sacramento River riparian zone. She characterizes these stands as common in backwater habitats such as along oxbow lakes. ABI (2003) describes stands of this alliance along permanent streams in Marin County.

References
ABI (2003), NatureServe (2006), Vaghti (2003)

***Salix lucida* Alliance only** **n=** 3

Stratum	Code	Species Name	Con	Avg	Min	Max
Tree Overstory						
	ALRH2-t	*Alnus rhombifolia*	100	2.0	1	3
	QULO-t	*Quercus lobata*	33	3.0	9	9
	ACNE2-t	*Acer negundo*	33	0.0	0.2	0.2
	FRLA-t	*Fraxinus latifolia*	33	0.0	1	1
	POFR2-t	*Populus fremontii*	33	0.0	1	1
Shrub						
	SALU-t	*Salix lucida*	100	59.0	44	79
	COSE16-m	*Cornus sericea*	100	22.0	20	25
	SALA6-m	*Salix lasiolepis*	67	4.0	1	10
	RUDI2-m	*Rubus discolor*	67	3.0	3	5
	SAEX-m	*Salix exigua*	67	1.0	0.2	4
	CEOC2-m	*Cephalanthus occidentalis*	33	0.0	0.2	0.2
	HILA6-m	*Hibiscus lasiocarpus*	33	0.0	0.2	0.2
Herb						
	CABA4-l	*Carex barbarae*	33	0.0	0.2	0.2
	COAR4-l	*Convolvulus arvensis*	33	0.0	0.2	0.2
	JUNCU-l	*Juncus*	33	0.0	0.2	0.2
	JUEF-l	*Juncus effusus*	33	0.0	0.2	0.2
	LAJEJ-m	*Lathyrus jepsonii ssp.*	33	0.0	0.2	0.2
	PADI3-l	*Paspalum dilatatum*	33	0.0	0.2	0.2

PHAU7-m	*Phragmites australis*	33	0.0	0.2	0.2

***Sambucus mexicana* Alliance**
Valley elderberry Alliance

Local Vegetation Description
One stand of *Sambucus mexicana* Alliance was sampled in the Delta (SSJD0258), and no associations have been described. The sampled stand of *Sambucus mexicana* alliance has a dense cover shrub layer (82%), and *Sambucus mexicana* dominates with 48% cover. *Rubus discolor* and *Salix lasiolepis* are sub-dominant, and the herb cover is very sparse.

This alliance was sampled in the following EMU: North Delta

Site Impacts
The one sample of this alliance had moderate impacts from non-native plant species. The non-native species with the highest cover was *Sorghum halepense.*

Rank: G3S3

Global Distribution
Stands are limited to the California floristic province. Holland (1986) discusses the presence of Valley Elderberry savanna, but to this date, little classification work has been done outside of southern California, where a *Sambucus mexicana/Leymus condensatus-Annual Grass-Herb* Shrubland *(*Keeler-Wolf and Evens 2006*)* has been described in the Santa Monica Mountains.

References
Holland (1986), Keeler-Wolf and Evens (2006)

***Sambucus mexicana* Alliance only** **n=** 1

Stratum Code	Species Name	Con	Avg	Min	Max
Tree Overstory					
PLRA-t	*Platanus racemosa*	100	3.0	3	3
SAGO-t	*Salix gooddingii*	100	3.0	3	3
ACNE2-t	*Acer negundo*	100	2.0	2	2
ALRH2-t	*Alnus rhombifolia*	100	2.0	2	2
FRLA-t	*Fraxinus latifolia*	100	1.0	1	1
POFR2-t	*Populus fremontii*	100	1.0	1	1
QULO-t	*Quercus lobata*	100	0.0	0.2	0.2
Tree Understory					
SAGO-m	*Salix gooddingii*	100	7.0	7	7
ALRH2-m	*Alnus rhombifolia*	100	0.0	0.2	0.2
Shrub					
SAME5-m	*Sambucus mexicana*	100	48.0	48	48
RUDI2-m	*Rubus discolor*	100	33.0	33	33
SALA6-m	*Salix lasiolepis*	100	10.0	10	10

	VICA5-m	*Vitis californica*	100	2.0	2	2
	CEOC2-m	*Cephalanthus occidentalis*	100	0.0	0.2	0.2
Herb						
	SOHA-m	*Sorghum halepense*	100	2.0	2	2

***Suaeda moquinii* Alliance**
Mojave seablite Alliance

Local Vegetation Description
One stand of the *Suaeda moquinii* Alliance was sampled in the Delta (SSJD0376), and therefore no associations have been described here. In the sample, *Suaeda moquinii* dominates at 8% cover, with *Allenrolfea occidentalis* at <1% cover. Total shrub cover is 8%. Dominant herbs include *Juncus bufonius, Lepidium dictyotum* and *Spergularia marina*. Herbaceous cover is 27%. Total vegetation cover is 28%.

This alliance was sampled in the following EMU: Central West Delta

Site Impacts
The one sampled stand had moderate grazing impacts.

Rank: G4S3

Global Distribution
Stands occur in CA, NV, and AZ. It is known from the warm deserts, Great Basin deserts, the inner South Coast Ranges, and the San Joaquin Valley in California (Sawyer and Keeler-Wolf 1995).

References
Sawyer and Keeler-Wolf (1995)

***Suaeda moquinii* Alliance Only** **n=** 1

Stratum	Code	Species Name	Con	Avg	Min	Max
Herb						
	JUBU-l	*Juncus bufonius*	100	9	9	9
	SUMO-l	*Suaeda moquinii*	100	8	8	8
	PAIN-l	*Parapholis incurva*	100	8	8	8
	LEDI2-l	*Lepidium dictyotum*	100	5	5	5
	SPMA2-l	*Spergularia marina*	100	4	4	4
	JUBU-l	*Puccinellia simplex*	100	2	2	2
	HODE2-l	*Hordeum depressum*	100	2	2	2
	PLEL-l	*Plantago elongata*	100	2	2	2
	ATRIP-l	*Atriplex*	100	0.0	0.2	0.2
	DISP-l	*Distichlis spicata*	100	0.0	0.2	0.2
	FRSA-l	*Frankenia salina*	100	0.0	0.2	0.2
	HEFI-l	*Hemizonia fitchii*	100	0.0	0.2	0.2

	HYGL2-I	*Hypochaeris glabra*	100	0.0	0.2	0.2
	LACA7-I	*Lasthenia californica*	100	0.0	0.2	0.2
	LENI-I	*Lepidium nitidum*	100	0.0	0.2	0.2
	MIAC-I	*Microseris acuminata*	100	0.0	0.2	0.2
	SPMAL2-I	*Spergularia macrotheca*	100	0.0	0.2	0.2
	TRDET-I	*Trifolium depauperatum* var. *truncatum*	100	0.0	0.2	0.2
Moss						
	MOSS-I	Moss	100	5	5	5

Herbaceous Vegetation

***Arundo donax* Alliance**
Giant reed Alliance

Local Vegetation Description
One stand of *Arundo donax* Alliance was sampled in the Delta (SSJD0107), and therefore no associations have been described here. In the one sample, *Arundo donax* dominates the herb layer with a cover of 40% at over 5m in height. *Fraxinus latifolia* and *Salix gooddingii* occur at 2% and 1% cover, respectively, although they are not taller than the *Arundo*. *Artemisia douglasiana* comprised 25% cover. This was a linear stand along a levee bank; the *Arundo* occurs in solid patches. Total vegetation cover is 77%.

This alliance was sampled in the following EMU: South Delta

Site Impacts
This is a non-native dominated alliance, with *Arundo donax* as the dominant species.

Rank: Unranked, non-native invasive

Global Distribution
Widely distributed in California and the Southwestern US and adjacent Mexico. All stands are non-native in North America. In much of lowland cismontane California this is a dangerously invasive alliance, choking many riparian stretches in southern California and the Central Valley.

References
Bossard et al. (2000), NatureServe 2006, Sawyer et al. (2006 MS)

***Arundo donax* Alliance only** **n=** 1

Stratum	Code	Species Name	Con	Avg	Min	Max
Tree Overstory						
	FRLA-t	*Fraxinus latifolia*	100	2.0	2	2
	SAGO-t	*Salix gooddingii*	100	1.0	1	1
Shrub						
	SAEX-m	*Salix exigua*	100	10.0	10	10
	RUUR-m	*Rubus ursinus*	100	5.0	5	5
	VICA5-m	*Vitis californica*	100	1.0	1	1
	NIGL-m	*Nicotiana glauca*	100	0.0	0.2	0.2
Herb						
	ARDO4-m	*Arundo donax*	100	40.0	40	40
	ARDO3-m	*Artemisia douglasiana*	100	25.0	25	25
	LELA2-m	*Lepidium latifolium*	100	3.0	3	3
	BRNI-m	*Brassica nigra*	100	1.0	1	1

***Azolla filiculoides* Alliance**
Large mosquito-fern Alliance

Local Vegetation Description
One stand of *Azolla filiculoides* Alliance was sampled in the Delta (SSJD0042), and therefore no associations have been described here. In the sample, the floating aquatic species, *Azolla filiculoides,* dominates at 85% cover. There is 10% cover of *Cabomba caroliniana.* Total vegetation cover is 95%.

This alliance was sampled in the following EMU: North Delta

Site Impacts
The one sampled stand had low impacts from the non-native species, *Cabomba caroliniana.*

Rank: G5S3?

Global Distribution
Throughout California (except deserts); extensive mats develop in the summer on the ponds at Arcata Marsh along Humboldt Bay. Northern Hemisphere, South America.

References
Mason (1957)

***Azolla filiculoides* Alliance** **n=** 1

Stratum	Code	Species Name	Con	Avg	Min	Max
Herb						
	AZFI-l	*Azolla filiculoides*	100	85.0	85	85
	BRASE-l	*Cabomba caroliniana*	100	10.0	10	10
Algae						
	ALGAE-l	Algae	100	10	10	10

California Annual Grassland / Herbaceous Alliance
One association of the California Annual Grassland / Herbaceous Alliance was described in the Delta: the *Bromus diandrus-Bromus hordeaceus* Provisional Association. One sample (SSJD0380) was classified to the alliance level only.

***Bromus diandrus - Bromus hordeaceus* Provisional Association**
Ripgut brome - soft chess Provisional Association

Local Vegetation Description
Stands of the *Bromus diandrus - Bromus hordeaceus* Provisional Association are characterized by an herbaceous layer that is intermittent to dense (45-90%, mean 66%) at 0-1m tall. The emergent shrub layer is very open (2-2%, mean 2%) at 0.5-5m tall. *Quercus lobata* occasionally occurs at 4-5% cover as an emergent. Total vegetation cover is 45-90%, mean 66%.

In this association, *Bromus hordeaceus* is frequently abundant, often with *Bromus diandrus*. Other abundant or characteristic species include *Distichlis spicata* and *Lotus purshianus* or the non-natives *Lactuca serriola* and *Vicia sativa.*

This association was sampled in the following EMUs: Central West Delta, North Delta, South Delta

Site Impacts
This association is dominated by non-natives, although it occasionally supports low cover of natives. Two stands had moderate to high impacts recorded from grazing and two had low to moderate impacts from landfill or trash/dumping.

Samples Used to Describe Association (n=6)
Rapid Assessment(s): SSJD0041, 0120, 0123, 0182, 0213, 0313

Rank: G5S5 (Note: this is largely a non-native association and it is debatable whether it should be ranked. However, some stands may have conservation value due to a component of native species)

Global Distribution
Throughout Cismontane California.

References
Sawyer et al. (2006 MS)

***Bromus diandrus - Bromus hordeaceus* Provisional Association** **n=** 6

Stratum	Code	Species Name	Con	Avg	Min	Max
Tree Overstory						
	QULO-t	*Quercus lobata*	33	2.0	4	5
Herb						
	BRHO2-l	*Bromus hordeaceus*	100	21.0	3	60
	BRDI3-l	*Bromus diandrus*	67	18.0	10	55
	DISP-l	*Distichlis spicata*	67	1.0	0.2	3
	LASE-m	*Lactuca serriola*	67	0.0	0.2	2
	LOPU3-l	*Lotus purshianus*	50	2.0	2	5
	VISA-l	*Vicia sativa*	50	0.0	0.2	1
	SIMA3-m	*Silybum marianum*	33	6.0	1	35
	TRHI4-l	*Trifolium hirtum*	33	6.0	1	35
	AVFA-m	*Avena fatua*	33	4.0	7	20

ERSE3-l	*Eremocarpus setigerus*	33	2.0	1	10
LOCO6-l	*Lotus corniculatus*	33	1.0	0.2	8
BRNI-m	*Brassica nigra*	33	0.0	1	1
CESO3-l	*Centaurea solstitialis*	33	0.0	0.2	1
COAR4-l	*Convolvulus arvensis*	33	0.0	0.2	0.2
COCA5-m	*Conyza canadensis*	33	0.0	0.2	0.2
LELA2-m	*Lepidium latifolium*	33	0.0	0.2	1
LOMU-l	*Lolium multiflorum*	33	0.0	0.2	1

***Carex barbarae* Alliance**
Santa Barbara sedge Alliance

Local Vegetation Description
One stand of *Carex barbarae* was sampled in the Delta (SSJD0014). It is characterized by a dense herbaceous layer at 0.5-1m tall strongly dominated by *Carex barbarae*. Total vegetation cover is 97%. Other species present include *Nicotiana glauca, Asclepias fascicularis*, and *Urtica dioica.*

This sampled stand was in the following EMU: South Delta

Site Impacts
The sampled stand of this association had moderate impacts from grazing.

Rank: G2S2

Global Distribution
The species occurs in northern and southern cismontane California (Evens and Kentner 2006). However, stands dominated by this species are usually associated with an overstory of woody species such as *Quercus lobata* and have been placed in the dominant overstory alliance. This species has important cultural significance to the original Native American inhabitants of the Central Valley.

References
Evens and Kentner 2006.

***Carex barbarae* Alliance** **n=** 1

Stratum	Code	Species Name	Con	Avg	Min	Max
Shrub						
	NIGL-m	*Nicotiana glauca*	100	0.0	0.2	0.2
Herb						
	CABA4-l	*Carex barbarae*	100	94.0	94	94
	ASFA-m	*Asclepias fascicularis*	100	3.0	3	3
	URDI-m	*Urtica dioica*	100	0.0	0.2	0.2

***Cortaderia (selloana, jubata*) Alliance**
Pampas grass Alliance

Local Vegetation Description
One stand of the *Cortaderia (selloana, jubata*) Alliance was sampled in the Delta (SSJD0352), and therefore no associations have been described here. In the one stand, *Cortaderia selloana* and the native *Phragmites australis* are codominants at 35 and 20% cover, respectively. All other herbaceous species occur at very low cover. The total herbaceous cover is 63%. *Rubus discolor* is an "emergent" shrub at 5% cover. Total vegetation cover is 65%.

This alliance was sampled in the following EMU: Central West Delta

Site Impacts
This alliance is dominated by the non-native *Cortaderia.* Several native species occur at low cover, including *Euthamia occidentalis* and *Calystegia sepium.*

Rank: Unranked, non-native invasive

Global Distribution
The alliance, dominated by either *C. jubata* or *C. selloana*, is common in coastal areas of northern and central California.

References
Sawyer et al. (2006 MS)

***Cortaderia (selloana, jubata)* Alliance only** **n=** 1

Stratum	Code	Species Name	Con	Avg	Min	Max
Shrub						
	RUDI2-m	*Rubus discolor*	100	5.0	5	5
Herb						
	COSE4-m	*Cortaderia selloana*	100	35.0	35	35
	PHAU7-m	*Phragmites australis*	100	20.0	20	20
	EUOC4-m	*Euthamia occidentalis*	100	3.0	3	3
	LOCO6-l	*Lotus corniculatus*	100	2.0	2	2
	AMPS-m	*Ambrosia psilostachya*	100	1.0	1	1
	CASE13-m	*Calystegia sepium*	100	0.0	0.2	0.2
	COCA5-m	*Conyza canadensis*	100	0.0	0.2	0.2
	LELA2-m	*Lepidium latifolium*	100	0.0	0.2	0.2

***Cynodon dactylon* Alliance**
Bermuda grass Alliance

Local Vegetation Description
Two stands of *Cynodon dactylon* Alliance were sampled in the Delta (SSJD0180 and 0309), and therefore no associations have been described here. The stands are characterized by a herbaceous layer that is 73% cover at 0-0.5m tall, with no shrub or tree layer. Total vegetation cover is 73%.

In this alliance, *Cynodon dactylon* dominates the herb layer at 52% cover. *Lolium multiflorum, Lotus corniculatus, Vulpia myuros, Bromus diandrus* and *Hypochaeris glabra* occur at lower cover.

This alliance was sampled in the following EMUs: Central West Delta, East Delta

Site Impacts
This alliance is dominated by a non-native species, *Cynodon dactylon*.

Rank: Unranked, non-native invasive

Global Distribution
Bermuda grass is a widespread weed in cismontane California and elsewhere in the warmer parts of North America. It has not been considered an alliance prior to this effort, although stands are probably common in disturbed areas (including lawns) throughout much of its introduced range. It is considered moderately invasive in California (CIPC 2006).

References
California Invasive Plant Council (2006)

***Cynodon dactylon* Alliance only** **n= 2**

Stratum	Code	Species Name	Con	Avg	Min	Max
Herb						
	CYDA-l	*Cynodon dactylon*	100	52.0	38	65
	LOMU-l	*Lolium multiflorum*	100	1	0.2	2
	LOCO6-l	*Lotus corniculatus*	50	14	0	27
	VUMY-l	*Vulpia myuros*	50	7.5	0	15
	BRDI3-l	*Bromus diandrus*	50	5.0	5	5
	HYGL2-l	*Hypochaeris glabra*	50	1	0	2
	RUCR-m	*Rumex crispus*	50	1	0	2
	LETR5-l	*Leymus triticoides*	50	0.0	0	1
	AGEL4-l	*Agrostis elliottiana*	50	0.0	0	0.2
	ASTER-m	*Aster* sp.	50	0.0	0	0.2
	AVENA-m	*Avena*	50	0.0	0	0.2
	BRMA3-l	*Bromus madritensis*	50	0.0	0	0.2
	CAPY2-m	*Carduus pycnocephalus*	50	0.0	0	0.2
	COAR4-l	*Convolvulus arvensis*	50	0.0	0	0.2
	HORDE-l	*Hordeum* sp.	50	0.0	0	0.2
	LASE-m	*Lactuca serriola*	50	0.0	0	0.2

LELA2-m	*Lepidium latifolium*	50	0.0	0	0.2
PLLA-l	*Plantago lanceolata*	50	0.0	0	0.2
SOOL-m	*Sonchus oleraceus*	50	0.0	0.2	0.2
TRRE3-l	*Trifolium repens*	50	0.0	0.2	0.2

***Deschampsia caespitosa* Alliance**
Tufted hairgrass Alliance

One association of the *Deschampsia caespitosa* Alliance was classified in the Delta: the *Deschampsia caespitosa-Lilaeopsis masonii* Provisional Association. All samples of this alliance were classified into this association.

***Deschampsia caespitosa - Lilaeopsis masonii* Provisional Association**
Tufted hairgrass - Mason's lilaeopsis Provisional Association

Local Vegetation Description
Stands of the *Deschampsia caespitosa-Lilaeopsis masonii* Provisional Association are characterized by an herbaceous layer that is intermittent to dense (50-75%, mean 60%) at 0-2m tall. There is, infrequently, an emergent tree layer (mean 2%) of *Alnus rhombifolia, Fraxinus latifolia* or *Juglans X hindsii*, or shrub layer (<1%) of *Baccharis douglasii, Cephalanthus occidentalis* or *Ficus carica*. Total vegetation cover is 50-75%, mean 61%.

In this association, *Deschampsia caespitosa* is the dominant species at 10-55% cover, with *Lilaeopsis masonii,* a state-listed Rare species, consistently present at <1 to 22% cover. Other frequently occurring herbs with >1% cover include *Schoenoplectus acutus* and *Hydrocotyle verticillata*.

This association was sampled in the following EMU: Central West Delta

Site Impacts
One stand had light impacts from non-native species, primarily *Paspalum dilatatum* and *Ficus carica*.

Samples Used to Describe Association (n=5)
Rapid Assessment(s): SSJD0273, 0274, 0277, 0315, 0354

Rank: G1S1

Global Distribution
Restricted to the Sacramento-San Joaquin Delta, so far as known.

References
Sawyer et al. (2006 MS) for alliance

***Deschampsia caespitosa - Lilaeopsis masonii* Provisional Association** **n=** 5

Stratum	Code	Species Name	Con	Avg	Min	Max
Tree Overstory						
	ALRH2-t	*Alnus rhombifolia*	20	0.0	1	1
Tree Understory						
	ALRH2-m	*Alnus rhombifolia*	20	0.0	2	2
	FRLA-m	*Fraxinus latifolia*	20	0.0	0.2	0.2
	JUCAH-m	*Juglans hindsii*	20	0.0	0.2	0.2
Shrub						
	BADO-m	*Baccharis douglasii*	20	0.0	0.2	0.2
	CEOC2-m	*Cephalanthus occidentalis*	20	0.0	0.2	0.2
	FICA-m	*Ficus carica*	20	0.0	0.2	0.2
Herb						
	DECA2-l	*Deschampsia caespitosa*	100	24.0	10	55
	LIMA7-l	*Lilaeopsis masonii*	100	7.0	0.2	22
	SCAC3-m	*Schoenoplectus acutus*	80	7.0	4	15
	HYVE2-l	*Hydrocotyle verticillata*	80	6.0	5	16
	HEPU2-m	*Helenium puberulum*	80	1.0	0.2	2
	ASLE17-m	*Aster lentus*	80	0.0	0.2	0.2
	LYCA4-m	*Lythrum californicum*	80	0.0	0.2	0.2
	SCCA-m	*Schoenoplectus californicus*	60	2.0	0.2	10
	EUOC4-m	*Euthamia occidentalis*	60	1.0	0.2	2
	CASE13-m	*Calystegia sepium*	60	0.0	0.2	1
	JUEF-m	*Juncus effusus*	60	0.0	0.2	1
	JUXI-m	*Juncus xiphioides*	40	2.0	2	6
	SEHY-m	*Senecio hydrophiloides*	40	1.0	1	3
	ARDO3-m	*Artemisia douglasiana*	40	0.0	0.2	0.2
	CEMU2-l	*Centaurium muehlenbergii*	40	0.0	0.2	0.2
	GRCA-m	*Grindelia camporum*	40	0.0	0.2	2
	MEAL2-m	*Melilotus albus*	40	0.0	0.2	0.2
	MIGU-m	*Mimulus guttatus*	40	0.0	0.2	0.2
	JUBA-l	*Juncus balticus*	20	3.0	15	15
	SCCE6-l	*Scirpus cernuus (=Isolepis c.)*	20	2.0	8	8
	GRIND-m	*Grindelia*	20	1.0	6	6
	PADI3-l	*Paspalum dilatatum*	20	1.0	6	6
	PADI3-m	*Paspalum dilatatum*	20	1.0	4	4
	PLSU2-l	*Plantago subnuda*	20	1.0	7	7
	TRST6-l	*Triglochin striatum*	20	1.0	5	5
	COSE4-m	*Cortaderia selloana*	20	0.0	0.2	0.2
	CYDA-l	*Cynodon dactylon*	20	0.0	2	2
	ECHIN4-l	*Echinochloa*	20	0.0	0.2	0.2
	ERAR11-m	*Eryngium aristulatum*	20	0.0	0.2	0.2
	ERAR14-m	*Eryngium articulatum*	20	0.0	1	1
	ERAR14-l	*Eryngium articulatum*	20	0.0	0.2	0.2
	LAJEJ-m	*Lathyrus jepsonii ssp.*	20	0.0	0.2	0.2
	LUPEM-l	*Ludwigia peploides ssp. montevidensis*	20	0.0	0.2	0.2
	LYAM-m	*Lycopus americanus*	20	0.0	0.2	0.2

LYAM-l	*Lycopus americanus*	20	0.0	0.2	0.2
MEAR4-m	*Mentha arvensis*	20	0.0	0.2	0.2
MIFR2-m	*Mimulus fremontii*	20	0.0	1	1
PHAU7-m	*Phragmites australis*	20	0.0	0.2	0.2
POAM8-l	*Polygonum amphibium*	20	0.0	2	2
POPU5-m	*Polygonum punctatum*	20	0.0	0.2	0.2
POPU5-l	*Polygonum punctatum*	20	0.0	0.2	0.2
POMO5-l	*Polypogon monspeliensis*	20	0.0	0.2	0.2
POAN5-l	*Potentilla anserina*	20	0.0	0.2	0.2
SCAM2-m	*Schoenoplectus americanus*	20	0.0	0.2	0.2
SENEC-m	*Senecio*	20	0.0	0.2	0.2
STACH-l	*Stachys*	20	0.0	0.2	0.2
TRIGL-l	*Triglochin*	20	0.0	0.2	0.2
TYPHA-m	*Typha*	20	0.0	1	1
TYLA-m	*Typha latifolia*	20	0.0	0.2	0.2
VERBE-m	*Verbena*	20	0.0	0.2	0.2

***Distichlis spicata* Alliance**
Saltgrass Alliance

Two associations of the *Distichlis spicata* Alliance were classified in the Delta: the *Distichlis spicata* / Annual Grasses and *Distichlis spicata - Salicornia virginica* provisional associations. In addition, two samples (SSJD0307and SSJD0350) of this alliance were classified to alliance level only, and reconnaissance-level data was collected from one stand that placed it in the *Distichlis spicata - Juncus balticus* Association, previously described from Suisun Marsh.

***Distichlis spicata* Alliance only** **n=** 2

Stratum	Code	Species Name	Con	Avg	Min	Max
Herb						
	DISP-l	*Distichlis spicata*	100	68.0	65	70
	LELA2-m	*Lepidium latifolium*	100	15.0	2	28
	LASE-m	*Lactuca serriola*	100	0.0	0.2	0.2
	AMPS-m	*Ambrosia psilostachya*	50	4.0	8	8
	ATTR2-m	*Atriplex triangularis*	50	4.0	8	8
	EUOC4-m	*Euthamia occidentalis*	50	1.0	2	2
	ATTR2-l	*Atriplex triangularis*	50	0.0	1	1
	BRHO2-l	*Bromus hordeaceus*	50	0.0	0.2	0.2
	CASE13-m	*Calystegia sepium*	50	0.0	0.2	0.2
	FRSA-l	*Frankenia salina*	50	0.0	1	1
	POMO5-l	*Polypogon monspeliensis*	50	0.0	0.2	0.2
	SAVI-l	*Salicornia virginica*	50	0.0	1	1
	SAVI-m	*Salicornia virginica*	50	0.0	0.2	0.2
	SOAS-l	*Sonchus asper*	50	0.0	0.2	0.2
	SOOL-m	*Sonchus oleraceus*	50	0.0	0.2	0.2

***Distichlis spicata* / Annual Grasses Provisional Association**
Saltgrass / Annual grasses Provisional Association

Local Vegetation Description
Stands of the *Distichlis spicata* / Annual Grasses Provisional Association are characterized by an herbaceous layer that is intermittent to dense (50-75%, mean 63%) at 0-1m tall. There are no emergent trees or shrubs.

In this association, *Distichlis spicata* dominates the herb layer at 22 to 40% cover; other frequent or abundant herbaceous species include *Cressa truxillensis* and the non-native annual grasses *Vulpia myuros, Polypogon monspeliensis, Bromus diandrus, B. hordeaceus*, and *Lolium multiflorum.*

This association was sampled in the following EMU: Central West Delta

Site Impacts
Both samples of this association had moderate impacts from non-native plant species, as listed above. One sample had moderate impacts from road construction/maintenance.

Samples Used to Describe Association (n=2)
Rapid Assessment(s): SSJD0311, 0312

Rank: G4S3?

Global Distribution
Known from California's cismontane regions from the Central Valley to southern California and along coastal salt marsh and brackish marsh margins into Baja California (Sawyer et al. 2006 MS). Note: inland alkaline vegetation and coastal saline vegetation may be dominated by different races of *Distichlis spicata.* This alliance is well represented in Suisun Marsh immediately west of the Delta study area (Keeler-Wolf and Vaghti 2000).

References
Keeler-Wolf and Vaghti (2000), Sawyer et al. (2006 MS)

***Distichlis spicata* / *Annual Grasses* Provisional Association** **n=** 2

Stratum	Code	Species Name	Con	Avg	Min	Max
Shrub						
	RUDI2-m	*Rubus discolor*	50	0.0	0.2	0.2
Herb						
	DISP-l	*Distichlis spicata*	100	31.0	22	40
	CRTR5-l	*Cressa truxillensis*	100	10.0	10	11
	VUMY-l	*Vulpia myuros*	100	10.0	1	20
	POMO5-l	*Polypogon monspeliensis*	100	5.0	0.2	10
	LELA2-m	*Lepidium latifolium*	100	4.0	0.2	7
	BRDI3-l	*Bromus diandrus*	100	1.0	0.2	2
	ATTR2-l	*Atriplex triangularis*	100	0.0	0.2	0.2

EUOC4-m	*Euthamia occidentalis*	100	0.0	0.2	0.2
LOMU-l	*Lolium multiflorum*	50	28.0	55	55
BRHO2-l	*Bromus hordeaceus*	50	8.0	15	15
LOCO6-l	*Lotus corniculatus*	50	2.0	4	4
VUBR-l	*Vulpia bromoides*	50	1.0	2	2
ASOF-m	*Asparagus officinalis*	50	0.0	1	1
COCO7-l	*Cotula coronopifolia*	50	0.0	0.2	0.2
HEGR7-m	*Heterotheca grandiflora*	50	0.0	1	1
HYGL2-l	*Hypochaeris glabra*	50	0.0	0.2	0.2
LASE-m	*Lactuca serriola*	50	0.0	0.2	0.2
SOOL-m	*Sonchus oleraceus*	50	0.0	0.2	0.2

Distichlis spicata - Salicornia virginica **Provisional Association**
Saltgrass - Pickleweed Provisional Association

Local Vegetation Description
Stands of the *Distichlis spicata-Salicornia virginica* Provisional Association are characterized by an herbaceous layer that is intermittent to dense (65-95%, mean 80%) at 0.5-1m tall. There are no emergent trees or shrubs. *Distichlis spicata* and *Salicornia virginica* are codominants at 25 to 50% cover. In one of the stands, *Grindelia stricta* has a cover of 40%.

This association was sampled in the following EMU: Central West Delta. It is likely to be restricted to the western-most portions of this EMU where saline soils occur.

Site Impacts
One sample of this association had light impacts from non-native plant species, predominantly *Polypogon monspeliensis*.

Samples Used to Describe Association (n=2)
Rapid Assessment(s): SSJD0308, 0320

Rank: G3S3

Global Distribution
This association is known from Suisun Marsh (Keeler-Wolf and Vaghti 2000), Point Reyes Peninsula (ABI 2003), and Southern coastal California (Keeler-Wolf and Evens 2006)

References
Keeler-Wolf and Evens (2006), Keeler-Wolf and Vaghti (2000), ABI (2003).

Distichlis spicata - Salicornia virginica **Provisional Association** **n=** 2

Stratum	Code	Species Name	Con	Avg	Min	Max
Herb						
	DISP-l	*Distichlis spicata*	100	38.0	25	50
	SAVI-l	*Salicornia virginica*	100	32.0	25	40
	GRST3-m	*Grindelia stricta*	50	20.0	40	40

PHAU7-m	*Phragmites australis*	50	5.0	10	10
AMPS-l	*Ambrosia psilostachya*	50	2.0	5	5
ATTR2-m	*Atriplex triangularis*	50	2.0	5	5
POMO5-l	*Polypogon monspeliensis*	50	1.0	2	2
SCAC3-m	*Schoenoplectus acutus*	50	1.0	2	2
AGEL4-m	*Agrostis elliottiana*	50	0.0	0.2	0.2
AMPS-m	*Ambrosia psilostachya*	50	0.0	0.2	0.2
ASLE17-m	*Aster lentus*	50	0.0	0.2	0.2
ATRIP-l	*Atriplex*	50	0.0	0.2	0.2
BRDI3-l	*Bromus diandrus*	50	0.0	0.2	0.2
COCO7-l	*Cotula coronopifolia*	50	0.0	0.2	0.2
FRSA-l	*Frankenia salina*	50	0.0	0.2	0.2
JUBA-l	*Juncus balticus*	50	0.0	1	1
LELA2-m	*Lepidium latifolium*	50	0.0	1	1
LOMU-l	*Lolium multiflorum*	50	0.0	0.2	0.2
SCMA-l	*Schoenoplectus maritimus*	50	0.0	0.2	0.2
SEVE2-l	*Sesuvium verrucosum*	50	0.0	0.2	0.2
SOOL-m	*Sonchus oleraceus*	50	0.0	0.2	0.2
TYAN-m	*Typha angustifolia*	50	0.0	0.2	0.2

Distichlis spicata - Juncus balticus **Association**
Saltgrass - Baltic rush Association

The *Distichlis spicata - Juncus balticus* Association was not adequately sampled in the Delta during this project, but reconnaissance-level data validate its existence there. Previously described from Suisun Marsh (Keeler-Wolf and Vaghti 2000), stands in this association are dominated by *Distichlis spicata* (> 50% relative cover) with the principal subordinate species being *Juncus balticus* or *J. mexicanus*.

References

Keeler-Wolf and Vaghti (2000)

Eichhornia crassipes **Alliance**
Water hyacinth Alliance

One association of the *Eichhornia crassipes* Alliance was classified in the Delta: the *Eichhornia crassipes - pure* provisional association. Both samples of this alliance were classified into this association.

Eichhornia crassipes - pure **Provisional Association**
Water hyacinth Association

Local Vegetation Description

Stands of the *Eichhornia crassipes - pure* Provisional Association are characterized by a floating aquatic herbaceous layer that is dense (97-100%, mean 99%) at 0-0.5m tall. In this association, *Eichhornia crassipes* dominates at 97-98% cover. Other species present at very low cover include *Hydrocotyle ranunculoides, Ludwigia peploides* ssp. *montevidensis*, *Schoenoplectus acutus*, and *Typha* sp.

This association was sampled in the following EMUs: East Delta, South Delta

Site Impacts
This alliance is dominated by a non-native species. Stands are often characterized by high cover of floating mats of this species, which choke waterways. Department of Boating and Waterways has an on-going herbicide spraying program to reduce cover of this species in the Delta.

Samples Used to Describe Association (n=2)
Rapid Assessment(s): SSJD0026, 0125

Rank: Unranked, non-native invasive

Global Distribution
This vegetation type is introduced and the plant is a serious pest of waterways in much of the warmer parts of North America. It is native to the Amazon Basin, South America. It has been given a high (dangerously invasive) rating by CIPC (2006)

References
California Invasive Plant Council (2006)

***Eichhornia crassipes - pure* Provisional Association n=** 2

Stratum	Code	Species Name	Con	Avg	Min	Max
Herb						
	EICR-l	*Eichhornia crassipes*	100	98.0	97	98
	EPILO-m	*Epilobium*	50	0.0	0.2	0.2
	HYRA-l	*Hydrocotyle ranunculoides*	50	0.0	0.2	0.2
	LUPEM-l	*Ludwigia peploides ssp. montevidensis*	50	0.0	1	1
	SCAC3-m	*Schoenoplectus acutus*	50	0.0	0.2	0.2
	TYPHA-m	*Typha*	50	0.0	1	1

***Equisetum (arvense, variegatum, heymale)* Alliance**
(Field Horsetail, Variegated Scouring-rush, Common Scouring-rush) Alliance

The *Equisetum (arvense, variegatum, heymale)* Alliance was not adequately sampled in the Delta during this project, but reconnaissance-level data also collected during this project validates its existence there. This Alliance also occurs in OR, WA, UT, CO, NM, and in BC and ONT, Canada. See NatureServe (2006) for more information.

References

NatureServe (2006)

***Frankenia salina* Alliance**
Alkali heath Alliance

Local Vegetation Description
Two stands of the *Frankenia salina* Alliance were sampled in the Delta (SSJD0318, 0319), and no associations were described. The stands are characterized by a dense herbaceous layer (80-95%, mean 88%) at 0-0.5m tall, with no emergent shrub or tree layer. In the two stands, *Frankenia salina* dominates the herb layer at 60 to 65% cover. *Distichlis spicata* is present at low cover, and *Salicornia virginica* is present at <1 to 30% cover.

Further sampling of this type is needed in the Delta and elsewhere. In Suisun Marsh, three provisional associations were sampled, the *Frankenia salina/Rumex crispus, Frankenia salina/Distichlis spicata, and Frankenia salina/Agrostis avenacea*

This alliance was sampled in the following EMU: Central West Delta

Site Impacts
One sample of this alliance had moderate impacts from non-native plant species including *Bromus diandrus* and *B. hordeaceus*.

Rank: G3S3

Global Distribution
California from Glenn County south to Mexico (species also ranges to South America). Alliance is known from San Francisco Bay Area and Bay Delta south to San Diego County.

References
Jepson Online Interchange (Aug 2006), Sawyer et al. (2006 MS)

***Frankenia salina* Alliance only** **n=** 2

Stratum	Code	Species Name	Con	Avg	Min	Max
Herb						
	FRSA-l	*Frankenia salina*	100	62.0	60	65
	SAVI-l	*Salicornia virginica*	100	15.0	0.2	30
	DISP-l	*Distichlis spicata*	100	1.0	0.2	2
	BRDI3-l	*Bromus diandrus*	50	10.0	20	20
	BRHO2-l	*Bromus hordeaceus*	50	4.0	7	7
	LELA2-m	*Lepidium latifolium*	50	2.0	5	5
	ASOF-m	*Asparagus officinalis*	50	0.0	0.2	0.2
	POMO5-l	*Polypogon monspeliensis*	50	0.0	1	1
	SOOL-m	*Sonchus oleraceus*	50	0.0	0.2	0.2

Hydrocotyle ranunculoides Alliance
Marsh pennywort Alliance

The *Hydrocotyle ranunculoides* Alliance was not adequately sampled in the Delta, but reconnaissance-level data collected from one stand validate its existence there. In this stand, *Hydrocotyle ranunculoides,* a floating aquatic, formed a pure stand. It has been described from Humboldt Bay National Wildlife Refuge (Pickart 2006). See the Manual of California Vegetation, Second Edition, for further information (Sawyer et al. 2006 MS).

References

Pickart 2006, Sawyer et al. (2006 MS)

Juncus bufonius Unclassified Stands
Toadrush Unclassified Stands

Local Vegetation Description

One stand of *Juncus bufonius* was sampled in the Delta (SSJD0310), and therefore no alliance or associations have been described here. In the one sample, *Juncus bufonius* dominates the herb layer with a cover of 40% at 0-0.5m. Other herbs include *Vulpia myuros* and *Distichlis spicata*. Total vegetation cover is 45%.

This stand was sampled in the following EMU: Central West Delta. It occurred in the center of an alkali "scald" adjacent to stands of *Salicornia virginica* and *Distichlis spicata* on the western end of Sherman Island.

Site Impacts

The sampled stand had low impacts from non-native species (*Vulpia myuros*) and from vandalism/litter/dumping.

Rank: G3S3?

Global Distribution

Unknown at this time. The species is widespread in the Northern Hemisphere. Some samples in Vernal Pool habitats elsewhere in the Central Valley area of California suggest this could be a common alliance of alkaline or saline vernally moist habitats. Preliminary analysis by Ayzik Solomeshch (personal communication 2006) suggests that *J. bufonius* dominates some Sacramento-San Joaquin Valley basin margin pools in association with other alkaline species such as *Cressa truxillensis, Frankenia salina, Distichlis spicata,* and *Cotula coronopifolia.*

References

Ayzik Solomeshch (personal communication 2006)

***Juncus bufonius* unclassified stand** **n=** 1

Stratum	Code	Species Name	Con	Avg	Min	Max
Herb						
	JUBU-l	*Juncus bufonius*	100	40.0	40	40

VUMY-l	*Vulpia myuros*	100	15.0	15	15
DISP-l	*Distichlis spicata*	100	2.0	2	2
SPAR-l	*Spergula arvensis*	100	1.0	1	1
SPERG2-l	*Spergularia*	100	1.0	1	1
AGEL4-l	*Agrostis elliottiana*	100	0.0	0.2	0.2
FRSA-l	*Frankenia salina*	100	0.0	0.2	0.2
HYGL2-l	*Hypochaeris glabra*	100	0.0	0.2	0.2
JUBA-l	*Juncus balticus*	100	0.0	0.2	0.2

***Lasthenia californica* Alliance**
California goldfields Alliance

Local Vegetation Description
Two stands of the *Lasthenia californica* Alliance were sampled in the Delta (SSJD0378 and 0379), and therefore no associations have been described here. Both were in the alkali wetlands near the Byron Airport in eastern Contra Costa County. In the samples, *Lasthenia californica* dominates the herb layer with an average cover of 43%; *Juncus bufonius, Vulpia microstachys,* and *Spergularia macrotheca* are also common. Total vegetation cover averaged 43%.

This alliance was sampled in the following EMU: Central West Delta, on vernally moist alkaline flats adjacent to stands of *Allenrolfea occidentalis, Suaeda moquinii,* and California annual grassland.

Site Impacts
The stands had moderate impacts from grazing.

Rank: G4S4

Global Distribution
This alliance is limited to CA, OR, and Mexico. *Lasthenia californica* alliance has been sampled in vernal pools and on volcanic flows in the Sierra Nevada foothills (A. Klein pers comm. 2006), in vernal flats Western Riverside County (Klein and Evens 2005) and in Central Valley Vernal Pools (Taylor et al. 1992). Similar stands have been placed in the *Vulpia microstachys* alliance by (Evens et al. 2004 and Evens and San 2004).

References
Evens and San (2004), Evens et al. (2004), Klein and Evens (2005), Anne Klein (personal communication 2006), Taylor et al. 1992

***Lasthenia californica* Alliance Only** **n=** 2

Stratum	Code	Species Name	Con	Avg	Min	Max
Herb						
	LACA7-l	*Lasthenia californica*	100	33.5	27	40
	JUBU-l	*Juncus bufonius*	100	8	1	15
	VUMI-l	*Vulpia microstachys*	100	7	5	9
	SUMO-l	*Suaeda moquinii*	100	3.5	3	4
	TRDE-l	*Trifolium depauperatum*	100	2.5	0.2	5

	HEFI-l	*Hemizonia fitchii*	100	0.5	0.2	1
	TRER6-l	*Triphysaria eriantha*	100	0.2	0.2	0.2
	TRHY3-l	*Triteleia hyacinthina*	100	0.2	0.2	0.2
	JUBU-l	*Juncus bufonius*	50	7.5	0	15
	SPMA-l	*Spergularia macrotheca*	50	3	0	6
	SPERG2-l	*Spergularia*	50	2.5	0	5
	LENI-l	*Lepidium nitidum*	50	2.5	0	5
	HYGL2-l	*Hypochaeris glabra*	50	2	0	4
	LEDI2-l	*Lepidium dictyotum*	50	2	0	4
	BRHO2-l	*Bromus hordeaceus*	50	1.5	0	3
	PARAP-l	*Parapholis* sp.	50	0.5	0	1
	LEPID-l	*Lepidium* sp.	50	0.5	0	1
	HOLE-l	*Hordeum leporinum*	50	0.5	0	1
	MOSS-l	Moss	50	0.5	0	1
	CRCO34-l	*Crassula connata*	50	0.0	0	0.5
	ERODE-l	*Erodium*	50	0.0	0	0.5
	HODE2-l	*Hordeum depressum*	50	0.0	0	0.5
	MIDO-l	*Microseris douglasii*	50	0.0	0	0.5
	PLEL-l	*Plantago elongata*	50	0.0	0	0.5
Algae						
	ALGAE-l	*Algae*	50	10	0	20
Moss						
	MOSS-l	Moss	150	0.5	0	1

***Lepidium latifolium* Alliance**
Perennial pepperweed Alliance

One association of the *Lepidium latifolium* Alliance was classified in the Delta: the *Lepidium latifolium-Salicornia virginica-Distichlis spicata* Provisional Association. Both samples of this alliance were classified into this association. This alliance, characterized by the invasive exotic *L. latifolium,* is of concern to many managers of wetlands in California. In some wildlife areas of the Delta, "Transline™blix" and other herbicides are being used to reduce the acreage of this alliance. Other more regularly disturbed stands of *L. latifolium* have been mapped in this study, but are not classified beyond the alliance due to the lack of samples and the likelihood of their regular disturbance by grazing, mowing, disking, burning, and other means.

***Lepidium latifolium - Salicornia virginica - Distichlis spicata* Provisional Association**
Perennial pepperweed - Pickleweed - Saltgrass Provisional Association

Local Vegetation Description
Stands of the *Lepidium latifolium - Salicornia virginica - Distichlis spicata* Provisional Association are characterized by a dense herbaceous layer (85-88%, mean 87%) at 0.5-1m tall. Total vegetation cover is 85-88%, mean 87%.

In this association, *Lepidium latifolium* dominates with 55-58% cover. *Salicornia virginica* cover ranges from 15-23% and *Distichlis spicata* from 10-20% cover. Other species at lower cover include *Atriplex triangularis, Cressa truxillensis,* and *Malva parviflora.*

This association was sampled in the following EMU: Central West Delta

Site Impacts
This alliance is dominated by a non-native species.

Samples Used to Describe Association (n=2)
Rapid Assessment(s): SSJD0316, 0348

Rank: G3S3 Note: although the nominate species is non-native, the nativity and restoration potential for this association may be high, thus we rank it here.

Global Distribution
Uncertain, but likely to occur in coastal salt and brackish marshes from Central to Southern California. Other similar *Lepidium*-dominated vegetation has been defined for Suisun Marsh (Keeler-Wolf and Vaghti 2000), which describes a *L. latifolium-Distichlis spicata* association. *Salicornia virginica* is present in this type at low cover, but *Distichlis* is significantly higher in cover. It may be determined that after further sampling, these two associations may be lumped.

References
California Invasive Plant Council (2006), Keeler-Wolf and Vaghti (2000)

***Lepidium latifolium - Salicornia virginica - Distichlis spicata* Provisional Association**
n= 2

Stratum	Code	Species Name	Con	Avg	Min	Max
Herb						
	LELA2-m	*Lepidium latifolium*	100	56.0	55	58
	DISP-l	*Distichlis spicata*	100	15.0	10	20
	ATTR2-m	*Atriplex triangularis*	100	1.0	1	1
	SOOL-m	*Sonchus oleraceus*	100	0.0	0.2	0.2
	SAVI-m	*Salicornia virginica*	50	12.0	23	23
	SAVI-l	*Salicornia virginica*	50	8.0	15	15
	CRTR5-l	*Cressa truxillensis*	50	3.0	6	6
	MAPA5-l	*Malva parviflora*	50	2.0	5	5
	ASOF-m	*Asparagus officinalis*	50	0.0	0.2	0.2
	FRSA-l	*Frankenia salina*	50	0.0	0.2	0.2
	PHAU7-m	*Phragmites australis*	50	0.0	0.2	0.2

***Leymus triticoides* Alliance**
Creeping wildrye Alliance

The *Leymus triticoides* Alliance was not adequately sampled in the Delta during this project, but reconnaissance-level data also collected during this project validates its existence there.

In this one stand, *Leymus triticoides* has 10% cover. It occurs in Suisun Marsh (Keeler-Wolf and Vaghti 2000). See the Manual of California Vegetation, Second Edition, for further information (Sawyer et al. 2006 MS).

References
Keeler-Wolf and Vaghti (2000), Sawyer et al. (2006 MS)

***Lolium multiflorum* Alliance**
Annual ryegrass Alliance

The *Lolium multiflorum* Alliance is represented in the Delta by one association: the *Lolium multiflorum - Convolvulus arvensis* Provisional Association. In addition, one stand (SSJD0144) was classified to the alliance level only. This stand was codominated by *Lolium multiflorum,* and the weedy natives *Malvella leprosa* and *Helianthus annuus*, and *Juncus* sp. The Alliance has been described from California (Sawyer et al. 2006 MS). *Lolium multiflorum* is an invasive non-native species, but many stands of the Alliance contain natives, some of which, depending upon the site, may be significant localized elements of biodiversity.

In addition to the provisional association described below from this project, Witham (2003) described the *Lolium multiflorum - Triphysaria eriantha, Lolium multiflorum - Lasthenia glabrata* ssp. *glabrata* and *Lolium multiflorum - Blennosperma nanum* associations from the Tule Ranch in Yolo County.

***Lolium multiflorum - Convolvulus arvensis* Provisional Association**
Annual ryegrass - Bindweed Provisional Association

Local Vegetation Description

Stands of the *Lolium multiflorum - Convolvulus arvensis* Provisional Association are characterized by an herbaceous layer that is intermittent to dense (50-100%, mean 89%) at 0-1m tall. *Quercus lobata* sometimes occurs as an emergent tree or shrub (0-5% cover, mean 1%). Total vegetation cover is 50-100%, mean 89%.

In this association, *Lolium multiflorum* dominates at 30-90% cover or occasionally codominates with *Bromus diandrus* or *B. hordeaceus*. *Convolvulus arvensis* is consistently present at < 1 to 15% cover.

This association was sampled in the following EMUs: East Delta, North Delta

Site Impacts
The alliance is dominated by non-native species. Four samples had low to moderate impacts from grazing; one had high impacts from agriculture.

Samples Used to Describe Association (n=6)
Rapid Assessment(s): SSJD0004, 0006, 0008, 0031, 0193, 0373

Rank: Unranked, non-native invasive; the stands sampled in the Delta had extremely low cover of native species.

Global Distribution
California Central Valley, so far as known.

References
No specific references.

***Lolium multiflorum - Convolvulus arvensis* Provisional Association n=** 6

Stratum	Code	Species Name	Con	Avg	Min	Max
Herb						
	LOMU-l	*Lolium multiflorum*	100	60.0	30	95
	COAR4-l	*Convolvulus arvensis*	100	3.0	0.2	15
	LASE-m	*Lactuca serriola*	67	0.0	0.2	1
	CESO3-l	*Centaurea solstitialis*	50	1.0	0.2	5
	DISP-l	*Distichlis spicata*	50	1.0	0.2	5
	RUCR-m	*Rumex crispus*	50	1.0	2	3
	TRIFO-l	*Trifolium*	50	1.0	0.2	5
	BRDI3-l	*Bromus diandrus*	33	3.0	0.2	20
	ASFA-m	*Asclepias fascicularis*	33	0.0	0.2	0.2
	CYRO-l	*Cyperus rotundus*	33	0.0	0.2	0.2
	HIIN3-m	*Hirschfeldia incana*	33	0.0	0.2	2
	LETR5-l	*Leymus triticoides*	33	0.0	0.2	0.2
	LOCO6-l	*Lotus corniculatus*	33	0.0	0.2	0.2
	MALE3-l	*Malvella leprosa*	33	0.0	0.2	0.2
	RUCO2-m	*Rumex conglomeratus*	33	0.0	0.2	1

***Ludwigia peploides* Alliance**
Water primrose Alliance
One association of the *Ludwigia peploides* Alliance occurs in the Delta: the *Ludwigia peploides* Provisional Association. All samples of this alliance were classified into this association.

***Ludwigia peploides* Provisional Association**
Water primrose Provisional Association

Local Vegetation Description
Stands of the *Ludwigia peploides* Provisional Association are characterized by an aquatic herbaceous layer that is intermittent to dense (65-99%, mean 82%) at 0-2m tall. In this association, *Ludwigia peploides* dominates/characterizes the herb layer at 45 to 82% cover. *Azolla filiculoides* is sometimes present at 1-40% cover, as is *Schoenoplectus acutus*, at <1 to 40%.

This association was sampled in the following EMUs: East Delta, North Delta

Site Impacts
Almost all, if not all, stands of this association were dominated by the non-native *Ludwigia peploide*s ssp. *montevidensis.*

Samples Used to Describe Association (n=6)
Rapid Assessment(s): SSJD0003, 0007, 0033, 0047, 0166, 0178

Rank: Unranked, non-native invasive

Global Distribution
This alliance is considered dominated by an invasive subspecies native to South America. It is known only from California. An alliance dominated by *Ludwigia peploides* (including *var. glabrescens* and/or *var. peploides*) is listed in NatureServe (2006) as occurring in the southeastern United States in similar ecological conditions. Due to the morphological and ecological similarity between native and non-native subspecies in this species, there is some uncertainty about all stands in the Delta being "written-off" as non-native. More detailed investigations into the specific identity of the subspecies composing stands in California are warranted.

References
NatureServe (2006)

***Ludwigia peploides* Provisional Association** **n=** 6

Stratum	Code	Species Name	Con	Avg	Min	Max
Herb						
	LUPEM-l	*Ludwigia peploides ssp. montevidensis*	83	53.0	45	82
	AZFI-l	*Azolla filiculoides*	50	9.0	1	40
	SCAC3-m	*Schoenoplectus acutus*	50	4.0	0.2	20
	COMA2-m	*Conium maculatum*	33	0.0	0.2	0.2

Managed Annual Wetland Vegetation Mapping Unit

Local Vegetation Description
Stands of the *Managed annual wetland vegetation* Mapping Unit are characterized by an intermittent herbaceous layer (35-65%, mean 49%) at 0-1m tall. There is an open emergent tall shrub layer (2%) at 5-10m and an emergent low shrub layer (0-8%, mean 4%) at 1-5m tall. Total vegetation cover is 35-65%, mean 51%.

Stands are dominated by wetland and facultative wetland annual or perennial plants such as *Paspalum distichum, Cynodon dactylon, Cyperus eragrostis, Xanthium strumarium,* and *Echinochloa crus-galli.* Species dominance varies according to flooding regime.

This type includes areas managed for waterfowl or that are in the process of being restored, such as at Cosumnes River Preserve or Stone Lakes NWR.

Stands were sampled in the following EMUs: East Delta, North Delta

Site Impacts
Managed annual wetland vegetation is dominated by non-native species. Four stands also had low to moderate impacts from grazing.

Samples Used to Describe Association (n=8)
Rapid Assessment(s): SSJD0066, 0069, 0183, 0186, 0190, 0365, 0368, 0369

Rank: Considered a mapping unit, not a vegetation type. Likely to be completely dominated by non-natives and thus likely to remain unranked.

Global Distribution
Not applicable, though most species are native to Europe or other parts of North America and not to California. NatureServe (2006) lists a *Polygonum* spp. (section *Persicaria*) Seasonally Flooded Herbaceous Alliance, which resembles this mapping unit to some degree. They also list *Polygonum* spp. - *Echinochloa* spp. Temporarily Flooded Herbaceous Alliance, from Nebraska, Kansas, and Oklahoma, which bears some similarity to this type. The latter name was used to define similar stands in Suisun Marsh (Keeler-Wolf and Vaghti 2000).

References
Keeler-Wolf and Vaghti (2000), NatureServe (2006)

Managed annual wetland vegetation **n=** 8

Stratum	Code	Species Name	Con	Avg	Min	Max
Herb						
	PADI6-l	*Paspalum distichum*	50	18.0	18	64
	CYDA-l	*Cynodon dactylon*	50	3.0	0.2	20
	CYER-l	*Cyperus eragrostis*	50	3.0	0.2	20
	XAST-l	*Xanthium strumarium*	50	3.0	0.2	18
	ECCR-l	*Echinochloa crus-galli*	38	3.0	3	20
	ELEOC-l	*Eleocharis*	38	2.0	1	10
	LUPEM-l	*Ludwigia peploides ssp. montevidensis*	38	1.0	0.2	5
	POLYG4-l	*Polygonum*	38	1.0	0.2	3
	POMO5-l	*Polypogon monspeliensis*	38	0.0	0.2	2
	RUCR-l	*Rumex crispus*	38	0.0	0.2	2
	BIFR-m	*Bidens frondosa*	25	1.0	1	10
	DISP-l	*Distichlis spicata*	25	1.0	2	5
	COAR4-l	*Convolvulus arvensis*	25	0.0	0.2	1
	CYPER-l	*Cyperus*	25	0.0	0.2	2
	JUBA-l	*Juncus balticus*	25	0.0	1	1
	LOCO6-l	*Lotus corniculatus*	25	0.0	0.2	0.2
	LUDWI-l	*Ludwigia*	25	0.0	0.2	1

MALE3-l	*Malvella leprosa*	25	0.0	0.2	0.2

***Myriophyllum* spp. Alliance**
Parrotfeather (or Water Milfoil) Alliance

One association of the *Myriophyllum* spp. Alliance was classified in the Delta, the *Egeria-Cabomba-Myriophyllum* Provisional Association. All stands of this alliance were classified into this association.

***Egeria – Cabomba - Myriophyllum* Provisional Association**
Brazilian elodea – Fanwort - Parrotfeather Provisional Association

Local Vegetation Description
Stands of the *Egeria – Cabomba - Myriophyllum* Provisional Association are characterized by an aquatic herbaceous layer that is intermittent to dense (60-90%, mean 76%) at 0-0.5m tall (or underwater). In this association, *Egeria densa, Cabomba caroliniana,* or *Myriophyllum* sp. dominate the herb layer. *Azolla filiculoides* is constant at <1 to 25% cover. Algae are frequently present at 12-72% cover.

This association was sampled in the following EMUs: Central West Delta, East Delta, North Delta

Site Impacts
This alliance is dominated by non-native species.

Samples Used to Describe Association (n=5)
Rapid Assessment(s): SSJD0036, 0083, 0091, 0163, 0301

Rank: Unranked, non-native invasive

Global Distribution
Most species in this association are non-native exotic aquatic weeds, with high potential for invasiveness. The California Invasive Plant Council (2006) lists *Egeria densa* as a species of high invasiveness. *Cabomba caroliniana* is native to the SE United States, but was recently introduced to California and other western states. *Myriophyllum* is represented by several species in the Delta, some of which are introduced.

References
California Invasive Plant Council (2006)

***Egeria – Cabomba - Myriophyllum* spp. Provisional Association n=** 5

Stratum	Code	Species Name	Con	Avg	Min	Max
Herb						
	AZFI-l	*Azolla filiculoides*	100	8.2	0.2	25

	EICR -l	*Eichhornia crassipes*	80	1.6	0.2	5
	EDGE-1	*Egeria densa*	60	37.0	30	85
	BRASE-l	*Cabomba caroliniana*	60	18.0	0.2	60
	CERAT-l	*Ceratophyllum demersum*	60	13.0	0.2	30
	LUPEM-l	*Ludwigia peploides ssp. montevidensis*	40	0.0	0.2	0.2
	MYRIO-l	*Myriophyllum*	40	0.0	0.2	0.2
Algae						
	ALGAE-l	Algae	60	20.0	12	72

***Phragmites australis* Alliance**
Common reed Alliance

Local Vegetation Description
Two stands of the *Phragmites australis* Alliance were sampled in the Delta, and no associations have been described. Delta stands are characterized by a dense herbaceous layer (84-90%, mean 87%) at 1-5m tall. The emergent shrub layer is open (1%) at 2-5m tall, and may include shrubs such as *Baccharis pilularis*, *Cephalanthus occidentalis* and the shrubby willows *Salix exigua* and *S. lasiolepis*. Total vegetation cover is 85-90%, mean 88%.

In stands of this alliance, *Phragmites australis* is present in the herb layer at 30 to 50% cover. *Ambrosia psilostachya* had a higher cover in one of the two sampled stands, and *Schoenoplectus californicus* codominated in the other stand.

This alliance was sampled in the following EMU: Central West Delta

Site Impacts
Both native and non-native races of this species are present in the Delta. Thus, it is difficult to determine the proper level of impact to these stands. According to Gedik (2005), morphological analyses of Humboldt County plants have confirmed that some of the local occurrences there are exotic. The variety of habitat types in the region supporting *Phragmites* include 1) palustrine emergent wetland (freshwater drainage ditch); 2) estuarine emergent intertidal (bay island); 3) estuarine emergent with freshwater and muted tidal influences (marsh complex); and 4) isolated palustrine emergent wetland with relict saline soils. Due to various management limitations, each site poses a different opportunity for method of treatment and analysis of treatment success. Treatment and eradication of *Phragmites* at these locations can be a first step towards site enhancement and restoration.

Samples Used to Describe Association (n=2)
Rapid Assessment(s): SSJD0131, 0306

Rank: G5S5 (Many stands in the Delta region are likely composed of the non-native race of this species, which is considered an invasive weed by most wildland managers.)

Global Distribution

World-wide in the broadest sense, but stands may be divided between native and non-native forms.

References
Gedik (2005)

***Phragmites australis* Alliance only** **n=** 2

Stratum	Code	Species Name	Con	Avg	Min	Max
Shrub						
	BADO-m	*Baccharis douglasii*	50	1.0	2	2
	CEOC2-m	*Cephalanthus occidentalis*	50	0.0	1	1
	SAEX-m	*Salix exigua*	50	0.0	0.2	0.2
	SALA6-m	*Salix lasiolepis*	50	0.0	0.2	0.2
Herb						
	PHAU7-m	*Phragmites australis*	100	40.0	30	50
	SCAC3-m	*Schoenoplectus acutus*	100	2.0	0.2	4
	AMPS-m	*Ambrosia psilostachya*	50	30.0	60	60
	SCCA-m	*Schoenoplectus californicus*	50	15.0	30	30
	DISP-l	*Distichlis spicata*	50	10.0	20	20
	LELA2-m	*Lepidium latifolium*	50	2.0	3	3
	ASOF-m	*Asparagus officinalis*	50	0.0	0.2	0.2
	ATTR2-m	*Atriplex triangularis*	50	0.0	1	1
	CASE13-m	*Calystegia sepium*	50	0.0	0.2	0.2
	EUOC4-m	*Euthamia occidentalis*	50	0.0	1	1
	SAVI-m	*Salicornia virginica*	50	0.0	0.2	0.2

***Polygonum* spp. - Mixed Forbs Alliance**
Water smartweed - Mixed Forbs Alliance

Six stands of the *Polygonum* spp. - Mixed Forbs Alliance were sampled in the Delta. All were classified into the *Polygonum amphibium (lapathifolium)* Provisional Association.

***Polygonum amphibium (lapathifolium)* Provisional Association**
Water smartweed (Willoweed) Provisional Association

Local Vegetation Description
Stands of the *Polygonum amphibium (lapathifolium)* Provisional Association are characterized by an herbaceous layer that is intermittent to dense (40-90%, mean 70%) at 0-1m tall. In this association, either *Polygonum amphibium* or *P. lapathifolium* dominates the herb layer at 20 to 79% cover. *Azolla filiculoides* may codominate. *Ludwigia peploides* ssp. *montevidensis* is infrequent.

This association was sampled in the following EMUs: East Delta, North Delta

Site Impacts
One sample of this association had moderate impacts from road construction/maintenance. According to Whitson et al. (1996) the species *P. lapathifolium* is considered invasive, even though it is native in much of the US.

Samples Used to Describe Association (n=6)
Rapid Assessment(s): SSJD0067, 0146, 0148, 0188, 0192, 0206

Rank: G5S5

Global Distribution
Both *P. lapathifolium* and *P. amphibium* are known from virtually every state in the conterminous United States (NRCS 2006). NatureServe (2006) lists a *Polygonum* spp. (section *Persicaria*) Seasonally Flooded Herbaceous Alliance, which is known from the southern Great Plains. They also list *Polygonum* spp. - *Echinochloa* spp. Temporarily Flooded Herbaceous Alliance, from Nebraska, Kansas, and Oklahoma, which bears similarity to this type. The latter name was used to define similar stands in Suisun Marsh (Keeler-Wolf and Vaghti 2000) which contained *P. lapathifolium*.

References
NatureServe (2006), NRCS (2006), Whitson et al. (1996)

Polygonum amphibium (lapathifolium) **Provisional Association** **n=** 6

Stratum	Code	Species Name	Con	Avg	Min	Max
Herb						
	LUPEM-l	*Ludwigia peploides ssp. montevidensis*	50	2.0	0.2	10
	POAM8-m	*Polygonum amphibium*	33	26.0	75	79
	AZFI-l	*Azolla filiculoides*	33	12.0	20	50
	POLA4-l	*Polygonum lapathifolium*	33	11.0	20	47
	POAM8-l	*Polygonum amphibium*	33	7.0	8	35
	CYER-l	*Cyperus eragrostis*	33	0.0	0.2	0.2
	EUOC4-m	*Euthamia occidentalis*	33	0.0	0.2	0.2

Potamogeton **spp.** ***- Ceratophyllum spp. - Elodea*** **spp. Alliance**
Waterweed - Coontail - Elodea Alliance

One stand of the *Potamogeton spp. - Ceratophyllum spp. - Elodea spp.* Alliance was sampled in the Delta. It was placed in the *Potamogeton pectinatus – pure* Provisional Association. Note: NatureServe now recognizes *Potamogeton pectinatus* as *Stuckinia pectinata*, and a *Stuckinia pectinata* Alliance.

***Potamogeton pectinatus - pure* Provisional Association**
Waterweed Provisional Association

Local Vegetation Description
The sampled stand of *Potamogeton pectinatus - pure* Provisional Association (SSJD0353) is characterized by an open herbaceous layer (15%) at 0-0.5m tall consisting almost solely of *Potamogeton pectinatus. Eichhornia crassipes* occurs at <1%.

This is a generic classification for probably several different, as yet undersampled associations found in the Delta composed of different combinations of species of *Potamogeton* along with *Ceratophyllum* and *Elodea* species. It can be considered a place-holder currently, but is meant to be a separate ecological entity from other floating hydrophyte vegetation such as *Eichhornia crassipes* and *Egeria-Cabomba-Myriophyllum*, mentioned previously in this report. This classification unit is typified by a dominance of *Potamogeton* spp., which includes *Potamogeton crispus, P. diversifolius, P. filiformis, P. foliosus, P. illinoensis, P. nodosus, P. pusillus,* and *P. zosteriformis.*

This association was sampled in the following EMU: Central West Delta

Note: NatureServe now recognizes *Potamogeton pectinatus* as *Stuckinia pectinata*, and a *Stuckinia pectinata* Alliance.

Site Impacts
No site impacts were reported.

Rank: G4S4

Global Distribution
This concept is based on the NatureServe (2006) classification unit of the same name, recorded from the Southeastern United States. Currently its actual similarity to this pre-determined type is uncertain based on a lack of detailed sampling and identification beyond the genus level in most stands.

References
NatureServe (2006)

***Potamogeton pectinatus - pure* Provisional Association** **n=** 1

Stratum	Code	Species Name	Con	Avg	Min	Max
Herb						
	POPE6-l	*Potamogeton pectinatus*	100	15.0	15	15
	EICR-l	*Eichhornia crassipes*	100	0.0	0.2	0.2

Ruderal Herbaceous Vegetation Mapping Unit

Local Vegetation Description
One stand of the Ruderal Herbaceous Vegetation Mapping Unit was sampled (SSJD0114). This stand is characterized by a dense herbaceous layer (70%) at 1-2m tall and an open emergent low shrub layer (4%) at 2-5m tall, with total vegetation cover at 74%. *Silybum marianum* codominates with *Artemisia douglasiana* and *Brassica nigra*.

This provisional classification unit was sampled in the following EMU: South Delta

Site Impacts
The sampled stand was dominated by non-native species.

Rank: Unranked, dominated and characterized by non-native often invasive weedy species.

Global Distribution
Similar vegetation types have been identified throughout much of cismontane California. These include *Brassica nigra, Brassica nigra-Bromus diandrus,* and *Brassica nigra-Centaurea melitensis* associations (Keeler-Wolf and Evens 2006) and *Raphanus sativus* Association (ABI 2003).

References
Keeler-Wolf and Evens (2006), ABI (2003)

Ruderal Herbaceous **n=** 1

Stratum	Code	Species Name	Con	Avg	Min	Max
Shrub						
	CEOC2-m	*Cephalanthus occidentalis*	100	2.0	2	2
	RUDI2-m	*Rubus discolor*	100	2.0	2	2
	FICA-m	*Ficus carica*	100	0.0	0.2	0.2
Herb						
	SIMA3-m	*Silybum marianum*	100	35.0	35	35
	ARDO3-m	*Artemisia douglasiana*	100	19.0	19	19
	BRNI-m	*Brassica nigra*	100	15.0	15	15
	JUEF-m	*Juncus effusus*	100	1.0	1	1
	POLYG4-m	*Polygonum*	100	0.0	0.2	0.2
	URDI-m	*Urtica dioica*	100	0.0	0.2	0.2
	VERBE-m	*Verbena*	100	0.0	0.2	0.2

Sagittaria sanfordii **unique stands**
Sanford's arroweed unique stands

Sagittaria sanfordii-dominated stands were not adequately sampled in the Delta, but reconnaissance-level data collected from one stand validate its existence there. In this stand, *Sagittaria sanfordii,* a CNPS List 1B species, was a dominant species.

References
None specific to this type.

***Salicornia virginica* Alliance**
Pickleweed Alliance

Three stands of the *Salicornia virginica* Alliance were sampled in the Delta, and were placed in the *Salicornia virginica-Cotula coronopifolia* Provisional Association or the *Salicornia virginica-Distichlis spicata* Provisional Association.

***Salicornia virginica - Cotula coronopifolia* Provisional Association**
Pickleweed - Brass buttons Provisional Association

Local Vegetation Description
One stand of the *Salicornia virginica-Cotula coronopifolia* Provisional Association was sampled in the Delta (SSJD0314). It is characterized by an intermittent herbaceous layer (53%) at 0-0.5m tall. In this association, *Salicornia virginica* dominates the herb layer at 42% cover, and *Cotula coronopifolia* is subdominant at 15%. Stands of this same association occur in Suisun Marsh (Keeler-Wolf and Vaghti 2000) and similar stands have been inventoried elsewhere in California (ABI 2003, Keeler-Wolf and Evens 2006, Evens and San 2004).

This association was sampled in the following EMU: Central West Delta

Site Impacts
Cotula coronopifolia is non-native.

Rank: G3S3

Global Distribution
Alliance range is from Northern California to Baja California.

References
Evens and San (2004), Keeler-Wolf and Evens (2006), ABI (2003), Keeler-Wolf and Vaghti (2000)

***Salicornia virginica - Cotula coronopifolia* Provisional Association n=** 1

Stratum	Code	Species Name	Con	Avg	Min	Max
Herb						
	SAVI-m	*Salicornia virginica*	100	42.0	42	42
	COCO7-l	*Cotula coronopifolia*	100	15.0	15	15
	POMO5-l	*Polypogon monspeliensis*	100	0.0	0.2	0.2

***Salicornia virginica - Distichlis spicata* Provisional Association**
Pickleweed - saltgrass Provisional Association

Local Vegetation Description
Stands of the *Salicornia virginica - Distichlis spicata* Provisional Association are characterized by a dense herbaceous layer (90-95%, mean 93%) at 0-0.5m tall, with no emergent shrubs or trees. In this association, *Salicornia virginica* clearly dominates at 70-85% cover, while *Distichlis spicata* is present at 5-20% cover.

This association was sampled in the following EMU: Central West Delta. It is likely to be restricted to the western portion of the legal Delta where saline soils predominate.

Site Impacts
No impacts were reported for these stands.

Samples Used to Describe Association (n=2)
Rapid Assessment(s): SSJD0346, 0349

Rank: G3S3

Global Distribution
This association is known from central California including Suisun Marsh and the Point Reyes Peninsula (Keeler-Wolf and Vaghti 2000, ABI 2003).

References
Keeler-Wolf and Vaghti (2000), ABI (2003)

***Salicornia virginica - Distichlis spicata* Provisional Association n=** 2

Stratum	Code	Species Name	Con	Avg	Min	Max
Herb						
	SAVI-l	*Salicornia virginica*	100	78.0	70	85
	DISP-l	*Distichlis spicata*	100	12.0	5	20
	LELA2-m	*Lepidium latifolium*	100	2.0	1	2
	ASSUC-m	*Aster subulatus var. cubensis*	100	1.0	0.2	2
	POMO5-l	*Polypogon monspeliensis*	100	0.0	0.2	0.2
	ATTR2-m	*Atriplex triangularis*	50	4.0	7	7
	ATTR2-l	*Atriplex triangularis*	50	0.0	0.2	0.2
	FRSA-l	*Frankenia salina*	50	0.0	1	1
	GRCA-m	*Grindelia camporum*	50	0.0	0.2	0.2
	GRST3-m	*Grindelia stricta*	50	0.0	0.2	0.2
	SOAS-m	*Sonchus asper*	50	0.0	0.2	0.2
	SOOL-m	*Sonchus oleraceus*	50	0.0	1	1

***Schoenoplectus acutus (- Schoenoplectus tabernaemontani)* Alliance**
Hardstem bulrush (- Softstem bulrush) Alliance

Five associations of the *Schoenoplectus acutus (- Schoenoplectus tabernaemontani)* Alliance were classified in the Delta: the *Schoenoplectus acutus - pure* Provisional, *Schoenoplectus acutus - Phragmites australis, Schoenoplectus acutus - Typha angustifolia* Provisional, *Schoenoplectus acutus - Typha latifolia* Provisional, and *Schoenoplectus acutus - Xanthium strumarium* Provisional associations. In addition, one sample (SSJD0276) of this alliance was classified to alliance level only.

***Schoenoplectus acutus (- Schoenoplectus tabernaemontani)* Alliance only n=** 1

Stratum	Code	Species Name	Con	Avg	Min	Max
Tree Overstory						
	POFR2-t	*Populus fremontii*	100	0.0	0.2	0.2
Shrub						
	SALA6-m	*Salix lasiolepis*	100	4.0	4	4
	RUDI2-m	*Rubus discolor*	100	2.0	2	2
	CEOC2-m	*Cephalanthus occidentalis*	100	0.0	0.2	0.2
	HOMA4-m	*Hoita macrostachya*	100	0.0	0.2	0.2
Herb						
	SCAC3-m	*Schoenoplectus acutus*	100	20.0	20	20
	EUOC4-m	*Euthamia occidentalis*	100	15.0	15	15
	ARDO3-m	*Artemisia douglasiana*	100	6.0	6	6
	SCCA-m	*Schoenoplectus californicus*	100	6.0	6	6
	TYAN-m	*Typha angustifolia*	100	4.0	4	4
	MIGU-l	*Mimulus guttatus*	100	1.0	1	1
	ARDO4-m	*Arundo donax*	100	0.0	0.2	0.2
	CASE13-m	*Calystegia sepium*	100	0.0	0.2	0.2
	COSE4-m	*Cortaderia selloana*	100	0.0	0.2	0.2
	DECA2-l	*Deschampsia caespitosa*	100	0.0	0.2	0.2
	GRIND-m	*Grindelia*	100	0.0	0.2	0.2
	LAJEJ-m	*Lathyrus jepsonii ssp.*	100	0.0	0.2	0.2
	LYCA4-m	*Lythrum californicum*	100	0.0	0.2	0.2
	PHAU7-m	*Phragmites australis*	100	0.0	0.2	0.2
	STAL-m	*Stachys albens*	100	0.0	0.2	0.2

***Schoenoplectus acutus - pure* Provisional Association**
Hardstem bulrush - pure Provisional Association

Local Vegetation Description
Stands of *Schoenoplectus acutus - pure* Provisional Association are characterized by an herbaceous layer that is intermittent to dense (60-100%, mean 85%) at 1-5m tall. The emergent low shrub layer is open (5%) at 1-2m tall. Total vegetation cover is 65-100%, mean 86%.

In this association, *Schoenoplectus acutus* dominates the herb layer at 55 to 98% cover. No other species characterize these stands; *Typha latifolia* is sometimes present at <5% cover.

This association was sampled in the following EMUs: Central West Delta, East Delta, North Delta

Site Impacts
One sample of this association had low impacts from non-native, *Ludwigia peploides* ssp. *montevidensis*. One sample had low impacts from road construction.

Samples Used to Describe Association (n=4)
Rapid Assessment(s): SSJD0009, 0037, 0126, 0271

Rank: G4S4

Global Distribution
This association is likely to occur throughout much of the warmer regions of North America. Currently NatureServe (2006) lists a tidal association of this alliance characterized by strong dominance of *S. californicus* from Alabama, Florida, Louisiana, and Texas.

References
NatureServe (2006)

Schoenoplectus acutus - pure **Provisional Association** **n=** 4

Stratum	Code	Species Name	Con	Avg	Min	Max
Shrub						
	RUDI2-m	*Rubus discolor*	25	1.0	5	5
	SAEX-m	*Salix exigua*	25	0.0	0.2	0.2
Herb						
	SCAC3-m	*Schoenoplectus acutus*	100	82.0	55	98
	TYLA-m	*Typha latifolia*	50	1.0	0.2	4
	URDI-m	*Urtica dioica*	50	0.0	0.2	1
	COMA2-m	*Conium maculatum*	25	0.0	0.2	0.2
	LUPEM-l	*Ludwigia peploides ssp. montevidensis*	25	0.0	0.2	0.2
	POAM8-l	*Polygonum amphibium*	25	0.0	2	2
	SPEU-m	*Sparganium eurycarpum*	25	0.0	0.2	0.2
	TYPHA-m	*Typha*	25	0.0	0.2	0.2

Schoenoplectus acutus - Phragmites australis **Association**
Hardstem bulrush - Common reed Association

Local Vegetation Description
Stands of the *Schoenoplectus acutus - Phragmites australis* Association are characterized by an herbaceous layer that is intermittent to dense (52-83%, mean 66%) at 1-2m tall. There is no emergent tree or shrub layer.

In this association, *Schoenoplectus acutus* often dominates the tall herb layer at 10 to 54% cover and *Phragmites australis* is constant at 1 to 15% cover. *Schoenoplectus californicus*, *Eichhornia crassipes, Hydrocotyle ranunculoides*, and *Calystegia sepium* are usually present.

This association was sampled in the following EMUs: Central West Delta, North Delta

Site Impacts
Two samples of this association had low to moderate impacts from non-native plant species. The non-native species with the highest cover was *Eichhornia crassipes*.

Samples Used to Describe Association (n=10)
Rapid Assessment(s): SSJD0095, 0219, 0232, 0236, 0240, 0242, 0267, 0269, 0304, 0341

Rank: G3S3?

Global Distribution
Currently not known beyond the Delta, but likely to occur elsewhere in cismontane California and in other southwestern USA states.

References
No specific references.

***Schoenoplectus acutus - Phragmites australis* Association** **n=** 10

Stratum	Code	Species Name	Con	Avg	Min	Max
Shrub						
	HILA6-m	*Hibiscus lasiocarpus*	50	0.0	0.2	0.2
Herb						
	SCAC3-m	*Schoenoplectus acutus*	100	31.0	10	54
	PHAU7-m	*Phragmites australis*	100	7.0	1	15
	SCCA-m	*Schoenoplectus californicus*	80	2.0	0.2	6
	EICR-l	*Eichhornia crassipes*	60	6.0	0.2	40
	HYRA-l	*Hydrocotyle ranunculoides*	60	1.0	0.2	2
	CASE13-m	*Calystegia sepium*	60	0.0	0.2	1
	TYPHA-m	*Typha*	50	3.0	1	11
	TYLA-m	*Typha latifolia*	40	5.0	3	20
	LEOR-m	*Leersia oryzoides*	40	4.0	0.2	35
	LYAM-m	*Lycopus americanus*	40	1.0	0.2	2
	IRPS-m	*Iris pseudacorus*	40	0.0	0.2	4
	LUPEM-l	*Ludwigia peploides ssp. montevidensis*	40	0.0	0.2	0.2
	PADI3-m	*Paspalum dilatatum*	40	0.0	0.2	4
	EPILO-m	*Epilobium*	30	0.0	0.2	1
	JUXI-m	*Juncus xiphioides*	30	0.0	0.2	0.2
	POPU5-m	*Polygonum punctatum*	20	1.0	2	7
	ASLE17-m	*Aster lentus*	20	0.0	0.2	1
	BILA-m	*Bidens laevis*	20	0.0	0.2	2
	COSE4-m	*Cortaderia selloana*	20	0.0	0.2	2

CYER-l	*Cyperus eragrostis*	20	0.0	0.2	3
JUEF-m	*Juncus effusus*	20	0.0	0.2	1
LIMA7-l	*Lilaeopsis masonii*	20	0.0	0.2	0.2
MEAR4-m	*Mentha arvensis*	20	0.0	0.2	0.2
POLYG4-l	*Polygonum*	20	0.0	0.2	0.2
POPU5-l	*Polygonum punctatum*	20	0.0	0.2	0.2
SAGIT-m	*Sagittaria*	20	0.0	0.2	0.2
VERBE-m	*Verbena*	20	0.0	0.2	0.2

***Schoenoplectus acutus - Typha angustifolia* Provisional Association**
Hardstem bulrush - Narrowleaf cattail Provisional Association

Local Vegetation Description
Stands of the *Schoenoplectus acutus - Typha angustifolia* Provisional Association are characterized by a dense herbaceous layer (75-85%, mean 80%) at 1-2m tall. The emergent low shrub layer is very open (mean 2%) at 2-5m tall. Total vegetation cover is 75-85%, mean 80%.

In this association, *Schoenoplectus acutus* dominates the tall herb layer at 32 to 50% cover and *Typha angustifolia* occurs at 6-15%. *Schoenoplectus californicus* is constant at 4 to 15%. *Phragmites australis* is sometimes present at low cover.

This association was sampled in the following EMUs: Central West Delta, East Delta

Site Impacts
One sample of this association had low impacts from non-native plant species, primarily *Echinochloa crus-galli* and *Eichhornia crassipes*.

Samples Used to Describe Association (n=2)
Rapid Assessment(s): SSJD0300, 0358

Rank: G4S4?

Global Distribution
NatureServe (2006) identifies a similar *Typha* spp. - *Schoenoplectus acutus* - Mixed Herbs Midwest Herbaceous Vegetation, which includes *Typha angustifolia* and *S. acutus* as codominants, along with other species. It remains to be seen if this is equivalent to the association described from the Delta in this report.

References
NatureServe (2006)

***Schoenoplectus acutus - Typha angustifolia* Provisional Association** **n=** 2

Stratum	Code	Species Name	Con	Avg	Min	Max
Shrub						
	SALA6-m	*Salix lasiolepis*	50	1.0	2	2
Herb						
	SCAC3-m	*Schoenoplectus acutus*	100	41.0	30	52
	SCCA-m	*Schoenoplectus californicus*	100	10.0	4	15

TYAN-m	*Typha angustifolia*	100	10.0	6	15
LUPEM-l	*Ludwigia peploides ssp. montevidensis*	100	1.0	0.2	1
ECCR-l	*Echinochloa crus-galli*	50	8.0	15	15
SALA2-m	*Sagittaria latifolia*	50	5.0	10	10
LEOR-m	*Leersia oryzoides*	50	2.0	3	3
EICR-l	*Eichhornia crassipes*	50	1.0	2	2
PHAU7-m	*Phragmites australis*	50	1.0	2	2
POLYG4-m	*Polygonum*	50	1.0	2	2
SPEU-m	*Sparganium eurycarpum*	50	0.0	0.2	0.2
TYLA-m	*Typha latifolia*	50	0.0	0.2	0.2
URDI-m	*Urtica dioica*	50	0.0	0.2	0.2

***Schoenoplectus acutus - Typha latifolia* Provisional Association**
Hardstem bulrush - Broadleaf cattail Provisional Association

Local Vegetation Description
Stands of the *Schoenoplectus acutus - Typha latifolia* Provisional Association are characterized by a dense herbaceous layer (75-80%, mean 78%) at 1-5m tall. The emergent low shrub layer is open (10%) at 2-5m tall. Total vegetation cover is 80-85%, mean 83%.

In this association, *Schoenoplectus acutus* dominates the tall herb layer at 60 to 75% cover. *Typha latifolia* is constant at 10-15% cover. *Schoenoplectus californicus* sometimes occurred at 15% cover.

In general, this association may be differentiated ecologically from local associations with *T. angustifolia* and *S. acutus* by typically more sheltered inner marsh settings (not adjacent to large expanses of open tidally influenced waters).

This association was sampled in the following EMU: North Delta

Site Impacts
One of the two samples of this association had low impacts from an unknown cause.

Samples Used to Describe Association (n=2)
Rapid Assessment(s): SSJD0043, 0090

Rank: G4S4?

Global Distribution
Although similar associations have been listed in NatureServe (2006), this is the first specific listing of an association with a dominance of *S. acutus* and subdominant *Typha latifolia*. Thus, we currently only know of stands such as this from central California.

References
NatureServe (2006)

***Schoenoplectus acutus - Typha latifolia* Provisional Association n=** 2

Stratum	Code	Species Name	Con	Avg	Min	Max
Tree Understory						
	ALRH2-m	*Alnus rhombifolia*	50	0.0	1	1
Shrub						
	CEOC2-m	*Cephalanthus occidentalis*	100	4.0	1	7
	SAEX-m	*Salix exigua*	50	2.0	4	4
	SALA6-m	*Salix lasiolepis*	50	2.0	3	3
	HILA6-m	*Hibiscus lasiocarpus*	50	0.0	0.2	0.2
	RUDI2-m	*Rubus discolor*	50	0.0	1	1
Herb						
	SCAC3-m	*Schoenoplectus acutus*	100	65.0	60	70
	TYLA-m	*Typha latifolia*	100	12.0	10	15
	SCCA-m	*Schoenoplectus californicus*	50	8.0	15	15
	AZFI-l	*Azolla filiculoides*	50	4.0	8	8

***Schoenoplectus acutus - Xanthium strumarium* Provisional Association**
Hardstem bulrush - Cocklebur Provisional Association

Local Vegetation Description
Stands of the *Schoenoplectus acutus - Xanthium strumarium* Provisional Association are characterized by an herbaceous layer that is open to dense (45-80%, mean 64%) at 1-5m tall. There is an emergent tall shrub layer at 1% cover at 5-10m. Total vegetation cover is 45-80%, mean 61%.

In this association, *Schoenoplectus acutus* dominates the stand at 30-70% cover or infrequently codominates the stand with *Polygonum amphibium*. *Xanthium strumarium* characterizes the herb layer at <1 to 10% cover.

This association was sampled in the following EMU: North Delta

Site Impacts
One sample of this association had low impacts from non-native plant species, one had low impacts from grazing, and one had low impacts from road construction/maintenance.

Samples Used to Describe Association (n=4)
Rapid Assessment(s): SSJD0177, 0218, 0287, 0288

Rank: G4S4?

Global Distribution
So far as known, restricted to the Delta, but likely to occur elsewhere throughout the warmer portions of North America.

References
No specific references.

***Schoenoplectus acutus - Xanthium strumarium* Provisional Association n=** 4

Stratum	Code	Species Name	Con	Avg	Min	Max
Tree Overstory						
	SAGO-t	*Salix gooddingii*	25	0.0	0.2	0.2
Tree Understory						
	SAGO-m	*Salix gooddingii*	25	0.0	1	1
Shrub						
	RUDI2-m	*Rubus discolor*	25	0.0	0.2	0.2
Herb						
	SCAC3-m	*Schoenoplectus acutus*	100	44.0	30	70
	XAST-m	*Xanthium strumarium*	75	3.0	0.2	10
	RUCR-m	*Rumex crispus*	75	0.0	0.2	0.2
	POAM8-m	*Polygonum amphibium*	50	10.0	0.2	40
	TYLA-m	*Typha latifolia*	50	3.0	1	10
	LELA2-m	*Lepidium latifolium*	50	1.0	0.2	2
	POLA4-m	*Polygonum lapathifolium*	50	1.0	0.2	5
	ASSUC-m	*Aster subulatus var. cubensis*	50	0.0	0.2	0.2
	ATTR2-m	*Atriplex triangularis*	50	0.0	0.2	0.2
	CYDA-l	*Cynodon dactylon*	50	0.0	0.2	1
	CYER-l	*Cyperus eragrostis*	50	0.0	0.2	1
	MALE3-l	*Malvella leprosa*	50	0.0	0.2	0.2
	PHNO2-l	*Phyla nodiflora*	50	0.0	0.2	1
	EUOC4-m	*Euthamia occidentalis*	25	1.0	3	3
	LUPEM-l	*Ludwigia peploides ssp. montevidensis*	25	1.0	5	5
	POMO5-l	*Polypogon monspeliensis*	25	1.0	3	3
	TYPHA-m	*Typha*	25	1.0	5	5
	ABTH-l	*Abutilon theophrasti*	25	0.0	0.2	0.2
	ALPLB-m	*Alisma plantago-aquatica ssp. brevipes*	25	0.0	1	1
	BIFR-m	*Bidens frondosa*	25	0.0	0.2	0.2
	COAR4-l	*Convolvulus arvensis*	25	0.0	0.2	0.2
	CUSCU-l	*Cuscuta*	25	0.0	0.2	0.2
	CYPER-l	*Cyperus*	25	0.0	0.2	0.2
	ECCR-l	*Echinochloa crus-galli*	25	0.0	0.2	0.2
	EICR-l	*Eichhornia crassipes*	25	0.0	0.2	0.2
	LEMNA-l	*Lemna*	25	0.0	0.2	0.2
	LOCO6-l	*Lotus corniculatus*	25	0.0	0.2	0.2
	LYAM-l	*Lycopus americanus*	25	0.0	0.2	0.2
	LYAM-m	*Lycopus americanus*	25	0.0	0.2	0.2
	MEAL2-l	*Melilotus albus*	25	0.0	0.2	0.2
	PHAU7-m	*Phragmites australis*	25	0.0	0.2	0.2
	PIEC-m	*Picris echioides*	25	0.0	0.2	0.2
	POAM8-l	*Polygonum amphibium*	25	0.0	1	1
	RUCO2-m	*Rumex conglomeratus*	25	0.0	1	1
	SYLE2-m	*Symphyotrichum lentum*	25	0.0	0.2	0.2
	XAST-l	*Xanthium strumarium*	25	0.0	0.2	0.2

***Schoenoplectus americanus* Alliance**
American bulrush Alliance

Local Vegetation Description
One stand of the *Schoenoplectus americanus* Alliance was sampled in the Delta (SSJD0351), and therefore no associations have been described here. In the one sample, *Schoenoplectus americanus* dominates the herb layer with a cover of 55% at 1-2m tall. Only three other herbs are present, and at very low cover: *Distichlis spicata*, *Typha angustifolia,* and *Salicornia virginica*. The herb layer is intermittent, at 59% cover, and there are no herb or tree emergents.

This alliance was sampled in the following EMU: Central West Delta. Stands are generally small and interdigitate with stands of *Typha angustifolia, Distichlis spicata*, and *Salicornia virginica* alliance in the extreme western portion of the study area where saline soils predominate. In the Suisun Marsh, Keeler-Wolf and Vaghti (2000) found this alliance to be much more variable and extensive.

NatureServe (2006) notes that there are taxonomic issues between *Schoenoplectus americanus* and *Schoenoplectus pungens* that need to be understood before descriptions of this alliance can be completed.

Site Impacts
No impacts were reported for the sampled stand.

Rank: G5S5

Global Distribution
This alliance is widespread throughout the southern Great Plains and several western states (NatureServe 2006).

References
Keeler-Wolf and Vaghti (2000), NatureServe (2006).

***Schoenoplectus americanus* Alliance only** **n=** 1

Stratum	Code	Species Name	Con	Avg	Min	Max
Herb						
	SCAM2-m	*Schoenoplectus americanus*	100	55.0	55	55
	DISP-l	*Distichlis spicata*	100	3.0	3	3
	TYAN-m	*Typha angustifolia*	100	1.0	1	1
	SAVI-m	*Salicornia virginica*	100	0.0	0.2	0.2

***Schoenoplectus californicus* Alliance**
Giant bulrush Alliance

Two associations of the *Schoenoplectus californicus* Alliance were classified in the Delta: the *Schoenoplectus californicus - Eichhornia crassipes* and *Schoenoplectus californicus - Schoenoplectus acutus* provisional associations. In addition, three samples (SSJD0059, 0118, 0360) of this alliance were classified to alliance level only.

***Schoenoplectus californicus* Alliance only** **n=** 3

Stratum	Code	Species Name	Con	Avg	Min	Max
Shrub						
	CEOC2-m	*Cephalanthus occidentalis*	33	0.0	0.2	0.2
	RUDI2-m	*Rubus discolor*	33	0.0	0.2	0.2
Herb						
	SCCA-m	*Schoenoplectus californicus*	100	55.0	40	65
	TYLA-m	*Typha latifolia*	67	2.0	0.2	6
	URDI-m	*Urtica dioica*	67	0.0	0.2	0.2
	TYAN-m	*Typha angustifolia*	33	12.0	35	35
	AZFI-l	*Azolla filiculoides*	33	5.0	15	15
	SALA2-m	*Sagittaria latifolia*	33	3.0	8	8
	SPEU-m	*Sparganium eurycarpum*	33	3.0	10	10
	EICR-l	*Eichhornia crassipes*	33	1.0	2	2
	ECCR-l	*Echinochloa crus-galli*	33	0.0	0.2	0.2
	JUEF-l	*Juncus effusus*	33	0.0	0.2	0.2
	JUXI-m	*Juncus xiphioides*	33	0.0	0.2	0.2
	LEOR-m	*Leersia oryzoides*	33	0.0	0.2	0.2
	LEMNA-l	*Lemna*	33	0.0	0.2	0.2
	LUPEM-l	*Ludwigia peploides ssp. montevidensis*	33	0.0	0.2	0.2
	PHAU7-m	*Phragmites australis*	33	0.0	1	1
	POLYG4-l	*Polygonum*	33	0.0	0.2	0.2
	SCAC3-m	*Schoenoplectus acutus*	33	0.0	1	1
Algae						
	ALGAE-l	*Algae*	33	2.0	5	5

***Schoenoplectus californicus - Eichhornia crassipes* Provisional Association**
Giant bulrush - Water hyacinth Provisional Association

Local Vegetation Description
Stands of the *Schoenoplectus californicus - Eichhornia crassipes* Provisional Association are characterized by an herbaceous layer that is open to dense (20-99%, mean 76%) at 0.5-2m tall. There is no emergent tree or shrub layer.

In this association, *Schoenoplectus californicus* is the dominant species codominant with *Eichhornia crassipes* at 10-85% cover. *Eichhornia* cover ranges from 5-35%. *Polygonum lapathifolium* or *Typha latifolia* infrequently codominate with *Schoenoplectus californicus*.

This association was sampled in the following EMUs: Central West Delta, North Delta, South Delta. It represents stands that are adjacent to open water sloughs and channels with typically enough wave action and wind to accumulate floating mats of *Eichhornia* around the stems of *S. californicus*.

Site Impacts
All stands had low to moderate impacts from non-native species (primarily *Eichhornia crassipes).*

Samples Used to Describe Association (n=5)
Rapid Assessment(s): SSJD0011, 0019, 0022, 0077, 0233

Rank: G3S3

Global Distribution
Currently only known from the Delta. This is a relatively unique and "unnatural" association comprised of a native tall graminoid with a non-native floating hydrophyte "understory." It may be found to occur in similar situations throughout the Western Hemisphere where *Eichhornia* becomes established.

References
No specific references.

Schoenoplectus californicus - Eichhornia crassipes **Provisional Association n=** 5

Stratum	Code	Species Name	Con	Avg	Min	Max
Herb						
	SCCA-m	*Schoenoplectus californicus*	100	42.0	10	85
	EICR-l	*Eichhornia crassipes*	100	20.0	5	35
	LUPEM-l	*Ludwigia peploides ssp. montevidensis*	80	0.0	0.2	0.2
	HYRA-l	*Hydrocotyle ranunculoides*	40	1.0	2	2
	TYLA-m	*Typha latifolia*	20	8.0	38	38
	POLA4-m	*Polygonum lapathifolium*	20	4.0	20	20
	PONO2-l	*Potamogeton nodosus*	20	1.0	3	3
	SCAC3-m	*Schoenoplectus acutus*	20	1.0	5	5
	AZFI-l	*Azolla filiculoides*	20	0.0	1	1
	BRASE-l	*Brasenia*	20	0.0	0.2	0.2
	CERAT-l	*Ceratophyllum*	20	0.0	0.2	0.2
	LEMNA-l	*Lemna*	20	0.0	0.2	0.2
	MYRIO-l	*Myriophyllum*	20	0.0	1	1
	POAM8-m	*Polygonum amphibium*	20	0.0	0.2	0.2
	SOLID-m	*Solidago*	20	0.0	0.2	0.2

***Schoenoplectus californicus - Schoenoplectus acutus* Provisional Association**
Giant bulrush-Hardstem bulrush Provisional Association

Local Vegetation Description
Stands of *Schoenoplectus californicus - Schoenoplectus acutus* Provisional Association are characterized by an herbaceous layer that is intermittent to dense (50-99%, mean 73%) at 1-5m tall. There is an intermittent emergent tall shrub (0-2%, mean 1%) at 1-5m, and an open emergent low shrub layer (0-25%, mean 7%) at 1-5m tall. *Quercus lobata* infrequently occurs as an emergent (0-1% cover, mean 0%). Total vegetation cover is 50-99%, mean 76%.

In this association, *Schoenoplectus californicus* and *Schoenoplectus acutus* are codominant in a tall herb layer at 5-85% and 5-45% cover, respectively. *Eichhornia crassipes* and *Pluchea odorata* often occur in the herb layer, also.

This association was sampled in the following EMUs: Central West Delta, East Delta, North Delta, South Delta

Site Impacts
One sample of this association had low impact from the non-native plant species, *Eichhornia crassipes* and *Iris pseudacorus.* One sample had low impacts from grazing.

Samples Used to Describe Association (n=9)
Rapid Assessment(s): SSJD0018, 0129, 0162, 0214, 0215, 0235, 0299, 0302, 0303

Rank: G4S3?

Global Distribution
So far as is known, this type only occurs in the Delta region of California. This association is to be expected elsewhere where these two principle species occur, but NatureServe (2006) does not report it.

References
NatureServe (2006)

***Schoenoplectus californicus - Schoenoplectus acutus* Provisional Association n=** 9

Stratum	Code	Species Name	Con	Avg	Min	Max
Tree Overstory						
	QULO-t	*Quercus lobata*	22	0.0	0.2	1
Shrub						
	CEOC2-m	*Cephalanthus occidentalis*	33	0.0	0.2	3
	RUDI2-m	*Rubus discolor*	33	0.0	0.2	2
	SALA6-m	*Salix lasiolepis*	22	1.0	1	10
	HILA6-m	*Hibiscus lasiocarpus*	22	0.0	0.2	0.2
	ROCA2-m	*Rosa californica*	22	0.0	0.2	1

Herb

SCCA-m	*Schoenoplectus californicus*	100	42.0	5	85
SCAC3-m	*Schoenoplectus acutus*	100	15.0	5	45
EICR-l	*Eichhornia crassipes*	56	3.0	0.2	20
PLOD-m	*Pluchea odorata*	56	0.0	0.2	0.2
PHAU7-m	*Phragmites australis*	44	1.0	0.2	5
JUXI-m	*Juncus xiphioides*	44	0.0	0.2	2
POPE3-m	*Polygonum persicaria*	33	2.0	1	15
TYAN-m	*Typha angustifolia*	33	1.0	1	5
ASLE17-m	*Aster lentus*	33	0.0	0.2	0.2
LEOR-m	*Leersia oryzoides*	33	0.0	0.2	0.2
TYPHA-m	*Typha*	33	0.0	0.2	2
POPU5-m	*Polygonum punctatum*	22	6.0	18	35
CASE13-m	*Calystegia sepium*	22	0.0	0.2	0.2
EUOC4-m	*Euthamia occidentalis*	22	0.0	0.2	0.2
IRPS-m	*Iris pseudacorus*	22	0.0	0.2	0.2
MEAR4-m	*Mentha arvensis*	22	0.0	0.2	0.2
POAM8-m	*Polygonum amphibium*	22	0.0	0.2	0.2
TYLA-m	*Typha latifolia*	22	0.0	0.2	4

***Typha (angustifolia, domingensis)* Alliance**
Cattail (Narrowleaf, Southern) Alliance

One association of the *Typha (angustifolia, domingensis)* Alliance occurs in the Delta: the *Typha angustifolia-Distichlis spicata* provisional association. Both samples of this alliance were classified into this association.

***Typha angustifolia - Distichlis spicata* Provisional Association**
Narrowleaf cattail - saltgrass Provisional Association

Local Vegetation Description

Stands of the *Typha angustifolia - Distichlis spicata* Provisional Association are characterized by an herbaceous layer that is intermittent to dense (45-85%, mean 65%) at 1-2m tall. There is no emergent shrub or tree layer.

In this association, *Typha angustifolia* dominates the tall herb layer at 22-40% cover, and *Distichlis spicata* is constant with 5-78% cover.

This association was sampled in the following EMU: Central West Delta. Stands were detected on Sherman Island at the border between tall emergent marsh dominated by *Typha* and *Schoenoplectus* spp., and low salt meadow dominated by *Distichlis spicata* and/or *Salicornia virginica*.

Site Impacts
No impacts were reported for these stands.

Samples Used to Describe Association (n=2)
Rapid Assessment(s): SSJD0317, 0347

Rank: G3S3?

Global Distribution
So far as is known, this association is limited to the Delta. However, other stands are likely present in other parts of Central California, particularly in the San Francisco Bay Area and perhaps the central and south coast.

References
No specific references.

***Typha angustifolia - Distichlis spicata* Provisional Association n=** 2

Stratum	Code	Species Name	Con	Avg	Min	Max
Herb						
	DISP-l	*Distichlis spicata*	100	42.0	5	78
	TYAN-m	*Typha angustifolia*	100	31.0	22	40
	SAVI-l	*Salicornia virginica*	100	0.0	0.2	0.2
	AMPS-m	*Ambrosia psilostachya*	50	0.0	1	1
	ATTR2-l	*Atriplex triangularis*	50	0.0	0.2	0.2
	EUOC4-m	*Euthamia occidentalis*	50	0.0	0.2	0.2
	GRCA-m	*Grindelia camporum*	50	0.0	0.2	0.2
	LELA2-m	*Lepidium latifolium*	50	0.0	0.2	0.2
	PLOD-m	*Pluchea odorata*	50	0.0	0.2	0.2

***Typha latifolia* Alliance**
Broadleaf cattail Alliance

One association of the *Typha latifolia* Alliance occurs in the Delta: the *Typha latifolia - pure* Provisional Association. All samples of this alliance were classified into this association.

***Typha latifolia - pure* Provisional Association**
Broadleaf cattail - pure Provisional Association

Local Vegetation Description
Stands of the *Typha latifolia - pure* Provisional Association are characterized by a dense herbaceous layer (75-97%, mean 82%) at 0.5-5m tall. There is an open, emergent tall shrub layer (2-5%, mean 3%) at 2-10m. Total vegetation cover is 75-97%, mean 84%.

In this association, *Typha latifolia* clearly dominates the herb layer at 59 to 74% cover. *Schoenoplectus acutus* and *Cyperus eragrostis* sometimes occur in stands at 3-10% and <1-3% cover, respectively.

This association was sampled in the following EMUs: Central West Delta, East Delta, North Delta

Site Impacts
One sample of this association had low impacts from non-native plant species.

Samples Used to Describe Association (n=6)
Rapid Assessment(s): SSJD0029, 0070, 0127, 0141, 0145, 0266

Rank: G4S2?

Global Distribution
This association is widespread across the western United States and western Great Plains, occurring near streams, rivers, and ponds (NatureServe 2006). It is formally known in NatureServe as the *Typha (latifolia, angustifolia)* Western Herbaceous Vegetation. According to NatureServe the dominant species, either *Typha latifolia* or *Typha angustifolia*, often form dense, almost monotypic stands. Other species typical of wetlands may be found in lesser amounts in this community; among these are shallower water emergents such as *Carex* spp., *Eleocharis macrostachya, Eleocharis palustris, Glyceria* spp., *Juncus balticus, Juncus torreyi, Mentha arvensis, Schoenoplectus acutus*, and *Veronica* spp. In deeper water, *Lemna minor, Potamogeton* spp., *Sagittaria* spp., *Azolla filiculoides*, and other aquatics may be present in trace amounts.

References
NatureServe (2006)

***Typha latifolia-pure* Provisional Association** **n=** 6

Stratum	Code	Species Name	Con	Avg	Min	Max
Herb						
	TYLA-m	*Typha latifolia*	100	67.0	59	74
	SCAC3-m	*Schoenoplectus acutus*	50	4.0	3	10
	CYER-l	*Cyperus eragrostis*	50	1.0	0.2	3

Vernal pool Stands

Local Vegetation Description
This classification unit remains unresolved at the current time, since little data specific to vernal pools has been completely analyzed. The vernal pool stand sampled in this project is characterized by an open herbaceous layer (9%) at 0-0.5m tall, dominated by *Navarretia leucocephala* at 7% cover. This pool was located on the Tule Ranch in the Yolo Basin Wildlife Area, Yolo County. Witham (2003) also sampled vernal pools on this property, and

found a low cover of non-native species and a dominance of natives including *Navarretia leucocephala (*ssp. *bakeri), Pogogyne douglasii,* and *Lasthenia fremontii.*

This vegetation was sampled in the following EMU: North Delta

Site Impacts
The one sample of this association had low impacts from grazing.

Samples Used to Describe Association (n=1)
Rapid Assessment(s): SSJD0363

Rank: G3S3?

Global Distribution
Cismontane northern California. *Navarretia leucocephala* is, according to Solomeshch (Personal communication 2005), a member of the class Downingio-Lasthenietea, as described by Barbour et al. (2003). This is the most common and ubiquitous class of vernal pools in California. However, further differentiation of this class into alliances and associations has not been done yet.

References
Barbour et al. (2003), Witham (2003)

Vernal Pool **n=** 1

Stratum	Code	Species Name	Con	Avg	Min	Max
Herb						
	NABA-l	*Navarretia bakeri*	100	7.0	7	7
	ERYNG-l	*Eryngium*	100	1.0	1	1
	DOBI-l	*Downingia bicornuta*	100	0.0	0.2	0.2
	ELEOC-l	*Eleocharis*	100	0.0	0.2	0.2
	EPILO-m	*Epilobium*	100	0.0	0.2	0.2
	MALVA-l	*Malva*	100	0.0	0.2	0.2
	PLST-l	*Plagiobothrys stipitatus*	100	0.0	0.2	0.2
	PSBR-l	*Psilocarphus brevissimus*	100	0.0	0.2	0.2

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APPENDIX A SAMPLE RAPID ASSESSMENT FIELD FORM

For Office Use:	Final database #: SSJD0224	Final vegetation type name:	Alliance Association

I. LOCATIONAL/ENVIRONMENTAL DESCRIPTION

Polygon/Stand #:	Air photo #:	Date:	Name(s) of surveyors:
SSJD221		08/25/05	(KAL) TKW, CLH

GPS waypoint #: 36 GPS name: 6265 GPS datum: (e.g. NAD 83) _____ Is GPS within stand? Yes (No)

If No, cite from GPS point to stand, the distance 40m (in meters) and bearing 330° (in degrees) GPS Error: ± 13.3 (ft) m

UTM field reading: UTME 607244 UTMN 4235361 UTM zone: 10S

Elevation: 19? (ft) m Photograph #'s: (e to w) TKW-0331-0334

Topography: convex___ flat✓ concave___ undulating___ | top___ upper___ mid___ lower___ bottom✓

Geology: _____ Soil Texture: _____ Rock: %Large / %Small / %Bare/Fine: 94 %Litter: 5 %BA Stems: 1

Slope exposure (circle one and/or enter actual °): NE_____ NW_____ SE_____ SW_____ Flat✓ Variable_

Slope steepness (circle one and enter actual °): 0°✓ 1-5°____ 5-25°____ >25°____ Upland or (Wetland/Riparian) (circle one)

Site history, stand age, and comments: Island in Lindsey slough, Lilaeopsis masonii present; dense canopy of Salix sp and Cornus

Type/ Level of disturbance (*use codes*): —/— ___/___ ___/___ ___/___ ___/___ ___/___ ___/___ ___/___ ___/___

II. VEGETATION DESCRIPTION

Field-assessed vegetation alliance name: Salas - Saex / Cose

Field-assessed association name (optional): _____

Size of stand: <1 acre___ 1-5 acres✓ >5 acres___ Plot: Yes / No If Yes, denote size: 100m²__ 400 m²__ 1000 m²__ Other ___

Adj alliances: open water _____ / _____

Tree DBH (enter counts or denote):	T1 (<1" dbh)	T2 (1-6" dbh)	T3 (6-11" dbh)	T4 (11-24" dbh)	T5 (24-48" dbh)	T6 (>48" dbh)
		Salas, Salv Saex	alrh Qulo			

If Tree, list 1-3 dominant overstory spp.: Salas, Saex

Shrub (mark one or enter %): S1 (seedling <3 yr old) ___ S2 (young <1% dead) ___ S3 (mature 1-25% dead) ✓ S4 (decadent >25% dead) ___

Herb (mark one or enter %'s): H1 (<4" height) ___ H2 (4 -<8" ht) ___ H3 (8 -<12" ht) ___ H4 (≥12" ht.) ✓ % Total Veg Cover: 92

% Cover- Overstory Tree Conifer/(Hardwood): — / 5 Low Tree-Tall Shrub: 60 Lo-Mid Shrub: 55 Herbaceous: 3

Height Class - Overstory Conifer/(Hardwood): — / 05 Low Tree-Tall Shrub: 05 Lo-Mid Shrub: 04 Herbaceous: 02

Height classes: 01=<1/2m 02=1/2-1m 03=1-2m 04=2-5m 05=5-10m 06=10-15m 07=15-20m 08=20-35m 09=35-50m 10=>50m

Species (List up to 12 major species), Stratum, and Approximate % cover: (Jepson Manual nomenclature please)

Stratum categories: T=tall, M=medium, L=low; *% cover intervals for reference*: <1%, 1-5%, >5-15%, >15-25%, >25-50%, >50-75%, >75%

Strata	Species	% cover	Strata	Species	% cover
T	Quercus lobata	<1	L	Lythrum californicum	<1
T	Alnus rhombifolia	4	L	Polygonum punctatum	<1
T/M	Salix lasiolepis	40/3	L	Lilaeopsis masonii	<1
T	Salix exigua	11	L	Lycopus americanus	<1
M	Cornus sericea	50	L	Hydrocotyle ranunculata	<1
M	Rosa californica	5	L	Plukea odorata	<1
T	Vitis californica	1	L	Juncus effusus	<1
M	Salix lucida	7	M	Scirpus acutus	<1
L	Cyperus eragrostis	<1	L	Carex barbarae	<1
L	Juncus xiphioides	<1	M	Fraxinus latifolia	<1

Unusual species: Ficus carycа (T, 1)

III. PROBLEMS WITH INTERPRETATION

Confidence in alliance identification: (L, M, (H)) _____ Explain _____

Other identification problems (describe): _____

Polygon is more than one type: (Yes, No) _____ (Note: type with greatest coverage in polygon should be entered in above section)

Other types: _____ _____ _____

Has the vegetation changed since air photo taken? Yes / No If Yes, What has changed? _____

APPENDIX B SAMPLE RECONNAISSANCE FIELD FORM

CALIFORNIA NATIVE PLANT SOCIETY - RECON FIELD FORM (May 01, 2002)

Surveyors: DH, DB, JK, BRAD BURKHOLDER, CURTIS MASON, DANE RICHTER, ANN AMY, PAUL HUFFMAN **Date:** 5/25/05

Polygon #: DRECO134 **GPS waypoint #:** 3 **GPS in stand?** Y / (N) **If No, distance/bearing:** 90' / 262
Correct Y / N **UTME** 606070 **UTMN** 4212684 **Error:** +/- 14' **GPS name:** 7097

Aspect: — **Elevation:** _____ ft/m **Photograph #'s:** 1104, 1103 **Size of stand:** < 1 acre

Comments: ISLAND: SCIRPUS CALIF (COLONY) ARUNDO ON BANK, SCIRPUS ACUTUS INSIDE **Site quality:** _____

Field-assessed alliance name: _____

Tree cover/ht /dbh: 5 / 30' / 13 **Shrub cover/ht:** 5 / 03 **Herbaceous cover/ht:** 1 / 01 **% Density** 70

Strata	Species	% cover	Strata	Species	% cover	Strata	Species	% cover
M	SALIX SP	3	M	RUBUS	2%	M	ROSA CALIFORNICA	1
M	ARUNDO DONAX	25	M	SCIRPUS CALIF	30	L	LICAEOPSIS MASONII	1
M	POPULUS FREMONTII	7	M	SCIRPUS ACUTUS	10			

Polygon #: DRECO135 **GPS waypoint #:** 004 **GPS in stand?** Y / (N) **If No, distance/bearing:** 200' / 352°
Correct Y / N **UTME** 605752 **UTMN** 4209265 **Error:** +/- 11.8 **GPS name:** 7014

Aspect: _____ **Elevation:** _____ ft/m **Photograph #'s:** 1105, 1106, 1107 **Size of stand:** 1 acre

Comments: LINEAR ISLAND W/S. CANOPY @ WATERLINE. POPULUS MAY INCLUDE LOMBARDY POPLAR. LARGE EGRET ROOKERY! **Site quality:** _____

Field-assessed alliance name: POFR (?)

Tree cover/ht /dbh: 10% / 07 / >12' **Shrub cover/ht:** 40 / 04 **Herbaceous cover/ht:** 20 / 03 **% Density** 70

Strata	Species	% cover	Strata	Species	% cover	Strata	Species	% cover
M	SALIX SP	20	M	S. GOODINGII	1%	M	ARUNDO DONAX	2
M	SCIRPUS CALIF	17	M/T	UNKNOWN VINE	3%	M	PHRAGMITES	2
T	POPULUS FREMONTII	15	M	RUBUS DISCOLOR	2%	M	SCIRPUS ACUTUS	1

Polygon #: DRECO136 **GPS waypoint #:** 007 **GPS in stand?** (Y) / N **If No, distance/bearing:** ____ / ____
Correct Y / N **UTME** 602397 **UTMN** 4212272 **Error:** +/- 14.4 **GPS name:** 7094

Aspect: _____ **Elevation:** _____ ft/m **Photograph #'s:** 1116 - 1123 **Size of stand:** _____ acre

Comments: WEST OF SHERMAN ISLAND, ON BOARDWALK **Site quality:** _____

Field-assessed alliance name: _____

Tree cover/ht /dbh: — / — **Shrub cover/ht:** — / — **Herbaceous cover/ht:** 70 / 03 **% Density** 70

Strata	Species	% cover	Strata	Species	% cover	Strata	Species	% cover
M	SCIRPUS ACUTUS	13		RUMEX CRISPUS	<1	M	SCIRPUS AMERICANUS	<1
M	IRIS PSEUDACORIS	9		TYPHA SP	5	M	PHRAGMITES	2
M	LEPIDIUM LATIFOLIUM	8		APIUM GRAVEOLENS	17	M	CALYSTEGIA SEPIUM	1
M	ARTEMISIA DOUGLASIANA	10		PLANTAGO	1	M	CAREX BARBARAE	2

Polygon #: DRECO137 **GPS waypoint #:** 8 **GPS in stand?** (Y) N **If No, distance/bearing:** ____ / ____
Correct Y / N **UTME** 602319 **UTMN** 4213255 **Error:** +/- 10.5 **GPS name:** 7094

Aspect: _____ **Elevation:** _____ ft/m **Photograph #'s:** 1126 - 1134 **Size of stand:** >5 acre

Comments: INTERIOR OF ISLAND - NOT THE LEVEES VERY PATCHY: PICKLEWEED PODS IN WEEDY MATRIX **Site quality:** DREDGE SPOILS

Field-assessed alliance name: MIGHT PULL OUT SALICORNIA

Tree cover/ht /dbh: — / — **Shrub cover/ht:** — / — **Herbaceous cover/ht:** 50 / 02 **% Density** 65

Strata	Species	% cover	Strata	Species	% cover	Strata	Species	% cover
L	BROMUS DIANDRUS	11	M	CENTAUREA SOL	<1	L	HORDEUM MARINUM GUSSONE.	
M	LEPIDIUM LATIFOLIUM	12	L	VULPIA MYUROS	20	L	LOTUS PURSHIANUS	2
L	SALICORNIA VIRGINICA	6	M	PHRAGMITES	<1	L	DISTICHLIS SPIC	1
L	HETEROTHECA GRANDIF	2	L	POLYPOGON MINSP	5	L	HYPOCHOERIS SP	1

APPENDIX C PLANT SPECIES RECORDED IN SAMPLED VEGETATION STANDS IN THE DELTA

Scientific name[1]	Common name[2]
Abies sp.*	fir
Abutilon theophrasti	velvetleaf
Acer negundo	boxelder
Aegilops sp.	goatgrass
*Aesculus californica**	California buckeye
Agrostis elliottiana	Elliott's bentgrass
Agrostis gigantea	redtop
Agrostis sp.	bentgrass
Ailanthus altissima	ailanthus (tree-of-heaven)
*Albizia julibrissin**	silktree
Algae	algae
Alisma plantago-aquatica var. *brevipes* (=*A. triviale*)	northern water plantain
Allenrolfea occidentalis	iodinebush
Alnus rhombifolia	white alder
Alopecurus sp.*	foxtail
Amaranthus sp.*	pigweed
Ambrosia psilostachya	western ragweed
Amsinckia menziesii var. *intermedia*	common fiddleneck
Anthemis cotula	stinking chamomile
Anthriscus caucalis	burr chervil
Apocynum cannabinum	Indianhemp dogbane
Artemisia douglasiana	Douglas' sagewort
Artemisia sp.*	sage
Arundo donax	giant reed
Asclepias fascicularis	Mexican whorled milkweed
Asparagus officinalis	garden asparagus
Aster sp.	aster
Aster lentus (=*Symphyotrichum lentum*)	Suisun Marsh aster
Aster subulatus var. *cubensis* *(=Symphyotrichum expansum)*	saltmarsh aster
Atriplex sp.	saltbush
Atriplex triangularis	triangle orache, fathen
Avena fatua	wild oat
Avena sp.	oat
Azolla filiculoides	Pacific mosquitofern
Baccharis douglasii	saltmarsh baccharis
Baccharis pilularis	dwarf chaparral broom
*Bidens frondos*a	devil's beggartick
Bidens sp.	beggarticks
Bidens laevis	bur-marigold
Boehmeria nivea	Chinese grass
Brassica nigra	black mustard
*Bromus carinatus**	California brome
Bromus diandrus	ripgut grass
Bromus hordeaceus	soft brome
Bromus sp.	Brome
Bromus madritensis	Spanish brome
Cabomba caroliniana	cabomba
Calystegia sepium	hedge bindweed
Carduus pycnocephalus	Italian thistle
Carex barbarae	Santa Barbara sedge
Carex sp.	carex

Carex praegracilis	clustered field sedge
Centaurea calcitrapa	red star-thistle
Centaurea solstitialis	yellow star-thistle
Centaurium muehlenbergii	Muhlenberg's centaury
Cephalanthus occidentalis	common buttonbush
Ceratophyllum demersum	coon's tail
*Chenopodium album**	lambsquarters
*Chenopodium ambrosioides**	Mexican tea
Chenopodium sp.	goosefoot
*Cicendia quadrangularis**	Oregon timwort
Cichorium intybus	chicory
Cicuta sp.	water hemlock
Cirsium vulgare	bull thistle
Clematis ligusticifolia	western white clematis
Conium maculatum	poison hemlock
Convolvulus arvensis	field bindweed
Conyza canadensis	Canadian horseweed
*Cornus glabrata**	brown dogwood
Cornus sericea	redosier dogwood
*Cornus sessilis**	blackfruit dogwood
Cortaderia selloana	Uruguayan pampas grass
Cotula coronopifolia	common brassbuttons
Crassula connata	sand pygmyweed
Cressa truxillensis	spreading alkaliweed
Crypsis sp.*	pricklegrass
Cuscuta sp.	dodder
Cynodon dactylon	Bermudagrass
Cyperus eragrostis	tall flatsedge
Cyperus sp.	flatsedge
Cyperus rotundus	nutgrass
*Datisca glomerata**	Durango root
*Daucus carota**	Queen Anne's lace
Deschampsia caespitosa	scarlet larkspur
Dipsacus sp.*	teasel
Distichlis spicata	inland saltgrass
*Downingia bicornuta**	doublehorn calicoflower
Echinochloa sp.	cockspur grass
Echinochloa crus-galli	barnyardgrass
Egeria densa	Brazilian waterweed
Eichhornia crassipes	common water hyacinth
Eleocharis macrostachya (=*Eleocharis palustris*)*	common spikerush
Eleocharis sp.	spikerush
Epilobium ciliatum	fringed willowherb
Epilobium sp.	willowherb
Equisetum hyemale var. *affine*	scouringrush horsetail
Eremocarpus setigerus (= *Croton setigerus)*	dove weed
Erigeron sp.	fleabane
*Erodium botrys**	longbeak stork's bill
Erodium cicutarium	stork's bill
Eryngium aristulatum	California eryngo
Eryngium articulatum	beethistle
Eryngium sp.*	eryngo
Eucalyptus globulus	blue gum
Eucalyptus sideroxylon	red ironbark
Euthamia occidentalis	western goldentop
Ficus carica	edible fig

Foeniculum vulgare	sweet fennel
Frankenia salina	alkali seaheath
Fraxinus latifolia	Oregon ash
Galium aparine	stickywilly
Galium sp.	bedstraw
Galium trifidum	threepetal bedstraw
Glycyrrhiza lepidota	American licorice
Grindelia camporum	Great Valley gumweed
Grindelia stricta	Oregon gumweed
Grindelia sp.	gumweed
Helenium puberulum	sneezeweed
Helianthus annuus	common sunflower
Hemizonia sp.*	tarweed
Hemizonia fitchii	Fitch's tarweed
Heterotheca grandiflora	telegraphweed
Hibiscus lasiocarpus (=Hibiscus moscheutos ssp. *lasiocarpus)*	crimsoneyed rosemallow
Hirschfeldia incana	shortpod mustard
Hoita macrostachya	large leather-root
Hordeum depressum	dwarf barley
Hordeum sp.	barley
*Hordeum leporinum**	leporinum barley
Hordeum marinum ssp. *gussoneanum**	Mediterranean barley
Hordeum murinum	mouse barley
Hordeum murinum ssp. *leporinum**	leporinum barley
Hydrocotyle ranunculoides	floating marshpennywort
Hydrocotyle verticillata	whorled marshpennywort
Hypochaeris glabra	smooth catsear
Ilex sp.*	holly
Iris pseudacorus	paleyellow iris
Juglans X californica var. *hindsii (=Juglans hindsii)*	Hinds walnut hybrids
Juglans regia	English walnut
Juncus balticus	Baltic rush
Juncus bufonius	toad rush
Juncus effusus	common rush
Juncus sp.	rush
Juncus xiphioides	irisleaf rush
Kickxia sp.	cancerwort
Lactuca sp.*	lettuce
Lactuca serriola	prickly lettuce
Lasthenia californica	California goldfields
Lathyrus jepsonii ssp. *jepsonii*	Delta tule pea
Lathyrus jepsonii var. *californicus*	Delta tule pea
Lathyrus sp.	pea
Leersia oryzoides	rice cutgrass
Lemna sp.	duckweed
*Lepidium dictyotum**	alkali pepperweed
Lepidium dictyotum var. *acutidens*	alkali pepperwort
Lepidium sp.	pepperweed
Lepidium latifolium	broadleaved pepperweed
Lepidium nitidum	shining pepperweed
Leymus triticoides	beardless wildrye
Lilaeopsis masonii	mudflat quillplant
Lolium multiflorum (=Lolium perenne ssp. multiflorum)	perennial ryegrass
*Lonicera involucrata**	twinberry honeysuckle
Lotus corniculatus	birdfoot deervetch
Lotus sp.	trefoil

Lotus purshianus	American bird's-foot trefoil
*Lotus scoparius**	common deerweed
*Ludwigia hexapetala (=Ludwigia uruguayensis)**	Uruguayan primrose-willow
Ludwigia sp.	primrose-willow
Ludwigia peploides ssp. *montevidensis*	floating primrose-willow
*Lupinus bicolor**	miniature lupine
Lupinus sp.*	lupine
Lycopus americanus	American water horehound
Lythrum californicum	California loosestrife
Malva sp.	mallow
*Malva parviflora**	cheeseweed mallow
Malvella leprosa	alkali mallow
Marah sp.*	manroot
Marrubium vulgare	horehound
*Medicago polymorpha**	burclover
*Medicago praecox**	Mediterranean medick
Melilotus albus (=Melilotus officinalis)	yellow sweetclover
Melilotus sp.*	sweetclover
Mentha arvensis	wild mint
*Mentha pulegium**	pennyroyal
Microseris acuminata	Sierra foothill silverpuffs
*Microseris douglasii**	Douglas' silverpuffs
*Mimulus fremontii**	Fremont's monkeyflower
Mimulus guttatus	seep monkeyflower
Monardella sp.	monardella
Morus alba	white mulberry
Moss	Moss
Myriophyllum sp.	watermilfoil
Myriophyllum spicatum	spike watermilfoil
Navarretia leucocephala[†]	navarretia
Nicotiana glauca	tree tobacco
Nicotiana sp.*	tobacco
Oenanthe sarmentosa	water parsely
*Oenothera biennis**	common evening-primrose
Oenothera sp.	evening-primrose
Parapholis sp.*	sicklegrass
Parapholis incurva	curved sicklegrass
Parthenocissus vitacea	woodbine
Paspalum distichum	knotgrass
*Phalaris canariensis**	annual canarygrass
Phalaris sp.	canarygrass
Phoradendron macrophyllum	Colorado Desert mistletoe
Phragmites australis	common reed
Phyla nodiflora	turkey tangle fogfruit
*Phytolacca americana**	American pokeweed
Picris echioides	bristly oxtongue
Piptatherum miliaceum	smilograss
*Plagiobothrys stipitatus**	stalked popcornflower
Plantago elongata	prairie plantain
Plantago lanceolata	narrowleaf plantain
*Plantago major**	common plantain
*Plantago subnuda**	tall coastal plantain
Platanus sp.	sycamore
Platanus racemosa	California sycamore
Pluchea odorata	sweetscent
Polygonum amphibium	water knotweed

Polygonum aviculare var. *arenastrum*	knotweed
Polygonum hydropiper	marshpepper knotweed
Polygonum sp.	knotweed
Polygonum lapathifolium	curlytop knotweed
Polygonum persicaria	spotted ladysthumb
Polygonum punctatum	dotted smartweed
Polypogon monspeliensis	rabbitfootgrass
Populus fremontii	Fremont cottonwood
Populus sp.	cottonwood
Portulaca sp.*	purslane
*Potamogeton foliosus**	pondweed
Potamogeton nodosus	longleaf pondweed
*Potamogeton pectinatus (=Stuckenia pectinatus)**	sago pondweed
*Potentilla anserina (=Argentina anserina)**	silverweed cinquefoil
Prunella sp.*	selfheal
Prunus cerasifera	cherry plum
*Psilocarphus brevissimus**	short woollyheads
Pteridium aquilinum	brackenfern
Puccinellia simplex	California alkaligrass
*Pyracantha angustifolia**	narrowleaf firethorn
Quercus agrifolia	California live oak
Quercus lobata	California white oak
Raphanus sativus	cultivated radish
Ribes aureum	golden currant
Robinia pseudoacacia	black locust
Rorippa sp.*	yellowcress
Rosa californica	California wildrose
Rubus discolor	Himalayan blackberry
Rubus sp.	blackberry
Rubus ursinus	California blackberry
Rumex conglomeratus	clustered dock
Rumex crispus	curly dock
Rumex sp.	dock
Rumex pulcher	fiddle dock
*Rumex violascens**	violet dock
Sagittaria sp.	arrowhead
Sagittaria latifolia	broadleaf arrowhead
Sagittaria sanfordii	valley arrowhead
Salicornia virginica	Virginia glasswort
Salix babylonica	weeping willow
Salix exigua	narrowleaf willow
Salix gooddingii	Goodding's willow
Salix sp.*	willow
Salix laevigata	red willow
Salix lasiolepis	arroyo willow
Salix lucida	shining willow
Sambucus mexicana (=Sambucus nigra ssp. canadensis)	common elderberry
*Schinus molle**	Peruvian peppertree
Schoenoplectus acutus	hardstem bulrush
Scirpus americanus (=Schoenoplectus americanus)	chairmaker's bulrush
Scirpus californicus (*=Schoenoplectus californicus)*	California bulrush
Scirpus cernuus (=Isolepis cernua)	low bulrush
Scirpus sp.*	bulrush
Scirpus maritimus (*=Schoenoplectus maritimus)*	cosmopolitan bulrush
Senecio hydrophiloides	tall groundwel

Senecio sp.	ragwort
Sesbania sp.*	riverhemp
*Sesuvium verrucosum**	verrucose seapurslane
Silybum marianum	blessed milkthistle
*Solanum americanum**	American black nightshade
Solanum douglasii	greenspot nightshade
Solanum sp.	nightshade
Solidago sp.*	goldenrod
Sonchus asper	spiny sowthistle
Sonchus oleraceus	common sowthistle
Sorghum halepense	Johnsongrass
Sparganium eurycarpum	broadfruit bur-reed
*Spergula arvensis**	corn spurry
Spergularia sp.	sandspurry
Spergularia macrotheca	sticky sandspurry
Spergularia macrotheca var. *longistyla**	sticky sandspurry
Spergularia marina (=Spergularia salina)	salt sandspurry
Stachys albens	whitestem hedgenettle
Stachys sp.*	hedgenettle
Suaeda moquinii	Mojave seablite
Symphyotrichum lentum	Suisun Marsh aster
*Taeniatherum caput-medusae**	medusahead
Tamarix sp.*	tamarisk
Toxicodendron diversilobum	Pacific poison oak
Trifolium depauperatum	cowbag clover
Trifolium depauperatum. var. *truncatum* *(=Trifolium depauperatum* var. *stenophyllum)*	balloon sack clover
Trifolium hirtum	rose clover
Trifolium sp.	clover
*Trifolium microcephalum**	smallhead clover
*Trifolium repens**	white clover
*Trifolium willdenovii**	tomcat clover
Triglochin sp.*	arrowgrass
*Triglochin striatum**	threerib arrowgrass
Triphysaria eriantha	johnny-tuck
Triteleia hyacinthina	white brodiaea
*Triteleia laxa**	Ithuriel's spear
Typha angustifolia	narrowleaf cattail
Typha sp.	cattail
Typha latifolia	broadleaf cattail
Ulmus sp.*	elm
*Ulmus minor (=Ulmus procera)**	English elm
Urtica dioica	stinging nettle
Verbena bonariensis	purpletop vervain
Verbena sp.	vervain
*Verbena lasiostachys**	western vervain
Vicia sativa	garden vetch
*Vicia villosa**	winter vetch
Vitis californica	California wild grape
Vitis vinifera	wine grape
*Vulpia bromoides**	brome fescue
Vulpia microstachys	small fescue
Vulpia myuros	rat-tail fescue
Xanthium sp.*	cocklebur
*Xanthium spinosum**	spiny cockleburr
Xanthium strumarium	rough cockleburr

[1] Nomenclature follows NRCS 2006
[2] Common names in this Appendix follow NRCS 2006
* Plants occurring in only one sample and excluded from the cluster analysis.
[†] Plants on Tule Ranch were identified as *Navarretia leucocephala* ssp. *bakeri* by C. Witham, however, we could not positively identify plants in our stands as ssp. *bakeri.*

APPENDIX D MAPPING REPORT BY AIS

FINAL REPORT

VEGETATION AND LAND USE MAPPING SACRAMENTO & SAN JOAQUIN RIVER DELTA

Prepared for

California Department of Fish and Game

By

Aerial Information Systems, Inc.

December 2006

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OVERVIEW

Aerial Information Systems, Inc. was contracted by the University of California at Davis to map vegetation and land use for approximately 725,000 acres of natural and built up land in the San Joaquin and Sacramento River Delta area for the California Department of Fish and Game. Photo interpreters used GIS processing software and high-resolution digital imagery to delineate mapping units and assign land use and land cover related attribute codes. Vegetation was mapped to the sub-alliance to super-alliance level of floristic classification. The land use classification was a modified Anderson *et al*. Level II classification. Field reconnaissance and verification enhanced map accuracy, as did ancillary data sources. Accuracy assessment points further improved the vegetation map reliability.

STUDY AREA

Figure 1 (pg.36) shows the extent of the area mapped. The study area boundary constitutes the legal definition of the California Delta. The area was subdivided based on digital orthoquadrangles (DOQs). There were eight full DOQs and 23 partial ones. Natural vegetation (including open water) comprises approximately 189,000 acres, or 26%, of the Delta study area. (See Appendix 8 - pg.33 for total acreage) The remaining acreage is in agricultural or urban uses. Roughly 65% of the total study area is currently under agriculture with about 9% as urban built up areas.

The western boundary adjoins the Suisun Marsh mapping effort completed in 1999.

IMAGERY

- USGS True Color Orthoimagery flown in May of 2002 – 1 Foot Resolution – Covers a majority of the study area and is the primary base imagery
- USDA True Color Imagery flown in 2005 – 1 Meter Resolution NAIP (National Agricultural Imagery Program) – Used as a base for the remainder of the study area not covered by the USGS 1 foot imagery (Including about 10 partial DOQ's in the northwestern and southeastern portions of the study area.)
- Google-map (Ancillary) – year unknown (pre-2004)

Note: Changes that were depicted along the interface between the two data sets favored the more recent imagery. Field verification data was used where available.

MAPPING CLASSIFICATIONS

Nine coding layers were devised for this project – Described in Detail in Appendices 1-5:

- Land Use (LU)
- Vegetation (VEG)
- Urban-Water-Agriculture Interface (NATURALVEG)
- Vegetation Canopy Density (DENSITY)
- Wildlife Habitat Relationships (WHR)
- WHR Acronym (WHRCODE)
- Vegetation Canopy Height (HEIGHT)
- Tree DBH (WHRSIZE)
- Polygons of High Conservation Value (HIGHVALUE)
- GIS-Related Attributes (Coverage Id's, Area, Perimeter)

Note: Every polygon is coded with a value for the above nine layers.

Multiple coding of each polygon for these layers allowed flexibility in representing complex situations. Natural vegetation could be represented in areas mapped as "water" or "urban" in the other layers. For instance, water with large areas of floating aquatics were coded as "Water" in the land use layer but as *Eichhornia crassipes* (6110) in the vegetation layer. As another example, a park with a large stand of valley oaks could be coded as "Other Urban or Built-up Land" in land use but as *Quercus lobata* (2230) in vegetation.

There are approximately 100 acres (37 polygons) which are coded 9999 or unknown: Further review by local expertise can attribute these polygons at a future date.

MINIMUM MAPPING RESOLUTION

The minimum mapping widths and sizes for this effort were a function of the amount of area to be mapped, the clarity of the imagery, and budget and time constraints.

The following are the minimum mapping units (MMU) and minimum widths for the project:

	MMU	Minimum width
Land use:	2 acres	25 meters
Isolated land use:	1 acre	10 meters
Water:	1 acre	10 meters
Vegetation:	2 acres	10 meters
Critical veg:	1 acre	10 meters

Features were occasionally mapped below MMU or minimum width. These features were so distinct or important compared to the surroundings that omitting them would have distorted the representation of the area.

LAND USE & VEGETATION MAPPING

Procedures

Land use and vegetation were mapped by DOQ - The USGS 7.5' Topo Quadrangle Maps. The interpreter selected a DOQ from an on-screen menu.

Preliminary Mapping Classifications: Mapping units were derived from initial reconnaissance visits and preliminary floristic classifications. Mapping was performed to the finest level deemed by the photo interpreter as a recognizable signature using the imagery and appropriate environmental modeling correlates where available. Generally, the photo interpreter maps to the finest level possible and where signature correlates fail, codes are later aggregated up to a more general category in the mapping classification.

Delineating: Both land use and natural vegetation were delineated using a heads-up digitizing approach in an ARC Edit session. The interpreter zoomed in to the imagery at an appropriate level for recognizing and then delineating the vegetation stand or land use type. The polygon delineations were based on photo signature and activities clearly discernable on the project imagery, not by land ownership. Polygon boundaries were added and adjusted on-screen to separate one type from another. Tools to measure area and width were employed to ensure a mapped feature met the minimum requirements.

Assigning codes: Once a delineation was completed, the interpreter added a label point inside the polygon and assigned the appropriate land use code. The interpreter pulled up digital land use data from DWR or San Joaquin County as needed to help in determining the best code. Additional information from reconnaissance data and field plot data aided in the assignment of polygon codes with both their floristic and land use related value. The polygon was flagged for a field check if the interpreter was unsure of the code. The interpreter could also type a brief note or question for the field crew or for the quality control reviewer.

Edge-matching: If an adjacent DOQ had already been mapped, the interpreter pulled up the linework and codes from the completed DOQ. The interpreter then ensured that the codes and polygon boundaries matched at the DOQ boundary.

Internal checks: Once a DOQ had been worked through, the interpreter ran a series of checks for dangling lines, imprecise digitizing, duplicate codes, and uncoded polygons.

Quality control: All mapped DOQs were reviewed by a senior interpreter. Corrections to linework and codes were made where appropriate.

Field preparation for verifying land use: After a group of adjoining DOQs had been mapped, orthophoto plots usually at a scale of 1:12,000 were produced. Most DOQs were divided into four quarter-quads for field plots. Labels of the polygons flagged for

field were plotted in a different color from the rest of the labels. Using local road maps as sources, the plots were then annotated by hand with road names, railroads, waterways, ferries, bridges, and other features. The most efficient routes for field checking were identified, as were islands without access, etc.

Field check: A pair of staff members made a total of three field check visits to the Delta. One person served as driver while the other used the field plots to navigate to polygons flagged for field check. The best code for these polygons was recorded and explanatory notes were made. The codes of other land use polygons along the route were also verified or corrected.

Areas of land use change were also noted. These were only incorporated in the final land use map if the boundaries of the new land use could be clearly identified on the imagery.

Vegetation questions were directed to field ecologists during the field data gathering process and after when the field data was being analyzed. Several accuracy assessment points were also given to the photo interpreters to help further train on signature variability.

Field revision: Once the team returned from the field, their findings were input into the land use overlay. All polygons that had been checked were coded as such in the Field coding layer. The polygons on the plot were marked off as their field codes were updated. If only part of a large extensive polygon had been viewed, the polygon was not marked as having been field checked. If a polygon had been flagged for field but was not visited due to lack of access, the field check code was set back to zero, and the field reviser made an educated guess on the most accurate land use code.

When field revisions for a DOQ were complete, the edges to adjoining DOQs were checked again to ensure consistent codes and linework across quad boundaries.

Vegetation Accuracy Assessment: Accuracy was assigned to floristic types based on a closeness or "fuzzy" category of 0-5. Accuracies ranged from perfect (5 = accurate at the mapped level – generally alliance or association) to Incorrect (0 = inaccurate to the life form level). Overall accuracy came out at 85% with 9 types falling below 70%. Of the nine types, six had less than three samples.

Accuracy Assessment points were collected during the field data gathering process and before the final map was completed.

Note: Corrections to the map were also performed based on specific notes from local ecologists and water resource engineers with expertise in the region.

The following efforts were completed to address the accuracy problems with the final product:

1. Under-mapping of California Bullrush was corrected by modeling out areas on large channels in permanently flooded windward portions on the outer edges of islands, especially in the western third of the study area.
2. Eucalyptus was reviewed on a polygon by polygon basis and several stands were coded to the more generic 9300 exotic vegetation stands.
3. Algae was reviewed on a polygon by polygon basis using a more refined signature correlate derived from the AA points; several polygons were changed to floating aquatic types or a mix of floating aquatic vegetation and bulrush.
4. Signature correlates could not be verified for perennial pepperweed and should be lumped into generic tall forb vegetation. Linework and coding structure remains for possible future assessment, however.
5. Common reed was reviewed on a polygon by polygon basis for texture; significant re-coding to dogwood-willow-common reed units occurred in areas of coarser texture using the AA points to refine photo interpretation signature correlates.
6. Coyote brush was reviewed on a polygon by polygon basis for confusion with pickleweed and locally recoded. Note: This error was very local and was a function of poor quality imagery and a lack of any correlation to pickleweed in either reconnaissance efforts or plot data.
7. California walnut was reviewed on a polygon by polygon effort; several polygons were reassigned to a generic exotic trees category. No signature correlation has been established for this class and is mapped primarily on plot related data only.

Criteria

Land/Water Interface

Tidal fluctuations in the Delta and the gradations of signature between "open water" and "upland" necessitated guidelines for delineating the land/water interface:

The following conditions were mapped as land:

-Upland vegetation, agriculture, urban and vacant areas
-Tidal & seasonally flooded mudflats exposed at the time of the imagery
-Emergent vegetation (Temporarily to permanently flooded) – including areas that are normally designed for water such as channels & canals

These conditions were mapped as water:

-Open water as depicted on the baseline imagery
-Submerged mudflats at the time the imagery was flown
-Flooded areas as a result of levee breakage

Floating & submerged (fixed or non fixed rooted) aquatic vegetation were the only types of vegetation mapped in what was coded as water in the land use layer.

Occasionally these transitional elements were mapped in the opposite category (e.g., wet mudflats included with land) if doing so allowed linking below-resolution patches into a unit big enough to map.

In the cases of tree canopy overhanging the shoreline, the land/water boundary was placed at the presumed location of the tree trunks. Shorelines on small islands may have been expanded outward slightly to meet MMU requirements.

Streams

Streams that appeared as polygons on the USGS 1:24,000 topographic maps were mapped as water polygons, even if their width tapered to less than 10 meters on the imagery.

Canals/Ditches

Canals and ditches were mapped as water polygons if the width of the water signature itself was greater than or equal to 10 meters, and that width continued for the majority of the length of the feature. If the width decreased to consistently less than 10 meters, a good visual break (bend, road crossing, etc.) was selected to end the water polygon. Canals and ditches were not delineated as polygons where the width of the water signature was less than 10 meters, even if the berm-to-berm width was greater than 10 meters.

A corridor consisting of two or more narrow (<10 meter) ditches and measuring more than 25 meters wide overall was mapped in land use as a Transportation, Communications, and Utilities polygon. Such a polygon was also mapped if the disturbance alongside a single narrow canal or ditch measured 25 meters or more in width. The delineations were made on the outside edges of the disturbance on either side of the corridor. The water in the canals or ditches was not pulled out separately. If the corridor of "ditch/canal-related disturbance" measured less than 25 meters in width, the corridor was not mapped.

In ditch corridors as described above, occasionally the water in a ditch widened to 10 meters or more. For continuity, the entire length of the corridor was mapped as a Transportation, Communication, and Utilities polygon. The water was not pulled out separately.

Linear Vegetation Features

Natural vegetation often occurred along narrow canals and ditches. The total width between the outside edges of the vegetation on either side of the feature sometimes exceeded 10 meters. In these situations, a vegetation polygon was drafted only if the vegetation on one side of the ditch bank was wider than 10 meters, and the entire polygon was larger than one acre. Such a polygon would include vegetation on both sides of the

ditch. A vegetation polygon was not pulled out if the vegetation on each bank measured less than 10 meters wide.

Windrows were not mapped unless the width of the canopy met or exceeded 10 meters. Trees flanking either side of a narrow road or stream were collected as one vegetation polygon where the canopy width met or exceeded 10 meters.

Although normally road centerlines were used to separate land use types, exceptions sometimes occurred where trees were involved. For instance, there were cases where a large area of trees occurred on one side of a road, and a narrow (<10 meter) strip of trees occurred on the other side of the road, which was in turn flanked by cropland. Rather than using the road to separate the natural vegetation from the cropland, the delineation was made on the tree/cropland interface.

Land Use Boundaries

Fence lines or the centerlines of roads, streams, ditches, etc. were used to separate adjacent land use types. Where these features weren't present, land use boundaries were drawn with consideration for polygons in the vegetation layer. Boundaries were drawn to avoid sliver polygons created when the land use and vegetation layers were superimposed. Conversely, some vegetation boundaries had straight portions due to land use delineations.

Cropland and Pasture

One challenge in land use mapping was to differentiate between fallow cropland, pasture, and vacant land in agricultural areas. Cropland and pasture were assigned land use code 2100, while vacant land received a code of 3100. The land use data from DWR and from San Joaquin County, as well as field observations, helped in separating these classes.

A field was considered to be fallow cropland if it occurred in close proximity to active agriculture and had weeds and grasses growing, but also showed some evidence of recent agricultural activity.

Similar fields sometimes occurred on the fringe of in-crop areas. If these fields had shrubs and tall weeds growing, they probably had not been farmed for more than five years. These fields were mapped as vacant.

Livestock, fences, watering holes, barns, and other features were used to distinguish pasture. These may have been visible on the imagery or during the field check. If there weren't clear signs of pasture use, the land was mapped as vacant.

Even with these rules, the best code for land that was not clearly in agricultural use was sometimes ambiguous. Fields extending more than 70 acres without being divided by fences, paths, etc. were generally coded as vacant.

Rice

At the outset of the project, the possibility of mapping rice as a separate agricultural class was investigated. This turned out not to be viable, as the signature of rice fields in the Delta region was too variable to map reliably. However, a class corresponding to Flooded Agriculture was added to the land use classification. Some of the polygons with this code may include rice.

Orchards

Active and recently abandoned orchards were mapped as orchards in land use. Long-abandoned orchards, with trees still standing or with trees removed, were collected as vacant land use.

Transportation Corridor

This land use class (code = 1410) was reserved for freeways and for city streets that exceeded 25 meters in width. Median vegetation was not pulled out separately. The delineations followed a visible right of way indicator (such as fence line) where present. Otherwise they followed the edge of the paved surface for freeways, or the bottom of the curb for city streets. On-ramps and off-ramps were not included.

AGRICULTURE CROSSWALK TO WHR CLASSES

To aid database users needing to compare the land use maps with Wildlife Habitat Relationship information, the correspondence between categories is addressed below.

NON-NATURAL VEGETATION WHR TYPE	DELTA LAND USE CATEGORY
Irrigated Hayfield (Cropland)	2100 Cropland and Pasture; 2110 Flooded Agriculture
Irrigated Row and Field Crops (Cropland)	2100 Cropland and Pasture; 2110 Flooded Agriculture
Dryland Grain Crops (Cropland)	2100 Cropland and Pasture; 2110 Flooded Agriculture
Irrigated Grain Crops (Cropland)	2100 Cropland and Pasture; 2110 Flooded Agriculture
Vineyard	2240 Vineyard
Evergreen Orchard	2230 Evergreen Orchard
Deciduous Orchard	2220 Deciduous Orchard
Barren	3100 Vacant; 7500 Strip Mines, Quarries, and Gravel Pits; 7600 Transitional Areas-Construction-Scraped Ground
Urban	1100 Residential; 1200 Commercial and Services; 1300 Industrial; 1400 Transportation, Communications, and Utilities; 1410 Transportation Corridor; 1500 Industrial and Commercial Complexes; 1600 Mixed Urban or Built-up Land; 1700 Other Urban or Built-up Land; 2300 Confined Feeding Operations; 2400 Other Agricultural Land
Pasture	2100 Cropland and Pasture; 2110 Flooded Agriculture
Rice (Cropland)	2100 Cropland and Pasture; 2110 Flooded Agriculture

The only one-to-one correspondences between these classifications are in the vineyard and orchard categories.

The WHR crop, pasture, and rice categories all fit within the land use category 2100 (Cropland and Pasture). Some of these may have been mapped as 2110 (Flooded Agriculture) depending on conditions at the time the imagery was acquired.

The WHR barren category could be included in the land use category 3100 (Vacant), but the majority of polygons mapped as 3100 were vegetated. The distinction between vegetated and barren vacant land was made in the vegetation code layer. WHR barren land may also occur in the land use categories including quarries and gravel pits, and transitional areas and construction.

The WHR urban vegetation category, which includes tree grove, street strip, shade tree/lawn, lawn, and shrub cover, could potentially be found in any of the urban land use categories as well as confined feeding operations and other agricultural land.

Appendix 1

Delta Vegetation Classification

DELTA MAPPING CLASSIFICATION (Mapping Short Form)

CLASS
- Formation-Mapping/Complex Mapping Unit
  - Alliance
    - Associations & Phases (phase species in parenthesis)

1000-2000 – FORESTS – WOODLANDS

- 1300 – Temporarily or Seasonally Flooded – Deciduous Forests
  - 1310
  - 1320 – White Alder (4 Recons/8 RAPs)
    - 1321 - *Alnus rhombifolia / Salix exigua (Rosa californica)(0/18)*
    - 1322 – *Alnus rhombifolia / Cornus sericea(0/7)*
  - 1330 – Oregon Ash *fraxinus latifolia(0/1)*
  - 1340 – Box Elder *Acer negundo(6/1)*
  - 1341 - Acer negundo- Salix gooddingii (0/7)
  - 1350 – California Walnut *juglans californica(1/1)*
  - 1360 – Fremont Cottonwood *Populus fremontii 5/1*
  - 1370 – California Sycamore *Platanus racemosa*
  - 1380 – Black Willow *Salix gooddingii 21/3*
    - 1381 - *Salix gooddingii /* wetland herbs 0/5
    - 1382 - *Salix gooddingii - Populus fremontii - (QuLo-SaEx-RuDi) 0/28*
    - 1383 - *Salix gooddingii – Quercus lobata /* Wetland Herbs 0/9
    - 1384 – *Salix gooddingii/Rubus discolor*
- 2100 – Sclerophyllous Woodlands
  - 2110 – Coast Live Oak *Quercus agrifolia 1/3*
- 2200 – Deciduous Woodlands
  - 2230 – Valley Oak *Quercus lobata 16/4*
  - 2231 - *Quercus lobata / Rosa californica (RuDi – SaLa / Carex) 0/27*
    - 2232 - *Quercus lobata – Acer negundo 0/5*
    - 2233 - *Quercus lobata – Alnus rhombifolia (SaLa – PoFr – QuAg) 0/28*
    - 2234 - *Quercus lobata – Fraxinus latifolia 0/15*

3000 – SHRUBLANDS

- 3200 – Microphyllous Shrubland
  - 3210 – Coyotebush *baccharis pilularis 0/1*
    - 3211 - *baccharis pilularis /* Annual Grasses & Herbs
- 3300 – Dwarf Shrublands
  - 3310 – Deerweed *lotus scoparius 1/0*
    - 3311 – *lotus scoparius* – Antioch Dune
- 3400 – Intermittently or Temporarily Flooded Deciduous Shrublands
  - 3410 – Blackberry *Rubus Discolor 2/0*

3420 – California Wild Rose *Rosa californica 2/0*
Mapped to 3400
3430 – Mexican Elderberry *Sambucus mexicana 0/1*
Mapped based on ground data only
3440 – California Dogwood *Cornus sericea 8/0*
3441 - *Cornus sericea – Salix exigua 0/3*
3442 - *Cornus sericea – Salix lasiolepis / (PhAu) 0/15*
3450 – Buttonbush *Cephalanthus occidentalis 1/3*
3460 – Arroyo Willow *Salix lasiolepis 3/8*
3461 – *Salix lasiolepis* – Mixed brambles (*RoCa – ViCa – RuDi)*
3462 - *Salix lasiolepis – (CoSe)/Scirpus spp.-(Phrag.-Typha) complex unit*
3470 – Shining Willow *Salix lucida 0/6*
3480 – Narrow-leaf Willow *Salix exiqua 24/3*
3481 – *Salix exigua – (SaLa – RuDi – RoCa) 0/39*
3500 – Broadleaf Shrublands
3510 – Silver Lupine *lupinus albifrons*
3511 - *lupinus albifrons* – Antioch Dune

4000 – HERBACEOUS GRASSES

4100 & 4700 – Tall & Medium Upland Grasses
4701 – Ruderal Herbaceous Grasses & Forbs 0/1
4110 – Pampas Grass *Cortaderia (SeJu) 0/1*
4710 – California Annual Grasslands – Herbaceous 3/0
4711 – *Bromus diandrus – Bromus hordeaceus 0/7*
4720 – Italian Rye-grass *lolium multiflorum 2/1*
4721 - *lolium multiflorum – Convolvulus arvensis 0/6*
4722 - *lolium multiflorum – Triphyssria eriantha*
4723 - *lolium multiflorum – lasthenia glabrata*
4724 - *lolium multiflorum – Blennosperma nanum*
4730 – Polypogon monospeliensis (Rabbitsfoot grass)
4200 – Intermittently Flooded Grasslands
4210 – Saltgrass *Distichlis spicata 2/0*
4211 - *Distichlis spicata* – Annual Grasses 0/2
4212 - *Distichlis spicata – Salacornia virginica 0/2*
4213 - *Distichlis spicata – Juncus balticus*
4220 – Santa Barbara Sedge *Carex barbaree* Stands 0/1
4300 – Temporarily Flooded Grasslands
4310 – Giant Cane *Arundo donax 3/1*
4320 - Creeping Wild Rye Grass *leymus triticoides*
4330 – Common Rush *Juncus effuses 0/1*
4340 – Broad-leaf Cattail *Typha latifolia 0/5*
4400 - Seasonally Flooded Grasslands
4401 – Juncus bufonius 0/1 (salt grasses)
4402 – Vernal Pools 0/1
4403 – Juncus balticus-meadow vegetation
4500 – Semi-permanently Flooded Grasslands
4501 – Mixed *Scirpus* Mapping Unit
4502 – Mixed Scirpus / Floating Aquatics (*hydrocotyle –Eichhornia)* Complex
4503 - Mixed Scirpus/ Submerged Aquatics (Egeria-Cabomba-Myriophyllum spp.) complex unit
4510 – Hard-stem Bullrush *Scirpus acutus 17/1*
4511 – *Scirpus acutus* Pure 0/4
4512 - *Scirpus acutus - Typha angustifolia 0/2*
4513 - *Scirpus acutus –Typha latifolia 0/2*
4514 - *Scirpus acutus –(Typha latifolia) – Phragmites australis 0/11*
4515 - *Scirpus acutus* – Cocklebur *Xanthium strumarium 0/4*

4520 – California Bullrush *Scirpus californicus 12/1*
4521 - *Scirpus californicus – Eichhornia crassipes 0/7*
4522 - *Scirpus californicus – Scirpus acutus 0/9*
4530 – American Bullrush *Scirpus americanus 0/1*
4600 – Tidally Flooded Grasslands
4610 – Narrow-leaf Cattail *Typha angustifolia*
4611 – *Typha angustifolia – Distichlis spicata 0/2*
4620 – California Hair-grass *Deschampsia caespitosa*
4621 - *Deschampsia caespitosa- Lilaeopsis masonii 0/5*
4630 – Common Reed *Phragmites australis 2/2*

5000 – FORBS

5100 – Tall & Medium Upland Forbs
5110 – Fennel *Foeniculum vulgare*
5120 – Poison Hemlock *Conium maculatum* Alliance
Mapped to 5100
5200 – Intermittently Flooded Perennial Forbs
5201 – Managed Annual Wetland Vegetation (Non-specific grasses & forbs) 2/8
5202 – Shallow flooding with minimal vegetation at time of photography
5203 – Seasonally flooded undifferentiated annual grasses and forbs
5205 – Intermittently or temporarily flooded undifferentiated annual grasses and forbs
5204- Managed alkali wetland (Crypsus grass)
5206 – Introduced wetland herb/forb with scirpus
5210 – Birdfoot Trefoil *Lotus corniculatus 0/1*
5300 – Temporarily Flooded Perennial Forbs
5301 – Smartweed *Polygonum spp.* - Mixed Forbs
5311 – *Polygonum amphibium 0/6*
5400 – Semi-permanently Flooded Forbs
5410 – Floating Primrose *Ludwigia peploides 6/0*
5411- Ludwigia peploides 0/6
5420 – Horsetail *Equisetum spp. 4/0*
5500 – Tall & Medium Perennial Forbs (Upland or Tidally Flooded)
5501- Alkaline vegetation M.U.
5502- Allenrolfea occidentalis M.U.
5503- Suaeda moquinii-(Lasthenia californica) M.U.
5504- Lasthenia californica M.U.
5510 – Alkali Heath *Frankenia salina*
5511 - *Frankenia salina – Distichilis spicata /02*
5512 – *Frankenia salina- annual grasses*
5520 – Pickleweed *Salacornia virginica*
5521 - *Salacornia virginica – Distichilis spicata 0/2*
5522 - *Salacornia virginica – Cotula coronopifolia 0/1*
5530 – Perennial Pepper-weed *Lepidium latifolium 4/0*
Mapped to 5100
5531 - *Lepidium latifolium – Salicornia virginica - Distichilis spicata 0/2*
5540 – Tobacco brush M.U.

6000 – PERMANENTLY FLOODED HYDROMORPHIC-ROOTED
6101 - Generic Floating Aquatics
6110 – Water Hyacinth *Eichhornia crasspes* – Floating 7/2
6201 – Pondweed – *Potamogeton 1/1*
6202 – Riverweed – *Ceratophyllum*
6203 – Waterweed – *Elodea*
6210 – Milfoil – Waterweed (generic submerged aquatics) 3/0
6211 – Brazilian Waterweed *Egeria –Myriophyllum* Submerged 0/6

6220 – *Hydrocotyle ranunculoides*
6230 – *Sagittaria sanfordii*

7000 – Algae

9000 – LAND USE – LITTLE OR NO VEGETATION – WATER

9100 - Urban Developed – Built Up
9200 – Agriculture
9300 – Exotic Vegetation Stands
9310 – Eucalyptus (2/0)
9320 – Tree-of-Heaven (1/0)
9330 – Acacia (10/1)
9400 – Sparsely or Unvegetated Areas; Abandoned orchards
9401 – Levee Rock Riprap
9402 – Salt scalds and associated sparse vegetation
9403 – Tidal mudflats
9404 – River blowout, sandy wash
9500 – Restoration Sites
9501 – Black Willow – Valley Oak
9502 – Valley Oak
9503 - White Alder – Arroyo willow
9800 – Water
9999 - Unknown

STRUCTURAL VEGETATION LAYERS

Density

1 = >60%
2 = 40-60%
3 = 25-40%
4 = 10-25%
5 = 2-10%

Height

1 = Less than 0.5 meters
2 = 0.5 – 2 meters
3 = 2 – 5 meters
4 = 5 – 15 meters
5 = 15 – 35 meters
6 = Greater than 35 meters
9 = Not applicable
0 = Floating or Submerged Vegetation

WHR Size

1 = Seedlings (Less than 1”)
2 = Saplings (1-6”)
3 = Pole (6-11”)
4 = Small (11-25”)
5 = Medium – Large (Greater than 25”)
6 = Multi Layered Medium – Large Trees over smaller Trees (Densities > 60%)

Appendix 2

Delta Land Use Classification

1000 Urban or built-up Land
- **1100 Residential**
- **1200 Commercial and Services**
  - **1271 – Military – Built Up**
  - **1272 – Military – Not Built Up**
- **1300 Industrial**
- **1400 Transportation, Communications, and Utilities**
  - **1410 Transportation Corridor**
- **1500 Industrial and Commercial Complexes**
- **1700 Other Urban or Built-up Land**

2000 Agricultural Land
- **2100 Cropland and Pasture**
  - **2110 Flooded Agriculture**
- 2200 Orchards, Groves, Vineyards, Nurseries, and Ornamental Horticultural Land
  - **2210 Nurseries and Ornamental Horticultural Land**
  - **2220 Deciduous Orchards**
  - **2230 Evergreen Orchards**
  - **2240 Vineyards**
- **2300 Confined Feeding Operations**
- **2400 Other Agricultural Land**

3000 Natural Vegetation
- **3100 Vacant**

5000 Water
- **5100 Streams - Rivers**
- **5200 Lakes, Reservoirs and Ponds**
- **5300 Canals**
- **5400 Areas of Inundation**

7000 Barren Land
- **7500 Strip Mines, Quarries, and Gravel Pits**
- **7600 Transitional Areas – Construction – Scraped Ground**

9999 OUT of STUDY

**** Bolded Categories indicate mapped units**

The land use definitions and descriptions were developed by Aerial Information Systems, Inc. as a Modified Anderson Land Use Classification. This classification uses a hierarchical system, allowing easy aggregation and disaggregation of classes. Most uses in the 2005 Land Use Study of the California Delta were mapped to the second level, with some uses mapped to the third level.

1000 URBAN OR BUILT-UP LAND

Areas of built-up land characterized by intensive land use, where most of the land is covered by man-made structures.

1100 RESIDENTIAL

The residential category includes areas of single-family residences, multi unit dwellings, and mobile homes. Rural residential/farmsteads are also included in this category. However, areas of non-residential use greater than the MMU within the farmstead are separated and coded as 2400- "other agricultural land."

Note: Many polygons mapped in the landuse field as residential may contain a value in the vegetation code as exotic trees. This enables the users to determine where isolated stands of trees may be located in large tracts of farmland for potential roosting sites for hawks. Other residential polygons where a significant remnant riparian vegetation was preserved such as valley oak will be coded in the vegetation field as valley oak.
See Figure 2, pg. 37 for a graphic example of duel coding.

1200 COMMERCIAL AND SERVICES

Commercial and Services includes areas used mainly for business or the sale of products and their associated services. Also included in this category are institutional uses such as schools, churches, and government and public service facilities. This class does not include industrial activities.

For the purposes of this mapping effort it was decided to represent military land within the Delta region, and to further indicate whether the land within installation boundaries was built up or undeveloped.

1271 Military - Built-Up

This category includes all developed land within a military installation. Includes bases, camps, armories, ordnance depots, and missile sites. Built up areas may contain office buildings, residential units, industrial areas, equipment storage facilities, administrative buildings, other support facilities, parking areas, landscaping, glades, walkways, and athletic facilities.

1272 Military – Not Built Up

This category includes all large areas of undeveloped lands within a military installation. Also included in this category are agricultural areas within the military reservation.

1300 INDUSTRIAL

Areas where manufacturing, assembly, processing, packaging, or storage of products takes place. Included in this category are open storage areas, warehouses, oil and gas extraction, wineries, packing houses, and grain elevators.

1400 TRANSPORTATION, COMMUNICATION, AND UTILITIES

Major structures and facilities associated with forms of transportation, communication, and utilities. Includes airports, railways, roads, harbor facilities, truck terminals, waste disposal, water storage and transfer facilities, gas and petroleum distribution systems, flood control features, wind energy facilities, and maintenance yards.

1410 Transportation Corridor

Freeways and city streets that exceeded 25 meters in width were mapped in this category. The delineations followed a visible right of way indicator (such as fence line) where present. Otherwise they followed the edge of the paved surface for freeways, or the bottom of the curb for city streets. On-ramps and off-ramps were not included.

1500 INDUSTRIAL AND COMMERCIAL COMPLEXES

This category includes both commercial and industrial land uses occurring together or in close proximity. Each individual land use unit is below the 2-acre minimum mapping resolution and neither use dominates.

Typically this class occurs at "industrial", "commercial" or "business" parks that contain a mixture of light industrial use, offices, warehouse/distribution use, retailing, and personal services. This class is also used in areas not located in a complex, but the industrial and commercial classes do follow the definition above. Also included are areas where a combination of commercial and industrial use occurs within the same building.

1700 OTHER URBAN OR BUILT-UP LAND

This includes developed open areas within urban settings, and urban and non-urban open areas developed for recreational activities. Golf courses, parks, cemeteries, and campgrounds are some of the land uses mapped in this category.

2000 AGRICULTURAL LAND

Agriculture includes land used primarily for the production of food, fiber, and livestock. Included in these classes are associated structures and facilities.

2100 CROPLAND AND PASTURE

Included here are active field and row cropland areas and improved pasturelands. The croplands include cultivated, in crop, harvested, fallow or temporarily idle land. The pastureland may be in pasture year-round or be in the cropland seasonal rotation. Pastureland does not include rangeland (see code 3100).

2110 Flooded Agriculture

This category was included to represent agricultural fields that were flooded at the time the imagery was acquired. These may have been rice fields or some other crop. This category is distinct from Areas of Inundation (code 5400), in which the flooding was so extensive that the photo interpreters couldn't distinguish between agriculture and other land uses underneath the floodwaters.

2200 ORCHARDS, GROVES, VINEYARDS, NURSERIES, AND ORNAMENTAL HORTICULTURAL LAND

Rather than create mapping units at this level, subcategories were established for the types of features contained within this level.

2210 Nurseries and Ornamental Horticultural Land

This category includes land managed for the production of ornamental trees, plants and flowers, vegetable seedlings, seed farms, sod farms, and wholesale greenhouses.

Nurseries appear similar to row crops but exhibit a patchwork of plant types being grown. Trees may occur in some rows, then plants in the next section. Greenhouses or hot houses may also occur in some row areas, or in separate areas altogether.

Nurseries may occur within electrical transmission line rights-of-way, in which case they take precedence over mapping the rights of way. Also included in this category are Christmas tree farms, which appear on the photo as groves with uneven spacing, smaller crown cover, and open space between the trees.

2220 Deciduous Orchards

This category includes commercially productive tree crops in which the trees lose their leaves at some point in the year. Orchards include fruit and nut trees, and bush crops. In a mature vineyard the trees are aligned in a matrix form, with crowns appearing to abut each other. Newly planted orchards or topped orchards appeared as rows of evenly spaced dots. Deciduous orchards were far more common in the Delta region than evergreen orchards. Bush crops are similar to orchards, but they may be configured in rows rather than a matrix, and are much shorter in height.

2230 Evergreen Orchards

Evergreen orchards include commercially productive tree crops in which the trees retain their leaves throughout the year. Citrus groves are a primary example of this category. Often the leaves have a darker green appearance than those of deciduous orchard trees.

2240 Vineyards

Vineyards usually appeared as dark green, coarse-textured, thin linear rows that were approximately five to ten feet apart. Most appeared neat and uniform, although those transitioning out of production showed weed and grass growth between and around the exterior of the rows. Wide row spacing and the non-vegetated dirt on the margins of vineyards distinguished them from row crops. Occasionally individual plantings rather than trellises were encountered in

vineyards. These sometimes resembled young orchards and were verified during field checks as much as possible.

2300 CONFINED FEEDING OPERATIONS

These areas have a high concentration of animal population in a relatively small area. This class includes beef cattle feed lots, dairies, hog farms, and goat farms.

Livestock feedlots and dairies both contain a series of small fenced areas with a very high concentration of animals. Dung piles appear as very dark to black features. Dairies contain simple rectangular shade structures that are evenly and widely spaced over the area. Structures for protecting stored hay bales may be present. Dairies also contain structures used for milking.

Pasture and field crops adjacent to and associated with dairies were mapped as 2100.

2400 OTHER AGRICULTURE

This category includes miscellaneous agricultural facilities not described in other agricultural categories. These facilities include farm equipment storage, product storage, horse ranches, dairy fertilizer piles, poultry operations, hydroponic farms, and fish hatcheries. Also included are backyard lots of mixed agricultural/non-agricultural use that meet the MMU.

Storage facilities can include isolated barns, or other structures located in or adjacent to an agricultural area. Also included are small plots of land where heavy equipment or machinery is stored within the agricultural field area. Horse ranches usually include long, thin buildings and corral areas. Dirt track ovals are often present. Poultry farms typically contain a series of long, narrow enclosed structures in a parallel, side-by-side configuration. Fish hatcheries may be identified on the map sources. Typically they appear as a series of small square or rectangular ponds adjacent to several small buildings. Backyard agriculture may include improved pastures, barns, and/or corrals. These areas were mapped as part of the residential class if the land use is less than 2.5 acres in size.

3000 NATURAL VEGETATION

This includes land that has not been built-up with man-made structures, and contains no agriculture or water body. The area is open, containing natural or disturbed natural vegetation. Rangeland is included.

3100 VACANT

Most vacant land is in a natural state, containing tree, brush/shrub, and/or grassland vegetation. No or few significant structures or improvements are present. Undeveloped areas of parks are also included. Rangeland may be open land or fenced over large areas. Rangeland vegetation may be no different than open vacant land, or may contain grassland for grazing livestock.

This category also includes abandoned orchards and vineyards not in commercial production. They may contain successional or weedy vegetation between the rows. Many trees or vine plants may be dead, or totally removed.

5000 WATER

Water includes open water bodies, which are greater than one acre in size.

5100 STREAMS – RIVERS

Streams and rivers are long, narrow concentrations of water moving downward across the land surface. They were mapped as polygons in this effort if the width of the visible water was 10 meters or greater and the size of the polygon exceeded one acre. Suisun Bay was included in this category.

5200 LAKES, RESERVOIRS AND PONDS

Lakes and ponds are stationary concentrations of surface water. Reservoirs are man-made concentrations of surface water. Clifton Court Forebay was mapped as 5200 in this effort.

5300 CANALS

Canals are artificial waterways created for navigation or irrigation. They were mapped as polygons in this effort if the width of the visible water was 10 meters or greater and the size of the polygon exceeded one acre.

5400 AREAS OF INUNDATION

This category includes areas that were flooded at the time the imagery was acquired. Areas appearing as under water on the imagery were compared to the corresponding topographic quadrangle. If the map showed the area as dry land, it was mapped as an area of inundation. Liberty Island was an example of this. Agricultural fields that appeared to have been purposely flooded were coded as 2110.

7000 BARREN LAND

7500 STRIP MINES, QUARRIES, AND GRAVEL PITS

This category includes surficial extraction of minerals and rock products, including sand, gravel, clay, diatomaceous earth, metals and other non-metals. Includes quarries, open pit mines, and borrow pits.

Most quarries will appear as a giant hole dug in the earth, with steep-sided edges. On the top surface and down in the pit there will be little or no vegetation due to the disturbance of the ground by earthmovers. Ponds of water may be located in the pit or on the upper ground surface. Sand and gravel pits may have the extracted material piled in the pit or adjacent to the pit on the upper ground surface, with storage bins and long linear conveyor belts crossing the piles. Borrow pits may appear only as small one- to 3-acre areas of graded land with little or no vegetation located near a highway or built up area. The borrow pit was extracted for fill dirt.

7600 TRANSITIONAL AREAS – CONSTRUCTION – SCRAPED GROUND

This category includes areas that were under construction or transition at the time aerial photography was taken, or at the time of field verification. Structure use was difficult to determine. (If the use and its extent could be determined, then the polygon was categorized with its known use.)

These areas were newly graded area with no vegetation. Pad platforms, foundations, and partly constructed structures may also have been visible.

Appendix 3

Natural Vegetation/Disturbance Classification

This layer was included to provide preliminary delineations for field crews to focus their sample sites, identifying areas of natural vegetation distinct from water or urban/agricultural areas. The code structure was as follows:

1 Natural Vegetation
2 Human Disturbance (urban/agriculture)
3 Open Water

Appendix 4

Field Check Classification

The field check coding layer allowed the interpreters to flag specific polygons for visits in the field, and to indicate after fieldwork was completed which polygons had been visited. The coding structure was as follows:

0 No Field Check
1 Field Check Needed
2 Field Checked

Note: This data layer was for internal AIS use only and has been subsequently removed from the final database.

Appendix 5 – WHR to VEG Lookup Table (From DFG Vegetation AA File)

Note: Shaded areas contain no WHR lookup

VEG	TYPE	WHR	WHR CODE
1300	Temporarily or Seasonally Flooded - Deciduous Forests		
1320	White Alder	Valley Foothill Riparian	VRI
1321	Alnus rhombifolia / Salix exigua (Rosa californica)	Valley Foothill Riparian	VRI
1322	Alnus rhombifolia / Cornus sericea	Valley Foothill Riparian	VRI
1330	Oregon Ash Fraxinus latifolia	Valley Foothill Riparian	VRI
1340	Box Elder Acer negundo	Valley Foothill Riparian	VRI
1341	Acer negundo- Salix gooddingii	Valley Foothill Riparian	VRI
1350	California Walnut Juglans californica	Valley Foothill Riparian	VRI
1360	Fremont Cottonwood Populus fremontii	Valley Foothill Riparian	VRI
1370	California Sycamore Platanus racemosa	Valley Foothill Riparian	VRI
1380	Black Willow Salix gooddingii	Valley Foothill Riparian	VRI
1381	Salix gooddingii / wetland herbs	Valley Foothill Riparian	VRI
1382	Salix gooddingii - Populus fremontii - (QuLo-SaEx-RuDi)	Valley Foothill Riparian	VRI
1383	Salix gooddingii - Quercus lobata / Wetland Herbs	Valley Foothill Riparian	VRI
1384	Salix gooddingii/Rubus discolor	Valley Foothill Riparian	VRI
2100	Sclerophyllous Woodlands		
2110	Coast Live Oak Quercus agrifolia	Coastal Oak Woodland	COW
2200	Deciduous Woodlands		
2230	Valley Oak Quercus lobata	Valley Foothill Riparian	VRI
2231	Quercus lobata / Rosa californica (RuDi - SaLa / Carex)	Valley Foothill Riparian	VRI
2232	Quercus lobata - Acer negundo	Valley Foothill Riparian	VRI
2233	Quercus lobata - Alnus rhombifolia (SaLa - PoFr - QuAg)	Valley Foothill Riparian	VRI
2234	Quercus lobata - Fraxinus latifolia	Valley Foothill Riparian	VRI
3000	SHRUBLANDS		
3200	Microphyllous Shrubland	Coastal Scrub	CSC
3210	Coyotebush Baccharis pilularis	Coastal Scrub	CSC
3211	Baccharis pilularis / Annual Grasses & Herbs	Coastal Scrub	CSC
3300	Dwarf Shrublands	Coastal Scrub	CSC
3310	Deerweed Lotus scoparius	Coastal Scrub	CSC
3311	Lotus scoparius - Antioch Dunes	Coastal Scrub	CSC
3400	Intermittently or Temporarily Flooded Deciduous Shrublands	Valley Foothill Riparian	VRI
3410	Blackberry Rubus Discolor	Coastal Scrub	CSC
3420	California Wild Rose Rosa californica	Coastal Scrub	CSC
3430	Mexican Elderberry Sambucus mexicana	Valley Foothill Riparian	VRI
3440	California Dogwood Cornus sericea	Valley-Foothill Riparian	VRI
3441	Cornus sericea - Salix exigua	Valley-Foothill Riparian	VRI
3442	Cornus sericea - Salix lasiolepis / (PhAu)	Valley-Foothill Riparian	VRI
3450	Buttonbush Cephalanthus occidentalis	Valley-Foothill Riparian	VRI
3460	Arroyo Willow Salix lasiolepis	Valley-Foothill Riparian	VRI
3461	Salix lasiolepis - Mixed brambles (RoCa - ViTi - RuDi)	Valley-Foothill Riparian	VRI
3462	Salix lasiolepis - (CoSe)/Scirpus spp.-(Phrag.-Typha) complex unit	Valley-Foothill Riparian	VRI
3470	Shining Willow Salix lucida	Valley-Foothill Riparian	VRI

3480	Narrow-leaf Willow Salix exiqua	Valley-Foothill Riparian	VRI
3481	Salix exigua - (SaLa - RuDi - RoCa)	Valley-Foothill Riparian	VRI
3500	Broadleaf Shrublands	Coastal Scrub	CSC
3510	Silver Lupine Lupinus albifrons	Coastal Scrub	CSC
3511	Lupinus albifrons - Antioch Dune	Coastal Scrub	CSC
4000	HERBACEOUS GRASSES		
4110	Pampas Grass Cortaderia (SeJu)	Fresh Emergent Wetland	FEW
4200	Intermittently Flooded Grasslands	Fresh Emergent Wetland	FEW
4210	Saltgrass Distichlis spicata	Saline Emergent Wetland	SEW
4211	Distichlis spicata - Annual Grasses	Saline Emergent Wetland	SEW
4212	Distichlis spicata - Salicornia virginica	Saline Emergent Wetland	SEW
4213	Distichlis spicata - Juncus balticus	Saline Emergent Wetland	SEW
4220	Santa Barbara Sedge Carex barbarae Stands	Fresh Emergent Wetland	FEW
4300	Temporarily Flooded Grasslands	Fresh Emergent Wetland	FEW
4310	Giant Cane Arundo donax	Fresh Emergent Wetland	FEW
4320	Creeping Wild Rye Grass Leymus triticoides	Fresh Emergent Wetland	FEW
4330	Common Rush Juncus effusus	Fresh Emergent Wetland	FEW
4340	Broad-leaf Cattail Typha latifolia	Fresh Emergent Wetland	FEW
4400	Seasonally Flooded Grasslands	Fresh Emergent Wetland	FEW
4401	Juncus bufonius (salt grasses)	Saline Emergent Wetland	SEW
4402	Vernal Pools	Annual Grassland	AGS
4403	Juncus balticus-meadow vegetation	Saline Emergent Wetland	SEW
4500	Semi-permanently Flooded Grasslands	Fresh Emergent Wetland	FEW
4501	Mixed Scirpus Mapping Unit	Fresh Emergent Wetland	FEW
4502	Mixed Scirpus / Floating Aquatics (Hydrocotyle-Eichhornia) Complex	Fresh Emergent Wetland	FEW
4503	Mixed Scirpus/ Submerged Aquatics (Egeria-Cabomba-Myriophyllum spp.) complex	Fresh Emergent Wetland	FEW
4510	Hard-stem Bulrush Scirpus acutus	Fresh Emergent Wetland	FEW
4511	Scirpus acutus Pure	Fresh Emergent Wetland	FEW
4512	Scirpus acutus - Typha angustifolia	Fresh Emergent Wetland	FEW
4513	Scirpus acutus -Typha latifolia	Fresh Emergent Wetland	FEW
4514	Scirpus acutus - (Typha latifolia) - Phragmites australis	Fresh Emergent Wetland	FEW
4515	Scirpus acutus - Cocklebur Xanthium strumarium	Fresh Emergent Wetland	FEW
4520	California Bulrush Scirpus californicus	Fresh Emergent Wetland	FEW
4521	Scirpus californicus - Eichhornia crassipes	Fresh Emergent Wetland	FEW
4522	Scirpus californicus - Scirpus acutus	Fresh Emergent Wetland	FEW
4530	American Bulrush Scirpus americanus	Saline Emergent Wetland	SEW
4600	Tidally Flooded Grasslands	Saline Emergent Wetland	SEW
4610	Narrow-leaf Cattail Typha angustifolia	Saline Emergent Wetland	SEW
4611	Typha angustifolia - Distichlis spicata	Saline Emergent Wetland	SEW
4620	Tufted Hair-grass Deschampsia caespitosa	Saline Emergent Wetland	SEW
4621	Deschampsia caespitosa - Lilaeopsis masonii	Saline Emergent Wetland	SEW
4630	Common Reed Phragmites australis	Fresh Emergent Wetland	FEW
4700	Tall & Medium Upland Grasses	Annual Grassland	AGS
4701	Ruderal Herbaceous Grasses & Forbs	Annual Grassland	AGS
4710	California Annual Grasslands - Herbaceous	Annual Grassland	AGS
4711	Bromus diandrus - Bromus hordeaceus	Annual Grassland	AGS
4720	Italian Rye-grass Lolium multiflorum	Annual Grassland	AGS
4721	Lolium multiflorum - Convolvulus arvensis	Annual Grassland	AGS

4722	Lolium multiflorum - Triphysaria eriantha	Annual Grassland	AGS
4723	Lolium multiflorum - Lasthenia glabrata	Annual Grassland	AGS
4724	Lolium multiflorum - Blennosperma nanum	Annual Grassland	AGS
4730	Polypogon maritimus (Rabbitsfoot grass)	Annual Grassland	AGS
5000	FORBS		
5100	Tall & Medium Upland Forbs	Annual Grassland	AGS
5110	Fennel Foeniculum vulgare	Annual Grassland	AGS
5120	Poison Hemlock Conium maculatum Alliance	Annual Grassland	AGS
5200	Intermittently Flooded Perennial Forbs	Fresh Emergent Wetland	FEW
5201	Managed Annual Wetland Vegetation (Non-specific grasses & forbs)	Fresh Emergent Wetland	FEW
5202	Shallow flooding with minimal vegetation at time of photography	Fresh Emergent Wetland	FEW
5203	Seasonally flooded undifferentiated annual grasses and forbs	Fresh Emergent Wetland	FEW
5204	Managed alkali wetland (Crypsis grass)	Saline Emergent Wetland	SEW
5205	Intermittently or temporarily flooded undifferentiated annual grasses and forbs	Fresh Emergent Wetland	FEW
5206	Scirpus spp. in managed wetlands	Fresh Emergent Wetland	FEW
5210	Birdfoot Trefoil Lotus corniculatus	Annual Grassland	AGS
5300	Temporarily Flooded Perennial Forbs	Fresh Emergent Wetland	FEW
5301	Smartweed Polygonum spp. - Mixed Forbs	Fresh Emergent Wetland	FEW
5311	Polygonum amphibium	Fresh Emergent Wetland	FEW
5400	Semi-permanently Flooded Forbs	Fresh Emergent Wetland	FEW
5410	Floating Primrose Ludwigia peploides	Fresh Emergent Wetland	FEW
5411	Ludwigia peploides	Fresh Emergent Wetland	FEW
5420	Horsetail Equisetum spp.	Fresh Emergent Wetland	FEW
5500	Tall & Medium Perennial Forbs (Upland or Tidally Flooded)	Fresh Emergent Wetland	FEW
5501	Alkaline vegetation M.U.	Alkali Desert Scrub	SEW
5502	Allenrolfea occidentalis M.U.	Alkali Desert Scrub	SEW
5503	Suaeda moquinii-(Lasthenia californica) M.U.	Alkali Desert Scrub	SEW
5504	Lasthenia californica M.U.	Annual Grassland	AGS
5510	Alkali Heath Frankenia salina	Saline Emergent Wetland	SEW
5511	Frankenia salina - Distichlis spicata	Saline Emergent Wetland	SEW
5512	Frankenia salina- annual grasses	Saline Emergent Wetland	SEW
5520	Pickleweed Salicornia virginica	Saline Emergent Wetland	SEW
5521	Salicornia virginica - Distichlis spicata	Saline Emergent Wetland	SEW
5522	Salicornia virginica - Cotula coronopifolia	Saline Emergent Wetland	SEW
5530	Perennial Pepperweed Lepidium latifolium	Saline Emergent Wetland	SEW
5531	Lepidium latifolium - Salicornia virginica - Distichlis spicata	Saline Emergent Wetland	SEW
5540	Tobacco brush M.U.		
6000	PERMANENTLY FLOODED HYDROMORPHIC-ROOTED	Fresh Emergent Wetland	FEW
6101	Generic Floating Aquatics	Fresh Emergent Wetland	FEW
6110	Water Hyacinth Eichhornia crassipes - Floating	Fresh Emergent Wetland	FEW
6201	Pondweed - Potamogeton	Fresh Emergent Wetland	FEW
6202	Riverweed - Ceratophyllum	Fresh Emergent Wetland	FEW
6203	Waterweed - Elodea	Fresh Emergent Wetland	FEW
6210	Milfoil - Waterweed (generic submerged aquatics)	Fresh Emergent Wetland	FEW
6211	Brazilian Waterweed Egeria -Myriophyllum Submerged	Fresh Emergent Wetland	FEW
6220	Hydrocotyle ranunculoides	Fresh Emergent Wetland	FEW
6230	Sagittaria sanfordii	Fresh Emergent Wetland	FEW
7000	Algae	Fresh Emergent Wetland	FEW

9000	LAND USE - LITTLE OR NO VEGETATION - WATER		
9100	Urban Developed - Built Up	Urban	URB
9200	Agriculture	Irrigated grain crops	IGR
9300	Exotic Vegetation Stands		
9310	Eucalyptus	Eucalyptus	EUC
9320	Tree-of-Heaven		
9330	Acacia		
9400	Sparsely or Unvegetated Areas; Abandoned orchards	Barren	BAR
9401	Levee Rock Riprap	Barren	BAR
9402	Salt scalds and associated sparse vegetation	Barren	BAR
9403	Tidal mudflats	Barren	BAR
9404	River blowout, sandy wash	Barren	BAR
9500	Restoration Sites	Barren	BAR
9501	Black Willow - Valley Oak	Valley-Foothill Riparian	VRI
9502	Valley Oak	Valley-Foothill Riparian	VRI
9503	White Alder - Arroyo willow	Valley-Foothill Riparian	VRI
9800	Water	Riverine	RIV
9999	Unknown		

Appendix 6 – Polygons of High Conservation Value

0 = Polygon not denoted with a high conservation value
1 = Polygon denoted with a high conservation value

Areas of significant conservation value generally fell into three broad categories:

1. Riparian & wetland forests and woodlands including some gallery forests
2. Tidally and non-tidally flooded marshlands and meadows including seasonally flooded vernal pools and alkali areas
3. Associated upland annual grasslands generally as a connecting corridor to the above two categories

Areas were designated with this category based on an evaluation of the following categories. A certain amount of subjectivity in the photo interpretation of high conservation polygons is inherent (as it is in all floristic and structural vegetation mapping), but the following guidelines were used in determining these assignments.

Criteria Used:

1. Total acreage: Generally, aggregations of polygons with natural cover over 15 - 20 acres were included in the assessment; except islands in large natural rivers where all polygon aggregations were included regardless of size. Area to perimeter ratios were factored in when evaluating narrow riparian zones or narrow natural vegetation strips along urban or agricultural interface.
2. Canopy Density: Significance was assigned to denser canopies, especially when the openness of the canopy was due to disturbance related factors such as scraping or burns.
3. Connectivity: Occasionally, less desirable polygons (such as annual herbaceous types) were included in the polygon aggregations to join special areas of concern that may have potential for restoration.
4. Floristic Type: Valley oak gallery forests were given most priority, less natural types such as arroyo willow with mixed brambles were generally included in areas adjacent to more floristically significant stands which are of significant conservation value.
5. Adjacent Land Use & Land Cover: Isolated stands within urban or agricultural areas or narrow strips along urban – agricultural interface were given less significance than areas surrounded by water or adjacent to natural vegetation. Stands adjacent to agriculture were given more significance than stands running through urban areas.
6. Exotic & Invasive Vegetation: For the most part, these polygons were taken out of any aggregations, even if they represented a connection or corridor between significant stands.

Appendix 7

SOURCE INFORMATION

- USGS 1:24,000 topographic quadrangles
- Local road maps published by Compass Maps, Thomas Guide, and other sources
- Digital land use data from the California Dept. of Water Resources, Land and Water Use Section
- Farmland data from San Joaquin County – California Department of Conservation, Division of Land Resources & Farmland Mapping & Monitoring Program
- *Egeria* Infestation Sites Report – Department of Boating & Waterways
- AB360 Habitat Projects Map – California Department of Fish & Game
- Delta Rapid Assessment Plot Photos & Data

Appendix 8 – Vegetation Acreage Counts by Type

Polygon Count	VEG Code	Total Acreage
-	Total Study Area	725597
48	1300	140
113	1320	150
260	1321	419
20	1322	32
2	1330	1
29	1340	45
11	1341	35
9	1350	21
296	1360	648
330	1380	650
259	1381	651
522	1382	1764
103	1383	433
51	1384	143
37	2110	83
592	2230	2026
212	2231	818
22	2232	68
136	2233	369
35	2234	317
1	3200	0
8	3210	28
22	3211	52
245	3400	536
619	3410	1200
54	3420	98
7	3430	17
78	3440	117
64	3441	122
249	3442	823
9	3450	8
267	3460	467
655	3461	1541
263	3462	493
7	3470	78
264	3480	296
674	3481	1092
13	4110	19
49	4210	140
163	4211	1447
2	4212	20
7	4213	30
5	4220	15
6	4300	7
96	4310	61
2	4320	3
1	4330	1

152	4340	363
31	4400	50
2	4401	6
122	4402	208
19	4403	45
226	4501	433
241	4502	345
309	4503	420
63	4510	188
714	4511	1482
197	4512	907
515	4513	2554
547	4514	1699
251	4520	427
7	4521	4
203	4522	676
6	4530	15
50	4610	97
1	4611	3
2	4620	1
2	4621	1
244	4630	372
1	4700	1
1568	4701	25859
945	4710	34849
67	4711	914
319	4720	5265
5	4721	36
48	4730	732
129	5120	765
4	5200	19
57	5201	603
66	5202	370
141	5203	812
182	5204	2917
243	5205	3604
85	5206	2426
2	5300	186
16	5301	59
87	5311	267
148	5410	186
64	5411	86
14	5420	83
4	5501	28
48	5502	260
52	5503	71
4	5510	2
12	5511	24
15	5520	15
2	5521	5
2	5522	3
360	5530	1671
23	5531	54

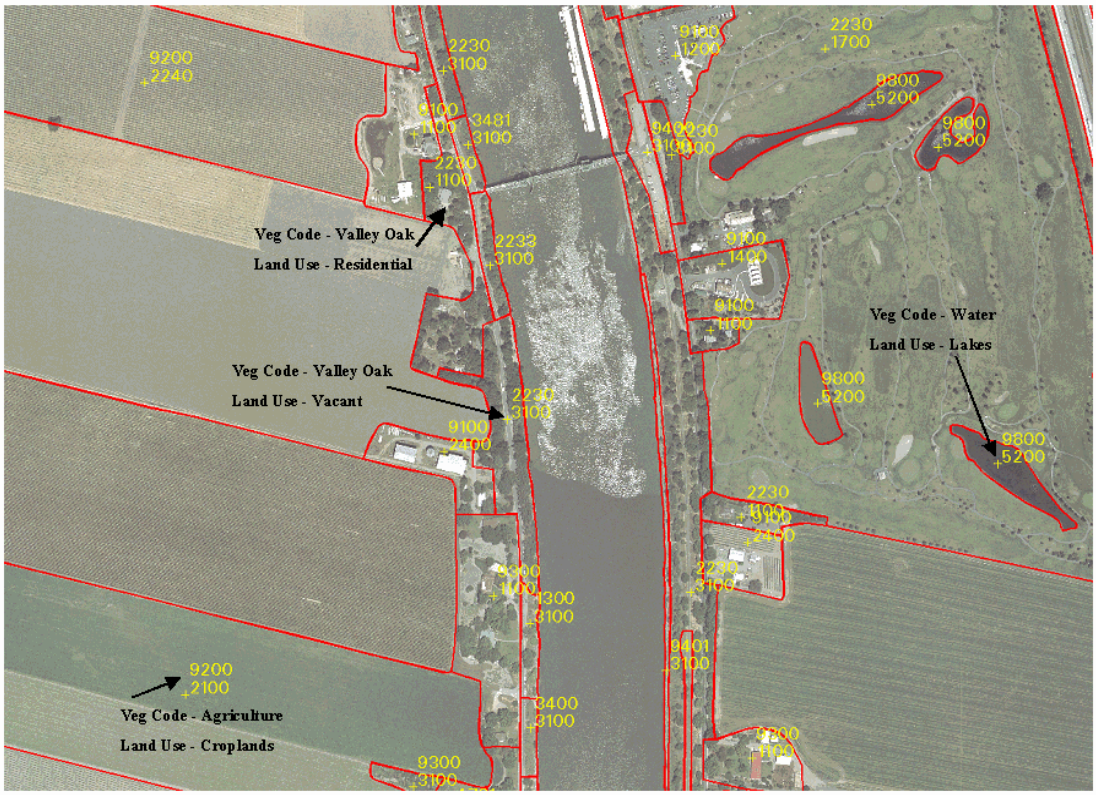
1	5540	2
309	6101	455
64	6110	224
8	6201	5
26	6210	71
807	6211	3004
10	6220	7
163	7000	398
3905	9100	62220
1184	9200	473974
1553	9300	5659
70	9310	188
7	9320	4
65	9330	86
538	9400	7425
314	9401	793
73	9402	66
28	9403	28
10	9500	31
15	9501	93
27	9502	96
2	9503	8
888	9800	60665
37	9999	100

Note: Three Shaded Areas

9100 – Urban
9200 – Agriculture
9800 – Open Water

Figure 1: Study Area Boundary

Figure 2: Coding Structure Example



Note in this example the top value shows the vegetation code; the lower value shows the detailed land use code. The dual-coding structure of each polygon enables a greater understanding of both land use attributes and associated vegetation. In this example, several residential polygons (coded 1100 in the second line) contain remnant riparian vegetation and in these examples are coded in the vegetation column as valley oak (coded 2230 in the first line.)

APPENDIX E CROSSWALK BETWEEN THE DELTA VEGETATION CLASSIFICATION AND MAP CLASSIFICATION (LEGEND)

Vegetation Classification	Rarity code*	Map Code	Map Classification (Legend)
Lowland or submontane winter-rain evergreen sclerophyllous forest			
Eucalyptus Alliance (includes multiple species)	none	9310	*Eucalyptus*
Lowland or submontane cold-deciduous forest			
Ailanthus altissima Alliance only	none	9320	Tree-of-Heaven (*Ailanthus altissima*)
Robinia pseudoacacia Alliance only	none	9330	Acacia - Locus *(Acacia - Robinia)*
Temporarily flooded cold-deciduous forest		1300	**Temporarily or Seasonally Flooded - Deciduous Forests**
Alnus rhombifolia	G4S4	1320	White Alder *(Alnus rhombifolia)*
Alnus rhombifolia/Salix exigua (Rosa californica)	G3S3	1321	*Alnus rhombifolia / Salix exigua (Rosa californica)*
Alnus rhombifolia/Salix exigua phase	G3S3	1321	*Alnus rhombifolia / Salix exigua (Rosa californica)*
Alnus rhombifolia/Rosa californica phase	G3S3	1321	*Alnus rhombifolia / Salix exigua (Rosa californica)*
Alnus rhombifolia/Cornus sericea Provisional	G2S2	1322	*Alnus rhombifolia / Cornus sericea*
Alnus rhombifolia/Salix lucida-Cornus sericea phase	G2S2	1322	*Alnus rhombifolia / Cornus sericea*
Fraxinus latifolia Alliance only	G4S3	1330	Oregon Ash *(Fraxinus latifolia)*
Acer negundo Alliance only	G5S2	1340	Box Elder *(Acer negundo)*
Acer negundo-Salix gooddingii Provisional	G2S2	1341	*Acer negundo - Salix gooddingii*
Juglans X hindsii Alliance only	none	1350	Hinds walnut *(Juglans hindsii)*
Populus fremontii Alliance only	G5S3	1360	Fremont Cottonwood *(Populus fremontii)*
---	G3S3	1370	California Sycamore *(Platanus racemosa)*
Salix gooddingii Alliance	G4S4	1380	Black Willow *(Salix gooddingii)*
Salix gooddingii/wetland herb Provisional	G3S3?	1381	*Salix gooddingii* / wetland herbs
Salix gooddingii-Populus fremontii	G4S3	1382	*Salix gooddingii - Populus fremontii - (Quercus lobata-Salix exigua-Rubus discolor)*
*Salix gooddingii-Quercus lobata/*wetland herb Provisional	G2S2	1383	*Salix gooddingii - Quercus lobata* / Wetland Herbs
	G4S4	1384	*Salix gooddingii / Rubus discolor*
Sclerophyllous extremely xeromorphic evergreen woodland		2100	Sclerophyllous Woodlands
Quercus agrifolia Alliance only	G4S4	2110	Coast Live Oak *(Quercus agrifolia)*
Cold-deciduous woodland		2200	Deciduous Woodlands
Quercus lobata Alliance only	G3S3	2230	Valley Oak *(Quercus lobata)*

Vegetation Classification	Rarity code*	Map Code	Map Classification (Legend)
Quercus lobata/Rubus discolor	G3S3	2231	*Quercus lobata / Rosa californica (Rubus discolor - Salix lasiolepis / Carex spp.)*
Quercus lobata/Rosa californica phase	G3S3	2231	*Quercus lobata / Rosa californica (Rubus discolor - Salix lasiolepis / Carex spp.)*
Quercus lobata/Rubus discolor/Carex barbarae Phase	G3S3	2231	*Quercus lobata / Rosa californica (Rubus discolor - Salix lasiolepis / Carex spp.)*
Quercus lobata-Acer negundo Provisional	G2S2	2232	*Quercus lobata - Acer negundo*
Quercus lobata-Alnus rhombifolia	G3S3	2233	*Quercus lobata - Alnus rhombifolia (Salix lasiolepis - Populus fremontii - Quercus agrifolia)*
Quercus lobata-Fraxinus latifolia/Vitis californica	G2S2	2234	*Quercus lobata - Fraxinus latifolia*
Quercus lobata-Fraxinus latifolia phase	G2S2	2234	*Quercus lobata - Fraxinus latifolia*
SHRUBLANDS		3000	**SHRUBLANDS**
Microphyllous Shrubland		3200	Microphyllous Shrubland
Baccharis pilularis Alliance only	G4S4	3210	Coyotebush *(Baccharis pilularis)*
Baccharis pilularis/Annual Grass-Herb	G4S4	3211	*Baccharis pilularis* / Annual Grasses & Herbs
Facultatively deciduous subdesert dwarf-shrubland		3300	Dwarf Shrublands
Lotus scoparius Alliance	G4S4	3310	Deerweed *(Lotus scoparius)*
Lotus scoparius Antioch Dunes	G1S1	3311	*Lotus scoparius* - Antioch Dunes
Intermittently flooded cold-deciduous shrubland		3400	Intermittently or Temporarily Flooded Deciduous Shrublands
Rubus discolor Alliance only	none	3410	Blackberry *(Rubus discolor)*
Rosa californica Alliance only	G3S3	3420	California Wild Rose *(Rosa californica)*
Sambucus mexicana Alliance only	G3S3	3430	Mexican Elderberry *(Sambucus mexicana)*
Cornus sericea Alliance	G4S3	3440	California Dogwood *(Cornus sericea)*
Cornus sericea-Salix exigua Provisional	G2S2?	3441	*Cornus sericea - Salix exigua*
Cornus sericea-Salix lasiolepis	G3S3	3442	*Cornus sericea - Salix lasiolepis / (Phragmites australis)*
Cornus sericea-Salix lasiolepis/Phragmites australis	G3S3	3442	*Cornus sericea - Salix lasiolepis / (Phragmites australis)*
Cephalanthus occidentalis Alliance only	G5S2	3450	Buttonbush *(Cephalanthus occidentalis)*
Salix lasiolepis Great Valley Provisional	G3S3	3460	Arroyo Willow *(Salix lasiolepis)*
--	G3S3	3461	*Salix lasiolepis* - Mixed brambles *(Rosa californica - Vitis californica - Rubus discolor)*
--	G3S3	3462	*Salix lasiolepis - (Cornus sericea) / Scirpus*† spp.- *(Phragmites australis - Typha spp.)* complex unit
Salix lucida Alliance only	G4S3	3470	Shining Willow *(Salix lucida)*

Vegetation Classification	Rarity code*	Map Code	Map Classification (Legend)
Salix exigua Alliance only	G5S5	3480	Narrow-leaf Willow *(Salix exigua)*
Salix exigua-(Salix lasiolepis)-Rubus discolor	G5S4	3481	*Salix exigua - (Salix lasiolepis - Rubus discolor - Rosa californica)*
Salix exigua-Rosa californica phase	G5S4	3481	*Salix exigua - (Salix lasiolepis - Rubus discolor - Rosa californica)*
Salix lasiolepis-Rubus discolor phase	G5S4	3481	*Salix exigua - (Salix lasiolepis - Rubus discolor - Rosa californica)*
Temperate broad-leaved evergreen shrubland		3500	Broadleaf Shrublands
Lupinus albifrons Shrubland Alliance	G4S4	3510	Silver Lupine *(Lupinus albifrons)*
Lupinus albifrons Antioch Dunes	G1S1	3511	*Lupinus albifrons* - Antioch Dunes
		4000	**HERBACEOUS GRASSES**
Cortaderia (selloana, jubata) Alliance	none	4110	Pampas Grass *(Cortaderia selloana - C. jubata)*
Short sod temperate or subpolar grassland			
Cynodon dactylon Alliance	none	4701	
Intermittently flooded temperate or subpolar grassland		4200	Intermittently Flooded Grasslands
Distichlis spicata Alliance	G5S4	4210	Saltgrass *(Distichlis spicata)*
Distichlis spicata-Annual grasses Provisional	G4S3?	4211	*Distichlis spicata* - Annual Grasses
Distichlis spicata-Salicornia virginica Provisional	G3S3	4212	*Distichlis spicata - Salicornia virginica*
Distichlis spicata-Juncus balticus	G3S3	4213	*Distichlis spicata - Juncus balticus*
Carex barbarae Alliance	G1S1?	4220	Santa Barbara Sedge *(Carex barbarae)*
Temporarily flooded temperate or subpolar grassland		4300	Temporarily Flooded Grasslands
Arundo donax Alliance only	none	4310	Giant Cane *(Arundo donax)*
Leymus triticoides Alliance	G4S3	4320	Creeping Wild Rye Grass *(Leymus triticoides)*
Typha latifolia-pure Provisional	G4S2?	4340	Broad-leaf Cattail *(Typha latifolia)*
Seasonally flooded temperate or subpolar grassland		4400	Seasonally Flooded Grasslands
Juncus bufonius non-classified stands	G3S3?	4401	*Juncus bufonius* (salt grasses)
Vernal Pool stands	G3S3?	4402	Vernal Pools
--	G5S3	4403	*Juncus balticus* - meadow vegetation
--		4500	Semi-permanently Flooded Grasslands
Schoenoplectus californicus- Schoenoplectus acutus	G4S3	4501	Mixed *Scirpus* Mapping Unit
--	G4S3?	4502	Mixed *Scirpus* / Floating Aquatics (*Hydrocotyle - Eichhornia*) Complex
--	G4S3?	4503	Mixed *Scirpus* / Submerged Aquatics (*Egeria-Cabomba-Myriophyllum* spp.) complex

Vegetation Classification	Rarity code*	Map Code	Map Classification (Legend)
Schoenoplectus acutus - (Schoenoplectus tabernaemontani) Alliance		4510	Hard-stem Bulrush *(Scirpus acutus)*
Schoenoplectus acutus - pure Provisional	G4S4	4511	*Scirpus acutus* Pure
Schoenoplectus acutus-Typha angustifolia Provisional	G4S4?	4512	*Scirpus acutus - Typha angustifolia*
Schoenoplectus acutus-Typha latifolia Provisional	G4S4?	4513	*Scirpus acutus -Typha latifolia*
Schoenoplectus acutus-Phragmites australis	G3S3?	4514	*Scirpus acutus - (Typha latifolia) - Phragmites australis*
Schoenoplectus acutus-Xanthium strumarium Provisional	G4S4?	4515	*Scirpus acutus - Xanthium strumarium*
Schoenoplectus californicus Alliance only	G4S3	4520	California Bulrush *(Scirpus californicus)*
Schoenoplectus californicus-Eichhornia crassipes Provisional	G3S3?	4521	*Scirpus californicus - Eichhornia crassipes*
Schoenoplectus californicus- Schoenoplectus acutus Provisional	G4S3?	4522	*Scirpus californicus - Scirpus acutus*
Schoenoplectus americanus Alliance only	G5S4	4530	American Bulrush *(Scirpus americanus)*
Tidal temperate or subpolar grassland		4600	Tidally Flooded Grasslands
Typha (angustifolia, domingensis) Tidal Herbaceous Alliance	G5S3	4610	Narrow-leaf Cattail *(Typha angustifolia)*
Typha angustifolia-Distichlis spicata (Provisional)	G3S3?	4611	*Typha angustifolia - Distichlis spicata*
Deschampsia caespitosa Tidal Herbaceous Alliance	G4S2	4620	California Hair-grass *(Deschampsia caespitosa)*
Deschampsia caespitosa-Lilaeopsis masonii Provisional	G1S1	4621	*Deschampsia caespitosa - Lilaeopsis masonii*
Phragmites australis Alliance only	G5S5	4630	Common Reed *(Phragmites australis)*
		4700	Tall & Medium Upland Grasses
Ruderal Herbaceous (non-native annual forbland)	none	4701	Ruderal Herbaceous Grasses & Forbs
California Annual Grassland/Herbaceous Alliance	G5S5	4710	California Annual Grasslands - Herbaceous
Bromus diandrus-Bromus hordeaceus Provisional	G5S5	4711	*Bromus diandrus - Bromus hordeaceus*
Lolium multiflorum Alliance only	none	4720	Italian Rye-grass *(Lolium multiflorum)*
Lolium multiflorum-Convolvulus arvensis Provisional	none	4721	*Lolium multiflorum - Convolvulus arvensis*
Lolium multiflorum-Triphysaria eriantha	G3S3	4722	*Lolium multiflorum - Triphysaria eriantha*
Lolium multiflorum-Lasthenia glabrata ssp. glabrata	G3S3	4723	*Lolium multiflorum - Lasthenia glabrata*
Lolium multiflorum-Blennosperma nanum	G3S3	4724	*Lolium multiflorum - Blennosperma nanum*
--	none	4730	Rabbitsfoot grass *(Polypogon maritimus)*

FORBS		5000	**FORBS**
--		5100	Tall & Medium Upland Forbs
--	none	5110	Fennel *(Foeniculum vulgare)*
--	none	5120	Poison Hemlock *(Conium maculatum)*
Intermittently Flooded Perennial Forbs		5200	Intermittently Flooded Perennial Forbs
Managed wetland vegetation	none	5201	Managed Annual Wetland Vegetation (Non-specific grasses & forbs)
--		5202	Shallow flooding with minimal vegetation at time of photography
--		5203	Seasonally flooded undifferentiated annual grasses and forbs
--		5204	Managed alkali wetland (*Crypsis*)
--		5205	Intermittently or temporarily flooded undifferentiated annual grasses and forbs
--		5206	*Scirpus* spp. in managed wetlands
--		5300	Temporarily Flooded Perennial Forbs
Polygonum spp. - Mixed Forbs Temporarily Flooded Herbaceous Alliance	none?	5301	Smartweed *Polygonum* spp. - Mixed Forbs
Polygonum amphibium (lapathifolium) Provisional	G5S5	5311	*Polygonum amphibium*
Semipermanently flooded temperate perennial forb vegetation		5400	Semi-permanently Flooded Forbs
Ludwigia peploides Alliance	none	5410	Floating Primrose *(Ludwigia peploides)*
Ludwigia peploides Provisional Association	none	5411	*Ludwigia peploides*
Equisetum (arvense, variegatum, hyemale)	G5S3	5420	Horsetail (*Equisetum* spp.)
--		5500	Tall & Medium Perennial Forbs (Upland or Tidally Flooded)
--		5501	Alkaline vegetation mapping unit
Allenrolfea occidentalis alliance only	G4S3	5502	*Allenrolfea occidentalis* mapping unit
Suaeda moquinii Alliance only	G4S3	5503	*Suaeda moquinii - (Lasthenia californica)* mapping unit
Lasthenia californica Alliance only	G4S4	5504	*Lasthenia californica* mapping unit
Frankenia salina Alliance	G3S3	5510	Alkali Heath *(Frankenia salina)*
--	G3S3	5511	*Frankenia salina - Distichlis spicata*
--	G3S3	5512	*Frankenia salina* - annual grasses
Salicornia virginica Alliance	G4S3	5520	Pickleweed *(Salicornia virginica)*
Salicornia virginica-Distichlis spicata Provisional	G3S3	5521	*Salicornia virginica - Distichlis spicata*
Salicornia virginica-Cotula coronopifolia Provisional	G3S3	5522	*Salicornia virginica - Cotula coronopifolia*
Lepidium latifolium Alliance only	none	5530	Perennial Pepperweed *(Lepidium latifolium)*

Lepidium latifolium-Salicornia virginica-Distichlis spicata Provisional	G3S3	5531	*Lepidium latifolium - Salicornia virginica - Distichlis spicata*
--	none	5540	Tobacco brush *(Nicotiana glauca)* mapping unit
PERMANENTLY FLOODED HYDROMORPHIC-ROOTED		6000	**PERMANENTLY FLOODED HYDROMORPHIC-ROOTED**
Azolla (filiculoides, mexicana) Alliance only	G5S3?	6101	Generic Floating Aquatics
Eichhornia crassipes Alliance only	none	6110	Water Hyacinth *(Eichhornia crassipes)*
Eichhornia crassipes - pure Provisional	none	6110	Water Hyacinth *(Eichhornia crassipes)*
Potamogeton spp*. - Ceratophyllum* spp*. - Elodea* spp. Alliance only (represented by *P. pectinatus* stands)	none	6201	Pondweed (*Potamogeton* sp.)
Potamogeton pectinatus - pure Provisional	G4S4	6201	Pondweed (*Potamogeton* sp.)
--	none	6202	Riverweed (*Ceratophyllum* sp.)
--	none	6203	Waterweed (*Elodea* sp.)
Myriophyllum spp. Alliance	none?	6210	Milfoil - Waterweed (generic submerged aquatics)
Egeria-Cabomba-Myriophyllum spp. Provisional	none	6211	Brazilian Waterweed (*Egeria - Myriophyllum*) Submerged
Hydrocotyle ranunculoides Alliance only	G3S3	6220	*Hydrocotyle ranunculoides*
Sagittaria sanfordii unique stands	G1S1	6230	*Sagittaria sanfordii*
--		7000	Algae
		9000	**LAND USE - LITTLE OR NO VEGETATION - WATER**
		9100	Urban Developed - Built Up
		9200	Agriculture
		9300	Exotic Vegetation Stands
Eucalyptus Alliance (includes multiple species)	none	9310	*Eucalyptus*
Ailanthus altissima Alliance only	none	9320	Tree-of-Heaven (*Ailanthus altissima*)
Robinia pseudoacacia Alliance only		9330	*Acacia - Robinia*
		9400	Sparsely or Unvegetated Areas; Abandoned orchards
		9401	Levee Rock Riprap
		9402	Salt scalds and associated sparse vegetation
		9403	Tidal mudflats
		9404	River blowout, sandy wash
		9500	Restoration Sites
		9501	Black Willow *(Salix gooddingii)* - Valley Oak *(Quercus lobata)* restoration
		9502	Valley Oak *(Quercus lobata)* restoration

		9503	White Alder *(Alnus rhombifolia)* - Arroyo willow *(Salix lasiolepis)* restoration
		9800	Water
		9900	Unknown

*Rarity Code: See explanation of codes in Table 1.
†Note: AIS used the name *Scirpus* in the map classification, whereas we have used the revised name, *Schoenoplectus* in the vegetation classification.

APPENDIX F CROSSWALK BETWEEN DELTA MAPPING CLASSIFICATION AND CALIFORNIA WILDLIFE HABITAT RELATIONSHIPS CLASSIFICATION

Map Code	Mapped Vegetation Type	WHR Type	WHR Code
1300	**Temporarily or Seasonally Flooded - Deciduous Forests**		
1320	White Alder *(Alnus rhombifolia)*	Valley Foothill Riparian	VRI
1321	*Alnus rhombifolia / Salix exigua (Rosa californica)*	Valley Foothill Riparian	VRI
1322	*Alnus rhombifolia / Cornus sericea*	Valley Foothill Riparian	VRI
1330	Oregon Ash *(Fraxinus latifolia)*	Valley Foothill Riparian	VRI
1340	Box Elder *(Acer negundo)*	Valley Foothill Riparian	VRI
1341	*Acer negundo - Salix gooddingii*	Valley Foothill Riparian	VRI
1350	Hinds walnut *(Juglans hindsii)*	Valley Foothill Riparian	VRI
1360	Fremont Cottonwood *(Populus fremontii)*	Valley Foothill Riparian	VRI
1370	California Sycamore *(Platanus racemosa)*	Valley Foothill Riparian	VRI
1380	Black Willow *(Salix gooddingii)*	Valley Foothill Riparian	VRI
1381	*Salix gooddingii* / wetland herbs	Valley Foothill Riparian	VRI
1382	*Salix gooddingii - Populus fremontii - (Quercus lobata-Salix exigua-Rubus discolor)*	Valley Foothill Riparian	VRI
1383	*Salix gooddingii - Quercus lobata* / Wetland Herbs	Valley Foothill Riparian	VRI
1384	*Salix gooddingii / Rubus discolor*	Valley Foothill Riparian	VRI
2100	**Sclerophyllous Woodlands**		
2110	Coast Live Oak *(Quercus agrifolia)*	Coastal Oak Woodland	COW
2200	**Deciduous Woodlands**		
2230	Valley Oak *(Quercus lobata)*	Valley Foothill Riparian	VRI
2231	*Quercus lobata / Rosa californica (Rubus discolor - Salix lasiolepis / Carex spp.)*	Valley Foothill Riparian	VRI
2232	*Quercus lobata - Acer negundo*	Valley Foothill Riparian	VRI
2233	*Quercus lobata - Alnus rhombifolia (Salix lasiolepis - Populus fremontii - Quercus agrifolia)*	Valley Foothill Riparian	VRI
2234	*Quercus lobata - Fraxinus latifolia*	Valley Foothill Riparian	VRI
3000	**SHRUBLANDS**		
3200	**Microphyllous Shrubland**	Coastal Scrub	CSC
3210	Coyotebush *(Baccharis pilularis)*	Coastal Scrub	CSC
3211	*Baccharis pilularis* / Annual Grasses & Herbs	Coastal Scrub	CSC
3300	**Dwarf Shrublands**	Coastal Scrub	CSC
3310	Deerweed *(Lotus scoparius)*	Coastal Scrub	CSC
3311	*Lotus scoparius* - Antioch Dunes	Coastal Scrub	CSC
3400	**Intermittently or Temporarily Flooded Deciduous Shrublands**	Valley Foothill Riparian	VRI
3410	Blackberry *(Rubus discolor)*	Coastal Scrub	CSC
3420	California Wild Rose *(Rosa californica)*	Coastal Scrub	CSC
3430	Mexican Elderberry *(Sambucus mexicana)*	Valley Foothill Riparian	VRI
3440	California Dogwood *(Cornus sericea)*	Valley-Foothill Riparian	VRI
3441	*Cornus sericea - Salix exigua*	Valley-Foothill Riparian	VRI
3442	*Cornus sericea - Salix lasiolepis / (Phragmites australis)*	Valley-Foothill Riparian	VRI
3450	Buttonbush *(Cephalanthus occidentalis)*	Valley-Foothill Riparian	VRI
3460	Arroyo Willow *(Salix lasiolepis)*	Valley-Foothill Riparian	VRI

Map Code	Mapped Vegetation Type	WHR Type	WHR Code
3461	*Salix lasiolepis* - Mixed brambles *(Rosa californica - Vitis californica - Rubus discolor)*	Valley-Foothill Riparian	VRI
3462	*Salix lasiolepis - (Cornus sericea)* / *Scirpus* spp.- *(Phragmites australis - Typha spp.)* complex unit	Valley-Foothill Riparian	VRI
3470	Shining Willow *(Salix lucida)*	Valley-Foothill Riparian	VRI
3480	Narrow-leaf Willow *(Salix exigua)*	Valley-Foothill Riparian	VRI
3481	*Salix exigua - (Salix lasiolepis - Rubus discolor - Rosa californica)*	Valley-Foothill Riparian	VRI
3500	**Broadleaf Shrublands**	Coastal Scrub	CSC
3510	Silver Lupine *(Lupinus albifrons)*	Coastal Scrub	CSC
3511	*Lupinus albifrons* - Antioch Dunes	Coastal Scrub	CSC
4000	**HERBACEOUS GRASSES**		
4110	Pampas Grass *(Cortaderia selloana - C. jubata)*	Fresh Emergent Wetland	FEW
4200	**Intermittently Flooded Grasslands**	Fresh Emergent Wetland	FEW
4210	Saltgrass *(Distichlis spicata)*	Saline Emergent Wetland	SEW
4211	*Distichlis spicata* - Annual Grasses	Saline Emergent Wetland	SEW
4212	*Distichlis spicata - Salicornia virginica*	Saline Emergent Wetland	SEW
4213	*Distichlis spicata - Juncus balticus*	Saline Emergent Wetland	SEW
4220	Santa Barbara Sedge *(Carex barbarae)*	Fresh Emergent Wetland	FEW
4300	**Temporarily Flooded Grasslands**	Fresh Emergent Wetland	FEW
4310	Giant Cane *(Arundo donax)*	Fresh Emergent Wetland	FEW
4320	Creeping Wild Rye Grass *(Leymus triticoides)*	Fresh Emergent Wetland	FEW
4340	Broad-leaf Cattail *(Typha latifolia)*	Fresh Emergent Wetland	FEW
4400	**Seasonally Flooded Grasslands**	Fresh Emergent Wetland	FEW
4401	*Juncus bufonius* (salt grasses)	Saline Emergent Wetland	SEW
4402	Vernal Pools	Annual Grassland	AGS
4403	*Juncus balticus* - meadow vegetation	Saline Emergent Wetland	SEW
4500	**Semi-permanently Flooded Grasslands**	Fresh Emergent Wetland	FEW
4501	Mixed *Scirpus* Mapping Unit	Fresh Emergent Wetland	FEW
4502	Mixed *Scirpus* / Floating Aquatics (*Hydrocotyle - Eichhornia*) Complex	Fresh Emergent Wetland	FEW
4503	Mixed *Scirpus* / Submerged Aquatics (*Egeria-Cabomba-Myriophyllum* spp.) complex	Fresh Emergent Wetland	FEW
4510	Hard-stem Bulrush *(Scirpus acutus)*	Fresh Emergent Wetland	FEW
4511	*Scirpus acutus* Pure	Fresh Emergent Wetland	FEW
4512	*Scirpus acutus - Typha angustifolia*	Fresh Emergent Wetland	FEW
4513	*Scirpus acutus -Typha latifolia*	Fresh Emergent Wetland	FEW
4514	*Scirpus acutus - (Typha latifolia) - Phragmites australis*	Fresh Emergent Wetland	FEW
4515	*Scirpus acutus - Xanthium strumarium*	Fresh Emergent Wetland	FEW
4520	California Bulrush *(Scirpus californicus)*	Fresh Emergent Wetland	FEW
4521	*Scirpus californicus - Eichhornia crassipes*	Fresh Emergent Wetland	FEW
4522	*Scirpus californicus - Scirpus acutus*	Fresh Emergent Wetland	FEW

Map Code	Mapped Vegetation Type	WHR Type	WHR Code
4530	American Bulrush *(Scirpus americanus)*	Saline Emergent Wetland	SEW
4600	**Tidally Flooded Grasslands**	Saline Emergent Wetland	SEW
4610	Narrow-leaf Cattail *(Typha angustifolia)*	Saline Emergent Wetland	SEW
4611	*Typha angustifolia - Distichlis spicata*	Saline Emergent Wetland	SEW
4620	California Hair-grass *(Deschampsia caespitosa)*	Saline Emergent Wetland	SEW
4621	*Deschampsia caespitosa - Lilaeopsis masonii*	Saline Emergent Wetland	SEW
4630	Common Reed *(Phragmites australis)*	Fresh Emergent Wetland	FEW
4700	**Tall & Medium Upland Grasses**	Annual Grassland	AGS
4701	**Ruderal Herbaceous Grasses & Forbs**	Annual Grassland	AGS
4710	California Annual Grasslands - Herbaceous	Annual Grassland	AGS
4711	*Bromus diandrus - Bromus hordeaceus*	Annual Grassland	AGS
4720	Italian Rye-grass *(Lolium multiflorum)*	Annual Grassland	AGS
4721	*Lolium multiflorum - Convolvulus arvensis*	Annual Grassland	AGS
4722	*Lolium multiflorum - Triphysaria eriantha*	Annual Grassland	AGS
4723	*Lolium multiflorum - Lasthenia glabrata*	Annual Grassland	AGS
4724	*Lolium multiflorum - Blennosperma nanum*	Annual Grassland	AGS
4730	Rabbitsfoot grass *(Polypogon maritimus)*	Annual Grassland	AGS
5000	**FORBS**		
5100	**Tall & Medium Upland Forbs**	Annual Grassland	AGS
5110	Fennel *(Foeniculum vulgare)*	Annual Grassland	AGS
5120	Poison Hemlock *(Conium maculatum)*	Annual Grassland	AGS
5200	**Intermittently Flooded Perennial Forbs**	Fresh Emergent Wetland	FEW
5201	Managed Annual Wetland Vegetation (Non-specific grasses & forbs)	Fresh Emergent Wetland	FEW
5202	Shallow flooding with minimal vegetation at time of photography	Fresh Emergent Wetland	FEW
5203	Seasonally flooded undifferentiated annual grasses and forbs	Fresh Emergent Wetland	FEW
5204	Managed alkali wetland (*Crypsis*)	Saline Emergent Wetland	SEW
5205	**Intermittently or temporarily flooded undifferentiated annual grasses and forbs**	Fresh Emergent Wetland	FEW
5206		Fresh Emergent Wetland	FEW
5210	*Scirpus* spp. in managed wetlands	Annual Grassland	AGS
5300	**Temporarily Flooded Perennial Forbs**	Fresh Emergent Wetland	FEW
5301	Smartweed *Polygonum* spp. - Mixed Forbs	Fresh Emergent Wetland	FEW
5311	*Polygonum amphibium*	Fresh Emergent Wetland	FEW
5400	**Semi-permanently Flooded Forbs**	Fresh Emergent Wetland	FEW
5410	Floating Primrose *(Ludwigia peploides)*	Fresh Emergent Wetland	FEW
5411	*Ludwigia peploides*	Fresh Emergent Wetland	FEW
5420	Horsetail (*Equisetum* spp.)	Fresh Emergent Wetland	FEW

Map Code	Mapped Vegetation Type	WHR Type	WHR Code
5500	**Tall & Medium Perennial Forbs (Upland or Tidally Flooded)**	Fresh Emergent Wetland	FEW
5501	Alkaline vegetation mapping unit	Alkali Desert Scrub	ADS
5502	*Allenrolfea occidentalis* mapping unit	Alkali Desert Scrub	ADS
5503	*Suaeda moquinii - (Lasthenia californica)* mapping unit	Alkali Desert Scrub	ADS
5504	*Lasthenia californica* mapping unit	Annual Grassland	AGS
5510	Alkali Heath *(Frankenia salina)*	Saline Emergent Wetland	SEW
5511	*Frankenia salina - Distichlis spicata*	Saline Emergent Wetland	SEW
5512	*Frankenia salina* - annual grasses	Saline Emergent Wetland	SEW
5520	Pickleweed *(Salicornia virginica)*	Saline Emergent Wetland	SEW
5521	*Salicornia virginica - Distichlis spicata*	Saline Emergent Wetland	SEW
5522	*Salicornia virginica - Cotula coronopifolia*	Saline Emergent Wetland	SEW
5530	Perennial Pepperweed *(Lepidium latifolium)*	Saline Emergent Wetland	SEW
5531	*Lepidium latifolium - Salicornia virginica - Distichlis spicata*	Saline Emergent Wetland	SEW
5540	Tobacco brush *(Nicotiana glauca)* mapping unit		
6000	**PERMANENTLY FLOODED HYDROMORPHIC-ROOTED**	Fresh Emergent Wetland	FEW
6101	**Generic Floating Aquatics**	Fresh Emergent Wetland	FEW
6110	Water Hyacinth *(Eichhornia crassipes)*	Fresh Emergent Wetland	FEW
6201	Pondweed (*Potamogeton* sp.)	Fresh Emergent Wetland	FEW
6202	Riverweed (*Ceratophyllum* sp.)	Fresh Emergent Wetland	FEW
6203	Waterweed (*Elodea* sp.)	Fresh Emergent Wetland	FEW
6210	Milfoil - Waterweed (generic submerged aquatics)	Fresh Emergent Wetland	FEW
6211	Brazilian Waterweed (*Egeria - Myriophyllum*) Submerged	Fresh Emergent Wetland	FEW
6220	*Hydrocotyle ranunculoides*	Fresh Emergent Wetland	FEW
6230	*Sagittaria sanfordii*	Fresh Emergent Wetland	FEW
7000	Algae	Fresh Emergent Wetland	FEW
9000	**LAND USE - LITTLE OR NO VEGETATION - WATER**		
9100	Urban Developed - Built Up	Urban	URB
9200	Agriculture	Irrigated grain crops	IGR
9300	Exotic Vegetation Stands		
9310	*Eucalyptus*	Eucalyptus	EUC
9320	Tree-of-Heaven (*Ailanthus altissima*)	no direct translation to CWHR	
9330	*Acacia - Robinia*	no direct translation to CWHR	
9400	Sparsely or Unvegetated Areas; Abandoned orchards	Barren	BAR
9401	Levee Rock Riprap	Barren	BAR
9402	Salt scalds and associated sparse vegetation	Barren	BAR
9403	Tidal mudflats	Barren	BAR
9404	River blowout, sandy wash	Barren	BAR

Map Code	Mapped Vegetation Type	WHR Type	WHR Code
9500	Restoration Sites	Barren	BAR
9501	Black Willow *(Salix gooddingii)* - Valley Oak *(Quercus lobata)* restoration	Valley-Foothill Riparian	VRI
9502	Valley Oak *(Quercus lobata)* restoration	Valley-Foothill Riparian	VRI
9503	White Alder *(Alnus rhombifolia)* - Arroyo willow *(Salix lasiolepis)* restoration	Valley-Foothill Riparian	VRI
9800	Water	Riverine	RIV
9900	Unknown		

APPENDIX G FULL ACCURACY ASSESSMENT

Waypt	GPS AA Waypoint	AIS Code	AIS Name	Delta V_id	Field-checked Classification Name	AA Score	Comments
208	208a	3420	Rosa californica	8814	*Vitis californica (pure stand… not in classification)*	1	weird sprawl of vitis, not in classif
	208b	1321	Alnus rhombifolia / Salix exigua (Rosa californica)	8819	*Alnus rhombifolia Alliance only*	don't use	cant tell which polygon relates to the portion described by aa crew
	208c	4310	Giant Cane Arundo donax	8826	*Arundo donax Alliance only*	5	
	208d	1321	Alnus rhombifolia / Salix exigua (Rosa californica)	8829	*Alnus rhombifolia Alliance only*	5	small poly included individual trees of qulo, but didn't include alra to west, close
	208e	3410	Blackberry Rubus Discolor	8621	*Rubus discolor Alliance only*	5	
210	210a	2110	Coast Live Oak Quercus agrifolia	8884	*Quercus agrifolia Alliance only*	5	has some qulo and saex, but keys to quag and looks quag dominant
207	207a	5420	Horsetail Equisetum spp.	8842	*Equisetum (arvense, variegatum, hyemale) Semipermanently Flooded Herbaceous Alliance*	5	
	207b	4701	Ruderal Herbaceous Grasses & Forbs	8818	ruderal herbaceous (non-native annual forbland)	5	
206	206a	2110	Coast Live Oak Quercus agrifolia	8911	*Quercus agrifolia Alliance only*	5	
	206b	1382	Salix gooddingii - Populus fremontii - (QuLo-SaEx-RuDi)	8961	*Quercus agrifolia Alliance only*	2	
205	205a					don't use	not applicable, stand too narrow (8 m)
	205b	1321	Alnus rhombifolia / Salix exigua (Rosa californica)	8995	*Salix lasiolepis-Rubus discolor phase*	3	different mesocluster

Waypt	GPS AA Waypoint	AIS Code	AIS Name	Delta V_id	Field-checked Classification Name	AA Score	Comments
209	209a	1382	Salix gooddingii - Populus fremontii - (QuLo-SaEx-RuDi)	8755	*Salix gooddingii-Populus fremontii*	5	
10	10a					don't use	egeria was not present in photo 2002, though field checked in 2005
	10b	4513	Scirpus acutus - Typha latifolia	10531	*Schoenoplectus californicus Alliance only*	4	diff mesocluster than, but phiog very similar
	10c	1360	Fremont Cottonwood Populus fremontii	10858	*Populus fremontii Alliance only*	5	
11	11a	4503	Mixed Scirpus/ Submerged Aquatics (Egeria-Cabomba-Myriophyllum spp.) complex	10942	*Schoenoplectus californicus Alliance only*	5	Egeria and PHAU noted in field
	11b	3460	Arroyo Willow Salix lasiolepis	10923	*Robinia pseudoacacia*	2	thought was salas, has some saex so minor similarity; no MU of robinia pseudoacacia?
12	12a	4503	Mixed Scirpus/ Submerged Aquatics (Egeria-Cabomba-Myriophyllum spp.) complex	10439	*Schoenoplectus californicus Alliance only*	5	looks like some submerged aquatics
	12b	9400	Sparsely or Unvegetated Areas; Abandoned orchards	10384	Unvegetated	5	mostly rock rip-rap
	12c	3461	Salix lasiolepis - Mixed brambles (RoCa - ViTi - RuDi)	10174	*Salix exigua-(Salix lasiolepis)-Rubus discolor*	5	meets classification description well
	12d					don't use	casurina grove adjacent to home was not pulled out separately and called it all 9100

Waypt	GPS AA Waypoint	AIS Code	AIS Name	Delta V_id	Field-checked Classification Name	AA Score	Comments
13	13a	4511	Scirpus acutus Pure	10172	*Schoenoplectus californicus Alliance only*	4	again I would predict scca, but we wonder if this is going to hold true further inland
	13b	3461	Salix lasiolepis - Mixed brambles (RoCa - ViTi - RuDi)	10174	*Salix exigua-(Salix lasiolepis)-Rubus discolor*	5	good match; translation to mapping unit for mixed scrubby willows over brambles
7	7a					don't use	remove because so much change in past 4-5 yrs after restor and fire
	7b					don't use	remove because so much change in past 4-5 yrs after restor and fire
8	8a	4701	Ruderal Herbaceous Grasses & Forbs	10137	ruderal herbaceous (non-native annual forbland)	5	currently this is reduced from the way it was in 2002, but a good call
	8b					don't use	major restoration since photo 2002
	8c					don't use	major restoration since photo 2002
	8d					don't use	major restoration since photo 2002
	8e					don't use	
9	9a					don't use	mapped as water because no egeria there in 2002
	9b	4513	Scirpus acutus - Typha latifolia	10531	*Schoenoplectus californicus-Eichhornia crassipes*	4	they should have a mental model for the open water edge scirpus being scca
	9c	1321	Alnus rhombifolia / Salix exigua (Rosa californica)	1320	*Alnus rhombifolia Alliance only*	5	
	9d	4701	Ruderal Herbaceous Grasses & Forbs	10137	ruderal herbaceous (non-native annual forbland)	5	this was done in 8a

Waypt	GPS AA Waypoint	AIS Code	AIS Name	Delta V_id	Field-checked Classification Name	AA Score	Comments
124	124a	4340	Broad-leaf Cattail Typha latifolia	11254	*Typha latifolia-pure*	5	
	124b	6211	Brazilian Waterweed Egeria - Myriophyllum Submerged	11256	Algae	don't use	looks similar, but it is a pond not likely to have egeria, etc and different
58	58a	3410	Blackberry Rubus Discolor	7444	*Rubus discolor Alliance only*	5	fits description
56	56a	3410	Blackberry Rubus Discolor	7545	ruderal herbaceous (non-native annual forbland)	don't use	photo shows rudi at upper margin and strip of rip-rap or ruderal closer to water; possible change since photo, suggest remove from assessment?
111	111a	7000	algae	10856	*Schoenoplectus californicus-Eichhornia crassipes*	0	pi mistook eichornea for algae, didn't see scca, they seem to be missing this signature
113	113a	7001	algae	10889	*Schoenoplectus californicus-Eichhornia crassipes*	0	pi mistook eichornea for algae, didn't see scca, they seem to be missing this signature
	113b	4630	Common Reed Phragmites australis	10868	*Cornus sericea-Salix lasiolepis*	1	pi missed texture and signature of young cose-salas and mistook it for phau alliance
112	112a	7000	algae	11080	*Schoenoplectus californicus-Eichhornia crassipes*	0	pi mistook eichornea for algae, didn't see scca, they seem to be missing this signature
	112b	5120	Poison Hemlock Conium maculatum Alliance		*Phragmites australis Alliance only*	1	same life form but not really similar ecologically
123	123a	1380	Black Willow Salix gooddingii	10686	*Salix gooddingii/wetland herb*	5	good match
	123b	5120	Poison Hemlock Conium maculatum Alliance	10685	ruderal herbaceous (non-native annual forbland)	5	good match
57	57a	9000	water		*Egeria-Cabomba-Myriophyllum spp.*	don’t use	changed since 2002 photo to now have egeria-myrophyllum, clearly no veg when imagery

Waypt	GPS AA Waypoint	AIS Code	AIS Name	Delta V_id	Field-checked Classification Name	AA Score	Comments
							was flown
121	121a	9300	Exotic Vegetation Stands	15500	*Populus fremontii Alliance only*	4	exotics are pretty high (palm, arundo) pofr probably planted
	121b	4501	Mixed Scirpus Mapping Unit	15388	*Schoenoplectus californicus Alliance only*	5	should have modeled it for scca because of open water setting in w delta
122	122a	3461	Salix lasiolepis - Mixed brambles (RoCa - ViTi - RuDi)	15465	*Salix exigua-(Salix lasiolepis)-Rubus discolor*	5	good match
	122b	4514	Scirpus acutus - (Typha latifolia) - Phragmites australis	15287	*Schoenoplectus californicus Alliance only*	4	suggest redraw poly on w side of island to make one poly as scca and separate an internal poly with the mix of scirpus and phragmites
6	6a	1382	Salix gooddingii - Populus fremontii - (QuLo-SaEx-RuDi)	15004	*Salix lasiolepis Alliance only*	4	a very mixed stand with sago and pofr in it so pi is close
	6b	4520	California Bulrush Scirpus californicus	15019	*Schoenoplectus californicus Alliance only*	5	good match
120	120a	3442	Cornus sericea - Salix lasiolepis / (PhAu)	15235	*Salix lasiolepis Alliance only*	4	very likely to have some cornus in it so possibly a match, but field assessment does not mention cornus (so a 4/5)
	120b	4513	Scirpus acutus - Typha latifolia	15239	*Schoenoplectus californicus-Schoenoplectus acutus*	4	close call, but different association/alliance
118	118a	5301	Smartweed Polygonum spp. - Mixed Forbs	16185	*Schoenoplectus americanus Alliance only*	1	not similar ecologically somewhat unexpected to see scam here
	118b	4340	Broad-leaf Cattail Typha latifolia	16231	*Schoenoplectus americanus Alliance only*	don't use	this has changed; it used to be more typha; suggest removing from consderation because of apparent change over 4 years

Waypt	GPS AA Waypoint	AIS Code	AIS Name	Delta V_id	Field-checked Classification Name	AA Score	Comments
119	119a	3461	Salix lasiolepis - Mixed brambles (RoCa - ViTi - RuDi)	15827	*Salix exigua-(Salix lasiolepis)-Rubus discolor*	5	good match
	119b	4511	Scirpus acutus Pure	15773	*Schoenoplectus californicus-Eichhornia crassipes*	4	similar alliance w ecological overlap, but should model based on scca in these situations
68	68a	4511	Scirpus acutus Pure	4654	*Schoenoplectus acutus-Typha latifolia*	4	right call at alliance level, but you tried for association (scac-pure)
199	199a	3481	Salix exigua - (SaLa - RuDi - RoCa)	3435	*Salix exigua Alliance only*	5	good match
200	200a	3480	Narrow-leaf Willow Salix exigua	3011	*Salix exigua-Rosa californica phase*	5	good match
	200b	2230	Valley Oak Quercus lobata	3031	Exotic Vegetation Stands	2	same sub-life form but can't tell species id, just "introduced exotic trees"
110	110a	1380	Black Willow Salix gooddingii	10237	*Salix gooddingii*	5	good match
	110b	3481	Salix exigua - (SaLa - RuDi - RoCa)	10216	*Salix exigua-(Salix lasiolepis)-Rubus discolor*	5	good match
1091	1091	4503	Mixed Scirpus/ Submerged Aquatics (Egeria-Cabomba-Myriophyllum spp.) complex	10058	*Schoenoplectus californicus-Eichhornia crassipes*	4	missed the eichornea and didn't get scca pure
	1091a	4514	Scirpus acutus - (Typha latifolia) - Phragmites australis	9975	*Schoenoplectus acutus - (Schoenoplectus tabernaemontani)*	5	we called generic alliance ais called specific map unit in this
	1091b	3442	Cornus sericea - Salix lasiolepis / (PhAu)	9996	*Cornus sericea-Salix lasiolepis*	5	a good call

Waypt	GPS AA Waypoint	AIS Code	AIS Name	Delta V_id	Field-checked Classification Name	AA Score	Comments
109	109a	4503	Mixed Scirpus/ Submerged Aquatics (Egeria-Cabomba-Myriophyllum spp.) complex	10340	*Schoenoplectus californicus-Eichhornia crassipes*	4	should have called it 4502 for perfect
	109b	3442	Cornus sericea - Salix lasiolepis / (PhAu)	10347	*Cornus sericea-Salix lasiolepis*	5	good match
19	19a	4511	Scirpus acutus Pure	11761	*Schoenoplectus acutus - pure*	5	good match
	19b	6211	Brazilian Waterweed Egeria - Myriophyllum Submerged	11770	*Schoenoplectus californicus-Eichhornia crassipes*	don't use	this is a lumping with the floating aquatics on the back side of the island (where aa couldn't see) this is fair to do, even though aa called out the scca/Eichhornia separately it is too small
20	20a	9800	Water	159	*Egeria-Cabomba-Myriophyllum spp.*	don't use	changed since 2002 photo to now have egeria-myrophyllum, clearly no veg when imagery was flown
18	18a	3442	Cornus sericea - Salix lasiolepis / (PhAu)	11986	*Salix exigua-(Salix lasiolepis)-Rubus discolor*	3	different alliance but salas mentioned and same mesocluster, also pi didn't pull out small stands of scac or pofr because well below mmu
17	17a	4340	Broad-leaf Cattail Typha latifolia	11893	*Schoenoplectus californicus-Schoenoplectus acutus*	3	should have modeled for scca not typha given outer margin position
	17b	3461	Salix lasiolepis - Mixed brambles (RoCa - ViTi - RuDi)	11885	*Salix lasiolepis Alliance only*	5	pi did call as mu of alliance poly is actually mixed with sago, pofr, and ahrh with uncertain presence of rudi; suggest you just label this at salas alliance level only
16	16a	4514	Scirpus acutus - (Typha latifolia) - Phragmites australis	12592	*Schoenoplectus californicus-Schoenoplectus acutus*	4	pi missed the typha but close

Waypt	GPS AA Waypoint	AIS Code	AIS Name	Delta V_id	Field-checked Classification Name	AA Score	Comments
	16b	3461	Salix lasiolepis - Mixed brambles (RoCa - ViTi - RuDi)	12600	*Salix lasiolepis Alliance only*	5	pi had more detail we mentioned tyla and phau along w salasio, but no comparable association
15	15a	3461	Salix lasiolepis - Mixed brambles (RoCa - ViTi - RuDi)	12689	*Rubus discolor Alliance only*	5	mmu issue for pi vs aa team lumping is appropriate and thus correct
	15b	4310	Giant Cane Arundo donax	12759	*Arundo donax Alliance only*	5	good match
	15c	4513	Scirpus acutus - Typha latifolia	12766	*Schoenoplectus californicus Alliance only*	4	aa called it scca alliance which is ecologically close to scca-tyla, but you should fix this and model these outer stands for scca
28	28a	3481	Salix exigua - (SaLa - RuDi - RoCa)	12765	*Salix exigua-(Salix lasiolepis)-Rubus discolor*	5	cortaderia of primary AA is too small to map, count as emergents in saex-rudi mapping unit as verified from field photos; scca mentioned in aa notes, but only 3 m wide and not mapped, ok
14	14a	3410	Blackberry Rubus Discolor	12244	*Rubus discolor Alliance only*	5	aa field mentions emergent salas and cortaderia, but too small to note in pi so perfect
114	114a	3481	Salix exigua - (SaLa - RuDi - RoCa)	12467	*Salix exigua-(Salix lasiolepis)-Rubus discolor*	5	good match; scca in aa is too narrow to map so ok
115	115a	1380	Black Willow Salix gooddingii	13460	*Salix gooddingii-Populus fremontii*	5	mapped to alliance correctly, probably unsure about the pofr pi sig
	115b	3410	Blackberry Rubus Discolor	13489	*Rubus discolor Alliance only*	5	not formally on aa, but unmistakable in field photo
116	116a	1384	Salix gooddingii/Rubus discolor	15046	*Salix gooddingii*	5	good match
24	24a	4511	Scirpus acutus Pure	15248	*Schoenoplectus acutus - pure*	5	good match
	24b	4310	Giant Cane Arundo donax	15188	*Arundo donax Alliance only*	5	good

Waypt	GPS AA Waypoint	AIS Code	AIS Name	Delta V_id	Field-checked Classification Name	AA Score	Comments
22	22a	1382	Salix gooddingii - Populus fremontii - (QuLo-SaEx-RuDi)	14424	*Salix gooddingii-Populus fremontii*	5	good, field aa stated there was narrow band of salasio, but that too small to map
	22b	4511	Scirpus acutus Pure	14748	*Schoenoplectus acutus - pure*	5	good, aa mentions rim of scac around open water pond so got it right
23	23a	3460	Arroyo Willow Salix lasiolepis	14479	*Salix gooddingii/wetland herb*	3	field says sago (but short so looked like salas, esp 4 yrs ago) so not that closely related so get a 3/5
	23b	9200	Agriculture	15407	Agriculture	5	good
151	151a	3442	Cornus sericea - Salix lasiolepis / (PhAu)	16757	*Salix exigua-(Salix lasiolepis)-Rubus discolor*	3	need to remodel sccal to edges of open water on big channels
	151b	4502	Mixed Scirpus / Floating Aquatics (Hydrocotyle-Eichhornia) Complex	16764	*Schoenoplectus californicus-Eichhornia crassipes*	5	actually scca w hyra but mapping unit is accurate so get full credit
1501	1501a	6211	Brazilian Waterweed Egeria - Myriophyllum Submerged	16766	*Egeria-Cabomba-Myriophyllum spp.*	5	good
	1501b	4511	Scirpus acutus Pure	16888, 16924, 16995	*Schoenoplectus californicus Alliance only*	4	different alliance, but close in cluster grouping so a four
152	152a	3442	Cornus sericea - Salix lasiolepis / (PhAu)	16798	*Rubus discolor Alliance only*	3	pi needs to notice the bad disturbed narrow levee setting and not model cornus there (old levees do not have cornus on them), this is rudi or saex(salas) rudi model
	152b	4514	Scirpus acutus - (Typha latifolia) - Phragmites australis	16786	*Schoenoplectus californicus Alliance only*	4	aa field didn't assess inner part of extended poly as drawn, may have scac and typha there, but we don't know so assessed based only on outer water side of poly which says scca on aa form
26	26a	3480	Narrow-leaf Willow Salix	16728	*Salix exigua Alliance only*	5	good

Waypt	GPS AA Waypoint	AIS Code	AIS Name	Delta V_id	Field-checked Classification Name	AA Score	Comments
			exigua				
	26b	1380	Black Willow Salix gooddingii	16410	*Salix gooddingii*	5	good
27	27a	7000	Algae	17138	*algae with egeria*	5	good, no formal algae type but aa mentions egeria-algae so should get full credit
	27b	6101	Generic Floating Aquatics	17099	*Hydrocotyle ranunculoides Alliance only*	5	good at mu level
	27c	4514	Scirpus acutus - (Typha latifolia) - Phragmites australis	17152	*Schoenoplectus acutus - (Schoenoplectus tabernaemontani) Alliance only*	5	good at alliance, which is what aa did its assessment at, probably does have tyla and phau back in the stand
117	117a	4502	Mixed Scirpus / Floating Aquatics (Hydrocotyle-Eichhornia) Complex	15926	*Hydrocotyle ranunculoides Alliance only*	5	mu included the patches of scirpus adjacent to the hyra so this makes sense and gets full credit
	117b	4514	Scirpus acutus - (Typha latifolia) - Phragmites australis	15669	*Schoenoplectus acutus-Phragmites australis*	5	good
25	25a	1382	Salix gooddingii - Populus fremontii - (QuLo-SaEx-RuDi)	16261	*Populus fremontii Alliance only*	5	aa assessed only front (smaller than mmu) stand which is mixed pofr, to enable this to be big enough to map pi included sago mix behind it so this is acceptable to get full credit
	25b	4502	Mixed Scirpus / Floating Aquatics (Hydrocotyle-Eichhornia) Complex	15943	*Schoenoplectus acutus - (Schoenoplectus tabernaemontani) Alliance only*	5	full credit
	25c	6211	Brazilian Waterweed Egeria - Myriophyllum Submerged	16150	*Potamogeton spp. - Ceratophyllum spp. - Elodea spp. Alliance only (represented by P. pectinatus stands)*	5	full credit

Waypt	GPS AA Waypoint	AIS Code	AIS Name	Delta V_id	Field-checked Classification Name	AA Score	Comments
21	21a	4503	Mixed Scirpus/ Submerged Aquatics (Egeria-Cabomba-Myriophyllum spp.) complex	13146	*Schoenoplectus acutus-Phragmites australis*	5	pi included surrounding scirpus and phau with the submerged aquatics as a bigger polygon, based on comments on aa sheet this is what surrounds the small (below mmu) stand of phau on either side of it, bordering the open water
	21b	3442	Cornus sericea - Salix lasiolepis / (PhAu)	13135	*Cornus sericea-Salix lasiolepis/Phragmites australis*	5	aa mentions salas and phau but doesn't mention cose, probably because its shorter and cant see it from the side
155	155a	4502	Mixed Scirpus / Floating Aquatics (Hydrocotyle-Eichhornia) Complex	13331	*Schoenoplectus californicus-Schoenoplectus acutus*	5	aa does not mention floating aquatics and they do not show in the field photo
	155b	3462	Salix lasiolepis - (CoSe)/Scirpus spp.-(Phrag.-Typha) complex unit	13257	*Salix lasiolepis Alliance only*	5	aa does not mention other members of the stand but as a mapping unit should get full credit
156	156a	3462	Salix lasiolepis - (CoSe)/Scirpus spp.-(Phrag.-Typha) complex unit	13568	*Cornus sericea-Salix lasiolepis/Phragmites australis*	5	good although uncertain about delineation of interior of island and how that relates to the aa field effort, assumed aa only saw the outer rim of the salax-cose phau unit
198	198a	4513	Scirpus acutus - Typha latifolia	20128	*Schoenoplectus acutus-Typha latifolia*	5	good match, but note we assessed the poly just west of the gps point assuming this is the correct one
	198b	4730	Polypogon maritimus (Rabbitsfoot grass)	20145	California Annual Grassland/Herbaceous Alliance	5	pi was more specific but this falls into this alliance
159	159a	4502	Mixed Scirpus / Floating Aquatics (Hydrocotyle-Eichhornia) Complex	18094	*Hydrocotyle ranunculoides Alliance only*	5	aa team was focused on the hydrocotyle, while pi was mapping mix of scirpus and hydrotyle

Waypt	GPS AA Waypoint	AIS Code	AIS Name	Delta V_id	Field-checked Classification Name	AA Score	Comments
	159b	6211	Brazilian Waterweed Egeria - Myriophyllum Submerged	18108	*Egeria-Cabomba-Myriophyllum spp.*	5	good call, in 2002 there was much egeria
	159c	4502	Mixed Scirpus / Floating Aquatics (Hydrocotyle-Eichhornia) Complex	18142	*Hydrocotyle ranunculoides Alliance only*	5	aa team was focused on the hydrocotyle, while pi was mapping mix of scirpus and hydrotyle
162	162a	1321	Alnus rhombifolia / Salix exigua (Rosa californica)	19205	*Salix lasiolepis-Rubus discolor phase*	3	aa did not see any alrh, pi definitely caught the salix and the brambles and in the same mesocluster so get a 3
160	160a	4514	Scirpus acutus - (Typha latifolia) - Phragmites australis	19408	*Schoenoplectus acutus-Phragmites australis*	5	classification of this type implies presence of both typha and phau so correct
	160b	4513	Scirpus acutus - Typha latifolia	19394	*Schoenoplectus acutus-Phragmites australis*	5	aa field team did not differentiate this from the adjacent poly (19408) but called the whole thing scac-tyla-phau, we believe pi was more accurate and the break is warranted, this poly also translates to a good match with the mapping unit so should get full credit
161	161a	3442	Cornus sericea - Salix lasiolepis / (PhAu)	19404	*Cornus sericea-Salix lasiolepis*	5	perfect
1941	1941a	4514	Scirpus acutus - (Typha latifolia) - Phragmites australis	21420	*Schoenoplectus acutus-Phragmites australis*	5	based on description on aa pi gets it right
	1941b	3440	California Dogwood Cornus sericea	21427	*Phragmites australis Alliance only*	0	Wrong life form

Waypt	GPS AA Waypoint	AIS Code	AIS Name	Delta V_id	Field-checked Classification Name	AA Score	Comments
194		4514	Scirpus acutus - (Typha latifolia) - Phragmites australis	21392, 21411	*Schoenoplectus acutus-Phragmites australis*	5	this includes one aa by field crew that combined two adjacent polys delineated by pi. These are one phau dom and one scac-typha so collectively pi is right on both
193		4511	Scirpus acutus Pure	21687	*Schoenoplectus acutus - (Schoenoplectus tabernaemontani) Alliance only*	5	poly includes sparganium eurycarpum below mmu so we would only classify it at alliance level so they get full credit
127		5502	Allenrolfea occidentalis M.U.	21848	Allenrolfea occidentalis alliance	5	good call
127	127a	4710	California Annual Grasslands - Herbaceous	21738	California Annual Grassland/Herbaceous Alliance	5	good call
192		1380	Black Willow Salix gooddingii	21807	*Salix gooddingii*	5	good call gps point is off on this one is projected into egeria patch that is clearly not tree dominated
1921		6101	Generic Floating Aquatics	21802	*Eichhornia crassipes alliance only*	5	should have been more specific to get full credit, looks like eichornia on air photo
	1921a	7000	Algae	21811	*Egeria-Cabomba-Myriophyllum spp.*	don't use	changed from algae in 2002 to egeria in 2005, but clearly pi knows what they're doing
	1921b	4511	Scirpus acutus Pure	21902	*Scirpus californicus Alliance only*	4	pi called scac when scca, so get a 4
129	129a	5503	Suaeda moquinii-(Lasthenia californica) M.U.	22126	Suaeda moquinii-(Lasthenia californica) M.U.	5	likely to match this mu, but no positive id on sumo in field
	129b	5502	Allenrolfea occidentalis M.U.	22153	Allenrolfea occidentalis alliance	5	good call
	129c	4511	Scirpus acutus Pure	22136	*Schoenoplectus acutus - (Schoenoplectus tabernaemontani) Alliance only*	5	
	129d	5503	Suaeda moquinii-(Lasthenia californica) M.U.	22010	Allenrolfea occidentalis alliance	4	based on assumed relationship between sueada and allenrolfea we called this a 4. There may be suaeda out there or some unknown chenopod as in previous exampled of this sample

Waypt	GPS AA Waypoint	AIS Code	AIS Name	Delta V_id	Field-checked Classification Name	AA Score	Comments
	129e	4710	California Annual Grasslands - Herbaceous	21738	California Annual Grassland/Herbaceous Alliance	5	good match (lolium mentioned but aa crew specified ca an gr)
130	130a	5503	Suaeda moquinii-(Lasthenia californica) M.U.	22299, 22288, 22295, 22305,22297, 22290, etc	Suaeda moquinii-(Lasthenia californica) M.U.	5	likely to match this mu, but no positive id on sumo in field, all of these polys are probably better called this rather than scald type (9402) we vote for a systematic lumping of these into 5503
	130b	4710	California Annual Grasslands - Herbaceous		*Lolium multiflorum Alliance only*	5	could have modeled lolium based on ecological setting
128	128a	5502	Allenrolfea occidentalis M.U.	22602	Allenrolfea occidentalis alliance	5	note that we probably have a ra for this area from april 2006
	128b	4530	American Bulrush Scirpus americanus	22524, 22518	Typha not to species	don't use	cant use because field team did not id typha to species and thus we don't know the ecological relationship between scam and typha
	128c	5503	Suaeda moquinii-(Lasthenia californica) M.U.	22509	Suaeda moquinii-(Lasthenia californica) M.U.	5	good match
	128d	4710	California Annual Grasslands - Herbaceous	22030	California Annual Grassland/Herbaceous Alliance	5	good match
187		3481	Salix exigua - (SaLa - RuDi - RoCa)	22568	*Salix exigua-(Salix lasiolepis)-Rubus discolor*	5	good
1871		1382	Salix gooddingii - Populus fremontii - (QuLo-SaEx-RuDi)	22613	*Salix gooddingii-Populus fremontii*	5	mapped correctly
1872		3410	Blackberry Rubus Discolor	22628	Rubus discolor Alliance only	5	note that database calls this pofr, but gps incorrectly projected, also note that there is some saex in this stand, but overwhelmingly looks like rudi

Waypt	GPS AA Waypoint	AIS Code	AIS Name	Delta V_id	Field-checked Classification Name	AA Score	Comments
1874		3461	Salix lasiolepis - Mixed brambles (RoCa - ViTi - RuDi)	22505	*Salix lasiolepis-Rubus discolor phase*	5	excellent match at phase level
1873		1382	Salix gooddingii - Populus fremontii - (QuLo-SaEx-RuDi)	22565	*Salix gooddingii alliance only*	5	a match but less info than desired from field assessment
188		3481	Salix exigua - (SaLa - RuDi - RoCa)	22657	*Salix lasiolepis-Rubus discolor phase*	5	this is an association level match; pi broke up what field crew called a very large stand into 3, we took the largest of these only for aa
	188b				*Schoenoplectus acutus - (Schoenoplectus tabernaemontani) Alliance only*	don't use	pi did not pull this out, because too small
189		3461	Salix lasiolepis - Mixed brambles (RoCa - ViTi - RuDi)	22679	*Salix lasiolepis-Rubus discolor phase*	5	good match
1912		3461	Salix lasiolepis - Mixed brambles (RoCa - ViTi - RuDi)	21958	*Salix exigua-(Salix lasiolepis)-Rubus discolor*	5	good match, though likely to be salas dom phase of this association, if we collected more detail in the field
1911		6211	Brazilian Waterweed Egeria - Myriophyllum Submerged	21951	*Eichhornia crassipes alliance only*	don't use	changed over yrs looked like pi would have been correct, note point is misprojected
1913		4701	Ruderal Herbaceous Grasses & Forbs	21959	ruderal herbaceous (non-native annual forbland)	5	actually contains sylibum as main species listed , also note misprojected
1914						don't use	bad misprojection
191		3410	Blackberry Rubus Discolor	22100	Rubus discolor-Rosa californica informal	5	good match, note no formal name for this association because of lack of sampling

Waypt	GPS AA Waypoint	AIS Code	AIS Name	Delta V_id	Field-checked Classification Name	AA Score	Comments
	191a	6211	Brazilian Waterweed Egeria - Myriophyllum Submerged	22084	*Egeria-Cabomba-Myriophyllum spp.*	5	good ,match
1902	1902a	3461	Salix lasiolepis - Mixed brambles (RoCa - ViTi - RuDi)	22092, 22088	*Salix lasiolepis-Rubus discolor phase*	5	good match; note we did not mention 22088 poly, but it is probably a 1321 just so you know!
	1902b	4520	California Bulrush Scirpus californicus	22118	*Schoenoplectus californicus-Eichhornia crassipes*	5	matched at alliance
190		3480	Narrow-leaf Willow Salix exigua	22603	*Salix exigua-(Salix lasiolepis)-Rubus discolor*	5	matched at alliance; we think you should be able to do association here, but we are giving you the benefit of the doubt
1901		1350	California Walnut Juglans californica	22656	Exotic Vegetation Stands	1	just a weird plantation, note we will send you the ground photo
186	186a	3461	Salix lasiolepis - Mixed brambles (RoCa - ViTi - RuDi)	22584	*Salix exigua-(Salix lasiolepis)-Rubus discolor*	5	good match
	186b	1384	Salix gooddingii/Rubus discolor	22587	*Salix gooddingii alliance only*	5	aa only did to alliance so perfect
185	185a	3461	Salix lasiolepis - Mixed brambles (RoCa - ViTi - RuDi)	22639		don't use	a likely change since 2002 where clearly looks like a 3461, aa says pure roca in oct 2005, levee maintance?
	185b	4310	Giant Cane Arundo donax	22637	*Arundo donax Alliance only*	5	good to pull this little fellow out
175	175a	1380	Black Willow Salix gooddingii	21674	*Salix gooddingii*	5	match to alliance, aa doesn't mention any pofr so we went to alliance only for aa as well
	175b	4514	Scirpus acutus - (Typha latifolia) - Phragmites australis	21728	*Schoenoplectus acutus - (Schoenoplectus tabernaemontani) Alliance only (Bulrush)*	5	match to alliance

Waypt	GPS AA Waypoint	AIS Code	AIS Name	Delta V_id	Field-checked Classification Name	AA Score	Comments
176		3461	Salix lasiolepis - Mixed brambles (RoCa - ViTi - RuDi)	21753	*Salix exigua-(Salix lasiolepis)-Rubus discolor*	5	stand matches at association
173		1384	Salix gooddingii/Rubus discolor	21879	*Salix gooddingii alliance only*	5	matches at alliance, understory is weedy no rudi mentioned
174		4513	Scirpus acutus - Typha latifolia	21927, (21932)	*Salix lasiolepis Alliance only*	don't use	these two polys are treated differently by aa team, because team couldn't see the scac-tyla behind the wall of salasio,
174	174a	5120	Poison Hemlock Conium maculatum Alliance	21932	ruderal herbaceous (non-native annual forbland)	5	nice match, even though assessed the mix of salas and scac-tyla differently to the e. the conium looks good from the photo
	174b	1382	Salix gooddingii - Populus fremontii - (QuLo-SaEx-RuDi)	21995	*Salix gooddingii alliance only*	5	correct at alliance level (that's all that aa did)
181		2232	Quercus lobata - Acer negundo	21654	*Quercus lobata-Acer negundo*	5	correct at association (good match)
	181a	2231	Quercus lobata / Rosa californica (RuDi - SaLa / Carex)	21684	*Quercus lobata Alliance only*	5	correct to alliance
182		2232	Quercus lobata - Acer negundo	21701	*Quercus lobata-Acer negundo*	5	excellent match at association
183		2231	Quercus lobata / Rosa californica (RuDi - SaLa / Carex)	21813	*Quercus lobata-Acer negundo*	4	difficult call, because aa does mention acne, but this may refer to polygon 21760, which does have qulo-acne,
	183a	2232	Quercus lobata - Acer negundo	21760	*Quercus lobata-Acer negundo*	5	this is totally correct
184		1382	Salix gooddingii - Populus fremontii - (QuLo-SaEx-RuDi)	22113	*Salix gooddingii-Populus fremontii*	5	good match at association

Waypt	GPS AA Waypoint	AIS Code	AIS Name	Delta V_id	Field-checked Classification Name	AA Score	Comments
39						out of study area	
40						out of study area	
41						out of study area	
42						out of study area	
43						out of study area	
44						out of study area	
30						out of study area	
31						out of study area	
32						out of study area	
33						out of study area	

Waypt	GPS AA Waypoint	AIS Code	AIS Name	Delta V_id	Field-checked Classification Name	AA Score	Comments
29						out of study area	
36						out of study area	
37						out of study area	
38						out of study area	
48						out of study area	
34						out of study area	
	35a	4630	Common Reed Phragmites australis	11183	*Phragmites australis Alliance only*	5	good match
35		9402	Salt scalds and associated sparse vegetation		*Salicornia virginica*	don't use	this would be in the same mesocluster; pi should model salicornia n of sac-san joaq river rather than suaeda, savi can be very low cover in some of these "scalds", this stand may have been lower cover when aerials were taken, savi can increase pretty rapidly
	49a	4520	California Bulrush Scirpus californicus	11195	*Schoenoplectus californicus Alliance only*	5	this is a big scirpus cal poly, that may be in part scsc, we will only assess this once, see also daa045)
49		3410	Blackberry Rubus Discolor	11192	*Rosa californica Alliance only*	4	stand dominated by roca with a little rudi
47		5520	Pickleweed Salicornia virginica	11180	*Salicornia virginica alliance*	5	good match

Waypt	GPS AA Waypoint	AIS Code	AIS Name	Delta V_id	Field-checked Classification Name	AA Score	Comments
	47a	4710	California Annual Grasslands - Herbaceous	11096	California Annual Grassland/Herbaceous Alliance	5	good match
51		3211	Baccharis pilularis / Annual Grasses & Herbs	11203	*Salicornia virginica*	1	barely correct at life form, pi mistook very dark distinct signature for bapi, was dense savi
50				11195		see 49a	
46		4701	Ruderal Herbaceous Grasses & Forbs	11258	*Salicornia virginica*	0	no life form match and no ecological similarity
	46a	4710	California Annual Grasslands - Herbaceous	11177	California Annual Grassland/Herbaceous Alliance	5	good match
45						don't use	see aa 049 (11192)
	45a					don't use	assessed above in daa049
52		3211	Baccharis pilularis / Annual Grasses & Herbs	11247	*Salicornia virginica*	1	barely correct at life form, pi mistook very dark distinct signature for bapi, was dense savi
53		5511	Frankenia salina - Distichlis spicata	11277	*Frankenia salina*	5	correct at alliance level we don't have a formal classif for frankinia over annual grasses, which is what this really is
54		4701	Ruderal Herbaceous Grasses & Forbs	11403	*Equisetum (arvense, variegatum, hyemale) Semipermanently Flooded Herbaceous Alliance*	2	life form similar, and similar environment, but diff ecologically
55		3410	Blackberry Rubus Discolor	11315	*Rosa californica Alliance only*	4	strongly dom by roca, no rudi mentioned
1		4522	Scirpus californicus - Scirpus acutus	12551	*Schoenoplectus californicus Alliance only*	5	good match

Waypt	GPS AA Waypoint	AIS Code	AIS Name	Delta V_id	Field-checked Classification Name	AA Score	Comments
	1a	4630	Common Reed Phragmites australis	12538	*Phragmites australis Alliance only*	5	good match
	1b	4514	Scirpus acutus - (Typha latifolia) - Phragmites australis	12279	*Schoenoplectus acutus - (Schoenoplectus tabernaemontani) Alliance only*	5	correct at alliance (aa only gave alliance)
2		4320	Creeping Wild Rye Grass Leymus triticoides	13456	*Deschampsia caespitosa-Lilaeopsis masonii*	check this	we think you miss coded for deschampsia
	2a	4514	Scirpus acutus - (Typha latifolia) - Phragmites australis	12279	*Schoenoplectus californicus Alliance only*	4	probably has more acutus farther inland, but aa mentions only scca from their point
3		4630	Common Reed Phragmites australis	14483	*Rubus discolor Alliance only*	0	no life form match and no ecological similarity
	3a	3462	Salix lasiolepis - (CoSe)/Scirpus spp.-(Phrag.-Typha) complex unit	14519	*Salix lasiolepis Alliance only*	5	match at alliance
4		3461	Salix lasiolepis - Mixed brambles (RoCa - ViTi - RuDi)	14473	*Salix exigua-(Salix lasiolepis)-Rubus discolor*	5	match at association
	4a	3462	Salix lasiolepis - (CoSe)/Scirpus spp.-(Phrag.-Typha) complex unit	14469	*Salix lasiolepis Alliance only*	5	match at alliance
5		4630	Common Reed Phragmites australis	14620	*Schoenoplectus californicus Alliance only*	3	different alliance, the signature looks like phau because of high native herb component including dece and eringium and sparganium

Waypt	GPS AA Waypoint	AIS Code	AIS Name	Delta V_id	Field-checked Classification Name	AA Score	Comments
				14924		not an AA	note this is eucalyptus not accacia!
125		4511	Scirpus acutus Pure	15804	*Schoenoplectus californicus Alliance only*	4	do not model scac on edge of big w delta open water
126		3211	Baccharis pilularis / Annual Grasses & Herbs	15904	*Ailanthus altissima Alliance only*	2	woody and weedy, ailanthus is short and shrubby
		2110	Coast Live Oak Quercus agrifolia	15862	*Quercus agrifolia Alliance only*	5	match at alliance
91		1382	Salix gooddingii - Populus fremontii - (QuLo-SaEx-RuDi)	9636	*Salix gooddingii-Populus fremontii*	5	match , notes say mostly pofr with occ. Sago and jucah
	91a	4503	Mixed Scirpus/ Submerged Aquatics (Egeria-Cabomba-Myriophyllum spp.) complex	9595	*Schoenoplectus californicus-Schoenoplectus acutus*	5	good match though no mention of egeria or other submerged aq in aa (do mention eichornia)
69		1382	Salix gooddingii - Populus fremontii - (QuLo-SaEx-RuDi)	10188	*Salix gooddingii-Populus fremontii*	5	good match
	69a	4511	Scirpus acutus Pure	10198	*Schoenoplectus californicus Alliance only*	4	don't forget the rule!
70		4511	Scirpus acutus Pure	10186	*Schoenoplectus californicus-Schoenoplectus acutus*	4	not sure about this one because scac is dom but technically it falls in scca alliance
79		3460	Arroyo Willow Salix lasiolepis	10863	*Salix lasiolepis Alliance only*	5	good match at alliance
791		4514	Scirpus acutus - (Typha latifolia) - Phragmites australis	10881	*Typha latifolia alliance*	3	mentioned typha, but different sub cluster so get 3/5 not 4/5

Waypt	GPS AA Waypoint	AIS Code	AIS Name	Delta V_id	Field-checked Classification Name	AA Score	Comments
	791a	3460	Arroyo Willow Salix lasiolepis	10863	*Arundo donax alliance only (in part)*	don't use	this poly looks like the arundo has come in since the photo)perhaps mowed in 2002, the delineation shows salas and other woody species, so cant really assess this in a simple way
792		1380	Black Willow Salix gooddingii	10911	*Salix gooddingii-Populus fremontii*	5	good at alliance only minor pofr says aa
80		3461	Salix lasiolepis - Mixed brambles (RoCa - ViTi - RuDi)	10833	*Salix lasiolepis-Rubus discolor phase*	5	good match
	80a	9300	Exotic Vegetation Stands	10854	*Eucalyptus Alliance (includes multiple species)*	5	includes eucs and other exotic species in polygon
	80b	4514	Scirpus acutus - (Typha latifolia) - Phragmites australis	10763	*Schoenoplectus acutus-Typha latifolia*	5	poly is more inclusive and grabs phau as well as scac-tyla so we should give them full credit
	80c	4511	Scirpus acutus Pure	10739	*Schoenoplectus californicus Alliance only*	4	we suggest pulling out e part along channel as separate scca, while larger w interior stand may remain scac.
81		4511	Scirpus acutus Pure	10724	*Schoenoplectus californicus-Schoenoplectus acutus*	4	close call, but different association/alliance
	81a	3461	Salix lasiolepis - Mixed brambles (RoCa - ViTi - RuDi)	10751	*Cornus sericea-Salix lasiolepis*	4	close call, but cose does not occur in 3461 and it was mentioned in aa field notes
	81b	4513	Scirpus acutus - Typha latifolia	10742, 10795	*Schoenoplectus acutus-Typha latifolia-Phragmites australis*	4	close call, but different association/alliance
71		3460	Arroyo Willow Salix lasiolepis	11655	Exotic Vegetation Stands	3	non-native willow (S babylonica) planting; got genus right, though
72		4511	Scirpus acutus Pure	11679	*Schoenoplectus acutus - (Schoenoplectus tabernaemontani) Alliance only*	5	good match, no matter about eichornia

Waypt	GPS AA Waypoint	AIS Code	AIS Name	Delta V_id	Field-checked Classification Name	AA Score	Comments
	72a	3442	Cornus sericea - Salix lasiolepis / (PhAu)	11687	*Salix lasiolepis-Rubus discolor phase*	3	cose is very distinct from salas-rudi so only get a 3/5
73							see aa072 same poly
	73a						see aa072a same poly
	72b	6211	Brazilian Waterweed Egeria - Myriophyllum Submerged	11701	*Egeria-Cabomba-Myriophyllum spp.*	5	good match
74		4502	Mixed Scirpus / Floating Aquatics (Hydrocotyle-Eichhornia) Complex	11567	*Schoenoplectus californicus-Eichhornia crassipes*	5	fits description including presence of both scirpus ac and ca
	74a	3442	Cornus sericea - Salix lasiolepis / (PhAu)	11599	*Cornus sericea-Salix lasiolepis*	5	good match
75		6211	Brazilian Waterweed Egeria - Myriophyllum Submerged	11563	*Eichhornia crassipes Alliance only*	don't use	probably was a good call, just no appreciable eichornia in 2002 here
	75a	4630	Common Reed Phragmites australis	11592	*Phragmites australis Alliance only*	5	good match
	76a	3460	Arroyo Willow Salix lasiolepis	11724	*Salix lasiolepis-Rubus discolor phase*	5	good to alliance level
76		3420	California Wild Rose Rosa californica	11693	*Rubus discolor Alliance only*	4	missed rudi and called roca, a close miss
77		1350	California Walnut Juglans californica	12048	*Alnus rhombifolia Alliance only*	3	may want to discuss, this is probably restoration work

Waypt	GPS AA Waypoint	AIS Code	AIS Name	Delta V_id	Field-checked Classification Name	AA Score	Comments
78		4511	Scirpus acutus Pure	11679	*Schoenoplectus acutus - (Schoenoplectus tabernaemontani) Alliance only*	5	good to alliance, ,may be with phau definitely has bidens
153		6211	Brazilian Waterweed Egeria - Myriophyllum Submerged	16908	*Eichhornia crassipes Alliance only*	don't use	clearly a change since 2002
	153a	4514	Scirpus acutus - (Typha latifolia) - Phragmites australis	16786	*Schoenoplectus californicus-Eichhornia crassipes*	4	missed again! (but don't worry you guys are great!)
154		3442	Cornus sericea - Salix lasiolepis / (PhAu)	16798	*Salix lasiolepis-Rubus discolor phase*	3	cose is very distinct from salas-rudi so only get a 3/5
157		4310	Giant Cane Arundo donax	17085	*Arundo donax Alliance only*	5	nice
158		6101	Generic Floating Aquatics	17412 (17403, 17395)	*Eichhornia crassipes Alliance only*	5	correct at higher level; do not count polys in parens as EICR has increased since photo taken (see ground photo)
89		9300	Exotic Vegetation Stands	9400	Exotic Vegetation Stands	5	correct; non-native sycamore planting
90		9401	Levee Rock Riprap	9315	*Schoenoplectus californicus-Schoenoplectus acutus*	don't use	strip of Scirpus too narrow to map; AIS mapped levee adjacent as riprap
201		3461	Salix lasiolepis - Mixed brambles (RoCa - ViTi - RuDi)	2922	*Salix lasiolepis-Rubus discolor phase*	5	good match
	201a	4701	Ruderal Herbaceous Grasses & Forbs	2924	ruderal herbaceous (non-native annual forbland)	5	called Conium in field, so correct
203							See this point on Sacto coverage (it's on both)

Waypt	GPS AA Waypoint	AIS Code	AIS Name	Delta V_id	Field-checked Classification Name	AA Score	Comments
203		2230	Valley Oak Quercus lobata	2841	*Populus fremontii Alliance only*	4	qulo and sago-pofr are surprisingly closely related ecologically in the delta
	203a	1383	Salix gooddingii - Quercus lobata / Wetland Herbs	2834	*Salix gooddingii-Populus fremontii*	4	ok
	203b	9300	Exotic Vegetation Stands	2857	Exotic Vegetation Stands	5	great
204		9401	Levee Rock Riprap	2888	*Equisetum (arvense, variegatum, hyemale) Semipermanently Flooded Herbaceous Alliance*	0	See ground photo and air photo; as mapped it seems more veg present, although not good type. This should be corrected, and the error is probably in part related to small narrow size of poly, but it clearly looks vegetated in imagery
	204a	2230	Valley Oak Quercus lobata	2875	*Quercus lobata Alliance only*	5	correct, however, pi's should bisect poly at road and call poly along water as qulo and opy around building exotic veg
227		9310	Eucalyptus	3006	*Robinia pseudoacacia*	3	MisID'd tree suggest having category for non native trees (higher category you can lump to that would include acacia and locust, etc.)
	227a	9300	Exotic Vegetation Stands	2995	Exotic Vegetation Stands	5	correct; non-native trees (conifers/hardwoods)
228		3461	Salix lasiolepis - Mixed brambles (RoCa - ViTi - RuDi)	2986	"mixed woodland"-not a type	don't use	See ground photo. Field notes say POFR-QULO-ROPS-SAGO-PLRA
229		4701	Ruderal Herbaceous Grasses & Forbs	3057	*Cephalanthus occidentalis Alliance only*	don't use	below MMU
230		9300	Exotic Vegetation Stands	3360	*Robinia pseudoacacia*	5	good match; could have ID'd ROSP?
231		2230	Valley Oak Quercus lobata	4239	*Quercus lobata Alliance only*	5	correct, though pi divided polygon between upper/lower bank. Lower bank (Deltav_id#4098) doesn't seem to be attributed correctly, however. Not shrubby; see ground photos.

Waypt	GPS AA Waypoint	AIS Code	AIS Name	Delta V_id	Field-checked Classification Name	AA Score	Comments
232		2110	Coast Live Oak Quercus agrifolia	4698	*Quercus agrifolia Alliance only*	5	This western polygon correct; in field called QUAG alliance w/less QULO
	232also	2233	Quercus lobata - Alnus rhombifolia (SaLa - PoFr - QuAg)	4638	*Quercus agrifolia Alliance only*	don't use	This eastern polygon may indeed have more QULO in it, in which case this is the closest mapping unit. However, aa doesn't describe difference between the two polys so we cant be sure which is which. Pi should be happy enough because the call seem generally correct
233		2110	Coast Live Oak Quercus agrifolia	4764	*Robinia pseudoacacia*	1	MisID'd tree suggest having category for non native trees (higher category you can lump to that would include acacia and locust, etc.), not at all similar and not ecologically related like calling a cornfield a Nassella grassland.
234		9401	Levee Rock Riprap	4802	*Alnus rhombifolia Alliance only*	don't use	Likely below MMU, plus ALRHs look like they're very young in ground photo; can't see them on aerial at all.
234a		4710	California Annual Grasslands - Herbaceous	4779	California Annual Grassland/Herbaceous Alliance	5	correct
235		9401	Levee Rock Riprap	4802	"mixed riparian" POFR, ALRH, PLRA	don't use	Likely below MMU, mapped as same poly for part of AA234
236		3461	Salix lasiolepis - Mixed brambles (RoCa - ViTi - RuDi)	6619	*Alnus rhombifolia/Salix exigua(Rosa californica)*	don't use	ALRH portion may be below MMU, but other components (VICA, SAEX) present
237		3481	Salix exigua - (SaLa - RuDi - RoCa)	6515	*Salix lasiolepis-Rubus discolor phase*	5	correct
238		2230	Valley Oak Quercus lobata	6790	*Quercus agrifolia Alliance only*	4	Field notes say QULO occasional in overstory. Ecologically closely related in delta classification
216		1381	Salix gooddingii / wetland herbs	156, 167	*Salix gooddingii alliance only*	5	sago correct, but understory is Foeniculum vulgare/mixed per field notes , make correction to alliance only
	216a	4701	Ruderal Herbaceous Grasses & Forbs	128	ruderal herbaceous (non-native annual forbland)	5	correct

Waypt	GPS AA Waypoint	AIS Code	AIS Name	Delta V_id	Field-checked Classification Name	AA Score	Comments
218		4513	Scirpus acutus - Typha latifolia	150	*Schoenoplectus acutus-Typha latifolia*	5	accurate to association!
224		2231	Quercus lobata / Rosa californica (RuDi - SaLa / Carex)	1434	*Quercus lobata Alliance only*	5	checked if 105m-long stand of ROPS (assessed bu aa as the core) is below MMU; field notes say QULO is to north and south on banks (so 5 if below MMU)
201		3461	Salix lasiolepis - Mixed brambles (RoCa - ViTi - RuDi)	2922	*Salix lasiolepis-Rubus discolor phase*	5	good match
217		1381	Salix gooddingii / wetland herbs	214	*Salix gooddingii-Populus fremontii*	4	called POFR-SAGO in field; this could be better labeled by ais so get 4/5
	217b	4514	Scirpus acutus - (Typha latifolia) - Phragmites australis	223 (and 210)	*Schoenoplectus acutus-Typha latifolia*	5	poly 210 labeled SCAC-TYLA, so also correct
219		1382	Salix gooddingii - Populus fremontii - (QuLo-SaEx-RuDi)	151	*Salix gooddingii-Populus fremontii*	5	note point misprojected
	219a	1382	Salix gooddingii - Populus fremontii - (QuLo-SaEx-RuDi)	173	*Salix gooddingii-Populus fremontii*	5	
	219b	3481	Salix exigua - (SaLa - RuDi - RoCa)	166	*Salix exigua Alliance only*	5	
220		2230	Valley Oak Quercus lobata	263	*Quercus lobata Alliance only*	5	
222		9800	Water	292	*Polygonum amphibium (lapathifolium)*	don't use	lake drier at time of field survey
	222a	4513	Scirpus acutus - Typha latifolia	286	*Schoenoplectus acutus-Typha latifolia*	5	
214		1360	Fremont Cottonwood Populus fremontii	1134, 1174	*Populus fremontii Alliance only*	5	actually called pofr-sago in field, but pofr dominated tree layer

Waypt	GPS AA Waypoint	AIS Code	AIS Name	Delta V_id	Field-checked Classification Name	AA Score	Comments
225		1383	Salix gooddingii - Quercus lobata / Wetland Herbs	1276	*Populus fremontii Alliance only*	4	sago not mentioned in field; called pofr-qulo-salas
215		2231	Quercus lobata / Rosa californica (RuDi - SaLa / Carex)	2064	*Quercus lobata/Rubus discolor*	5	
211		1382	Salix gooddingii - Populus fremontii - (QuLo-SaEx-RuDi)	283	*Salix gooddingii-Populus fremontii*	5	great
	211a	4710	California Annual Grasslands - Herbaceous	266	ruderal herbaceous (non-native annual forbland)	5	field notes say silybum/centaurea/heterotheca, but visited in october, plus poly covers much more area than the limited observation in the field
		5530	Perennial Pepperweed Lepidium latifolium		ruderal herbaceous (non-native annual forbland)	don't use	we don't think there is lepidium based on a field photo, so suggest you change this to ruderal herbaceous. Question: when do you use cal annual grassland versus 4701. we think you should use 4701 for any herbaceous uplands that arent pepperweed or fennel or conium or lower annual grasses.
2111		1360	Fremont Cottonwood Populus fremontii	306	*Populus fremontii Alliance only*	5	waypoint misprojected, but clearly this polygon is the one described in field
	2111a	1340	Box Elder Acer negundo	302	*Acer negundo-Salix gooddingii*	5	field went to association, but map to alliance; okay
212		7000	Algae	528	Permanently flooded temperate or subpolar hydromorphic-rooted vegetation	4	Lemna in field; consider this (Lemna or Azolla) as a generic mapping unit and call it Permanently flooded temperate or subpolar hydromorphic-rooted vegetation
	212a	1360	Fremont Cottonwood Populus fremontii	522	*Populus fremontii Alliance only*	5	
	212b	1360	Fremont Cottonwood Populus fremontii	524	*Populus fremontii Alliance only*	5	

Waypt	GPS AA Waypoint	AIS Code	AIS Name	Delta V_id	Field-checked Classification Name	AA Score	Comments
213		9200	Agriculture	405	Agriculture	5	
	213a	2232	Quercus lobata - Acer negundo	721	*Quercus lobata Alliance only*	5	although association may be incorrect
	213b	1382	Salix gooddingii - Populus fremontii - (QuLo-SaEx-RuDi)	755	*Salix gooddingii-Populus fremontii*	5	
226		3481	Salix exigua - (SaLa - RuDi - RoCa)	2643	*Salix exigua-(Salix lasiolepis)-Rubus discolor*	5	
202		3410	Blackberry Rubus Discolor	2492	*Equisetum (arvense, variegatum, hyemale) Semipermanently Flooded Herbaceous Alliance*	don't use	field notes say equisetum and TODI, this is a very messy early seral stand with no good field name, but best might be Equisetum base on field photo
	202a	1321	Alnus rhombifolia / Salix exigua (Rosa californica)	2505	*mix trees: QULO, JUCAH, PLRA plus Cephalanthus*	don't use	no good type in field; don't use? Unclassifiable
	202b	4701	Ruderal Herbaceous Grasses & Forbs	2436	California Annual Grassland/Herbaceous Alliance	4	close relationship, debatable phenological issues but 4/5 in general
221		4710	California Annual Grasslands - Herbaceous	266	*Typha latifolia-pure*	don't use	this poly has changed since 2002, when it was a recently constructed detention basin with little or no discernable wetland vegetation
223		4511	Scirpus acutus Pure	970	*Schoenoplectus acutus - pure*	5	small poly correct, the poly to e 972 has changed to be tyla pure rather than water weed or open water.
96		1382	Salix gooddingii - Populus fremontii - (QuLo-SaEx-RuDi)	1436	*Salix gooddingii-Populus fremontii*	5	good match for small poly
	96a	4513	Scirpus acutus - Typha latifolia	1324	*Schoenoplectus acutus - pure*	4	aa suggests scac pure so 4/5
	96b	9200	Agriculture	1360	Agriculture	5	good match
97		4513	Scirpus acutus - Typha latifolia	1324	*Schoenoplectus acutus-Typha angustifolia*	4	not match at association but close

Waypt	GPS AA Waypoint	AIS Code	AIS Name	Delta V_id	Field-checked Classification Name	AA Score	Comments
	97a	5411	Ludwigia peploides	1437		don't use	but likely to have changed and certainly not Ludwigia in 2005
99		1382	Salix gooddingii - Populus fremontii - (QuLo-SaEx-RuDi)	1419	*Salix gooddingii-Populus fremontii*	5	good to association
100		5530	Perennial Pepperweed Lepidium latifolium		*Distichlis spicata-Annual grasses*	don't use	we think this has changed but update to lolium 4720
103		4511	Scirpus acutus Pure	1374, 1364	*Schoenoplectus acutus-Typha latifolia*	4	didn't mention tyla,
	103a	5411	Ludwigia peploides	1367	*Ludwigia peploides Association*	5	good
104		5206	Scirpus spp. in managed wetlands	1282	*Schoenoplectus acutus-Xanthium strumarium*	5	pi has a 4515 that would match this but we bet you will not use this unless you have field data, so you may want to replace this with 5206 on a regular basis
105		4720	Italian Rye-grass Lolium multiflorum	1222	*Lolium multiflorum Alliance only*	5	good match; polygon 1233 (adjacent) is probably managed scirpus but cant score you because it has changed since photo 2002
106		1383	Salix gooddingii - Quercus lobata / Wetland Herbs	1234	*Salix gooddingii/wetland herb*	4	no qulo expected in Yolo WLA, you get 4/5
107		4513	Scirpus acutus - Typha latifolia	1228	*Schoenoplectus acutus-Typha angustifolia*	4	wrong typha, maybe you should assume that in Yolo when you see typha it is angustifolia not latifolia
108						don't use	now is xanthium on w and scac on e, but you saw mostly water
95		4710	California Annual Grasslands - Herbaceous	1135	*Distichlis spicata-Annual grasses*	4	close. But a perennial type in the disp alliance
	95a	5206	Scirpus spp. in managed wetlands	1452	*Schoenoplectus acutus - (Schoenoplectus tabernaemontani) Alliance only (Bulrush)*	5	aa only did to alliance so perfect

Waypt	GPS AA Waypoint	AIS Code	AIS Name	Delta V_id	Field-checked Classification Name	AA Score	Comments
136		4720	Italian Rye-grass Lolium multiflorum	673	*Distichlis spicata-Annual grasses*	5	small linear feature is not pulled out because too narrow, but aa called this cyperis-phyla which would translate to ntermittently flooded perennial herbaceous vegetation
132		3460	Arroyo Willow Salix lasiolepis	848	*Salix gooddingii-Populus fremontii*	3	this is very early seral pofr-sago/saex and we can see where you could call it a salas type, however, technically salas is less closely related to sago-pofr than saex so you get a 3
	132a	4340	Broad-leaf Cattail Typha latifolia	837	*Typha latifolia alliance*	5	good at alliance
	132b	4701	Ruderal Herbaceous Grasses & Forbs	819	*ruderal herbaceous (non-native annual forbland)*	5	good
133						don't use	this ha changed since 2002 now tyla but was ruderal
134		5411	Ludwigia peploides	827, 821	*Ludwigia peploides Association*	5	this is less extensive now than in 2002, but still present on e side of pond and parts of center and w
135							
101		5204	Managed alkali wetland (Crypsis grass)	1430	*Distichlis spicata*	3	this is generally correct but no crypsis, its disp, so different alliance although ecologically close, crypsis is an annual not a perennial, though
102						don't use	same poly as 1324, (98a)
98		1382	Salix gooddingii - Populus fremontii - (QuLo-SaEx-RuDi)	1409	*Cephalanthus occidentalis Alliance only*	3	same meso cluster but different alliances, although some ecological similarity
	98a	4513	Scirpus acutus - Typha latifolia	1324	*Schoenoplectus acutus-Typha latifolia*	5	there is some fine scale partitioning of this big polygon in to pure scac and scac-tyla, but as a generic lumped polygon we give you 5/5
	98b	9200	Agriculture	1360	*Agriculture*	5	good match
	92a	5206	Scirpus spp. in managed wetlands	1452	*Schoenoplectus acutus - (Schoenoplectus tabernaemontani) Alliance only (Bulrush)*	5	good match

Waypt	GPS AA Waypoint	AIS Code	AIS Name	Delta V_id	Field-checked Classification Name	AA Score	Comments
92						don't use	
93		4710	California Annual Grasslands - Herbaceous	1428	*Distichlis spicata-Annual grasses*	don't use	some parts are a match at mapping unit, in some parts could have gone to lolium ,, however, there seems to be a gradient which runs to disp dominance in some parts (see aa092) in general this cant be assessed further because of high variation so we are throwing it out
94		5530	Perennial Pepperweed Lepidium latifolium	1421	*Distichlis spicata-Annual grasses*	4	probably closely related by no lepidium mentioned by aa crew
88		3461	Salix lasiolepis - Mixed brambles (RoCa - ViTi - RuDi)	9549	*Cornus sericea-Salix lasiolepis*	3	cose is very distinct from salas-rudi so only get a 3/5
	88a	1382	Salix gooddingii - Populus fremontii - (QuLo-SaEx-RuDi)	9566	*Salix gooddingii-Populus fremontii*	5	good match
87		1380	Black Willow Salix gooddingii	10045	*Salix lasiolepis Alliance only*	3	
	87a	4514	Scirpus acutus - (Typha latifolia) - Phragmites australis	9985	*Schoenoplectus acutus-Phragmites australis*	5	good match
	87b	4501	Mixed Scirpus Mapping Unit	10030	*Schoenoplectus californicus-Schoenoplectus acutus*	5	good match; could correct to SCCA-SCAC
	87c	3460	Arroyo Willow Salix lasiolepis	10025	*Populus fremontii Alliance only*	don't use	sketchy as to which poly this refers, perhaps don't count
85		9300	Exotic Vegetation Stands	10063	Exotic Vegetation Stands	5	good match; Lombardy poplar I'd in field

Waypt	GPS AA Waypoint	AIS Code	AIS Name	Delta V_id	Field-checked Classification Name	AA Score	Comments
	85a	4514	Scirpus acutus - (Typha latifolia) - Phragmites australis	10099	*Schoenoplectus acutus - (Schoenoplectus tabernaemontani) Alliance only*	5	good, perhaps recode poly to alliance
86		1321	Alnus rhombifolia / Salix exigua (Rosa californica)	10140	*Alnus rhombifolia Alliance only*	5	field notes to alliance only
	86b	9300	Exotic Vegetation Stands	10148	Exotic Vegetation Stands	5	good call; "hodgepodge of ornamental trees"
83		3440	California Dogwood Cornus sericea	10495	*Schoenoplectus acutus- Phragmites australis*	don't use	guessing on veg type; poly is probably combo of #3 and #4 on field form, *i.e.*, cose/phau band plus phau/typha/scirpus stand. Not sure how to assess.
	83b	4511	Scirpus acutus Pure	10488	*Schoenoplectus acutus - pure*	5	I'm not exactly sure of poly, but this seems correct
	83c	6211	Brazilian Waterweed Egeria - Myriophyllum Submerged	10484	*Schoenoplectus acutus - (Schoenoplectus tabernaemontani) Alliance only*	don't use	is this the correct poly; may not be
	83d	3461	Salix lasiolepis - Mixed brambles (RoCa - ViTi - RuDi)	10492	*Salix lucida Alliance only*	3	salas-rudi is ecologically pretty different from salix lucida so 3/5
84		1382	Salix gooddingii - Populus fremontii - (QuLo-SaEx-RuDi)	10482	*Salix gooddingii alliance only*	5	some pofr also noted in field, could be same association
82		1382	Salix gooddingii - Populus fremontii - (QuLo-SaEx-RuDi)	10991	*Salix gooddingii- Populus fremontii*	5	good match
195			can't tell which polys			don't use	poorly described in aa form
1951			can't tell which polys			don't use	poorly described in aa form

Waypt	GPS AA Waypoint	AIS Code	AIS Name	Delta V_id	Field-checked Classification Name	AA Score	Comments
196		3461	Salix lasiolepis - Mixed brambles (RoCa - ViTi - RuDi)	21247	*Rubus discolor Alliance only*	3	ecologically similar but aerial does not suggest much if any salasio, so physiognomy is different and get 3/5
177		9800	Water	159 (this immediate part of this poly)	*Eichhornia crassipes Alliance only*	don't use	EICH has filled in the channel since air photo taken (see ground photos)
178		3460	Arroyo Willow Salix lasiolepis	21323	*Salix lasiolepis Alliance only*	5	Good, but perhaps expand poly 40 or so meters further to west in Salix (?)
	178a	1360	Fremont Cottonwood Populus fremontii	21320	*Eucalyptus globulus mapping unit*	1	
179		1360	Fremont Cottonwood Populus fremontii	21434	Populus fremontii Alliance only	5	As best as can figure out AA field form, plus ground photo
	179a	3461	Salix lasiolepis - Mixed brambles (RoCa - ViTi - RuDi)	21417	*Rubus discolor Alliance only*	don’t use	Maybe same as 196, above, though ALRH, CEOC, SALAS mentioned as occurring in RUDI, but cant be sure from field notes which poly it is
180		3481	Salix exigua - (SaLa - RuDi - RoCa)	21304	*Salix exigua-(Salix lasiolepis)-Rubus discolor*	5	good call
59						out of study area	
60						out of study area	
61						out of study area	

Waypt	GPS AA Waypoint	AIS Code	AIS Name	Delta V_id	Field-checked Classification Name	AA Score	Comments
62		6211	Brazilian Waterweed Egeria - Myriophyllum Submerged	4594	*Egeria-Cabomba-Myriophyllum spp.*	5	poly includes all open water and thin margin of scac, but remember its NAIP and this is as good as a mapping unit can be, see photo for confirmation (2322)
63		4501	Mixed Scirpus Mapping Unit	4177	*Schoenoplectus acutus - (Schoenoplectus tabernaemontani) Alliance only (Bulrush)*	5	alliance only from field because cant id the typha species, mapping unit is analog to alliance level
64		4513	Scirpus acutus - Typha latifolia	4163	*Schoenoplectus acutus-Typha angustifolia*	4	maybe there is more t angustifolia than latifolia on this part of delta because it's alkaline over there, so default would be tyan.
65		2231	Quercus lobata / Rosa californica (RuDi - SaLa / Carex)	4307	*Quercus lobata/Rubus discolor*	5	nice call
66					*Typha latifolia*	don't use	unmappable at NAIP scale (ditch is ca. 8 m wide)
67		4513	Scirpus acutus - Typha latifolia	3506	*Polygonum spp. - Mixed Forbs Temporarily Flooded Herbaceous Alliance*	4	ecologically close to tyla even though dominated by Cyperus eragrostis with some polygonum, judging from cluster analysis
131		4340	Broad-leaf Cattail Typha latifolia	618	*Schoenoplectus acutus - (Schoenoplectus tabernaemontani) Alliance only (Bulrush)*	4	main aa point is below mmu (thin band of saex) but can do the scac-tyla
163		5206	Scirpus spp. in managed wetlands	2304	*Schoenoplectus acutus - pure*	5	good at alliance level with proper management call (flooded in winter)
164		4211	Distichlis spicata - Annual Grasses	2192	*Distichlis spicata-Annual grasses*	5	this aa is discussed in part in 163 comments as well as 164, by deduction we can determine that poly in question is disp-annual grasses, actual aa164 is below mmu (and sparse grindelia etc.) and included in this poly.
165		4710	California Annual Grasslands - Herbaceous	1624	*Distichlis spicata-Annual grasses*	4	4/5 because this call does not emphasize the alkaline nature of the grassland here, better to call it disp-annual grasses, also has frankenia,

Waypt	GPS AA Waypoint	AIS Code	AIS Name	Delta V_id	Field-checked Classification Name	AA Score	Comments
							etc.
166		4513	Scirpus acutus - Typha latifolia	2252	*Schoenoplectus acutus - pure*	4	same alliance, but tried for association and missed, very heavily grazed
167		9300	Exotic Vegetation Stands	2174	*Eucalyptus Alliance (includes multiple species)*	5	no problem, do you have a rule about when you decide when to call eucalyptus versus exotic, could you call it exotic trees versus veg?
168		4402	Vernal Pools	1951	Vernal Pool stands	5	aa calls this a playa pool
169		4402	Vernal Pools	2044	Vernal Pool stands	5	good work
170		4511	Scirpus acutus Pure	1841	tamarix (non specific) with scirpus acutus	4	suggest re drawing this polygon as it includes a bit of scac, tamarix (below mmu) and ludwigia and water. Just do the scac part on ne end and do rest attach to poly #1806
171		4511	Scirpus acutus Pure	1806	*Ludwigia peploides Association*	don't use	see comments for aa 170, attach the ludwigia to #1806
172		4211	Distichlis spicata - Annual Grasses	1720	*Distichlis spicata- Annual grasses*	5	not core polygon for aa, because that was too narrow for NAIP (thin strip of saex), but aa describes the disp-ann grass so we did that
137						out of study area	
138						don't use	below mmu not delineated no additional info from aa form
139		1380	Black Willow Salix gooddingii	25500	*Salix gooddingii*	5	both aa and pi correct at alliance level
140						out of study area	qulo but outside
141		1380	Black Willow Salix gooddingii	25442	*Salix gooddingii*	5	assessed SAGO not paspalum < mmu as discussed on aa form
142		1380	Black Willow Salix gooddingii	25338	*Salix gooddingii*	5	good match

Waypt	GPS AA Waypoint	AIS Code	AIS Name	Delta V_id	Field-checked Classification Name	AA Score	Comments
	142a	4710	California Annual Grasslands - Herbaceous	25332	California Annual Grassland/Herbaceous Alliance	5	good match
143		1382	Salix gooddingii - Populus fremontii - (QuLo-SaEx-RuDi)	25327	*Salix gooddingii-Populus fremontii*	5	match at association
	143a	3460	Arroyo Willow Salix lasiolepis	25350	*Salix exigua Alliance only*	4	close but at alliance level this is not totally correct
144		1360	Fremont Cottonwood Populus fremontii	25195	*Salix gooddingii-Populus fremontii*	4	technically a sago alliance, but very closely related
145		1382	Salix gooddingii - Populus fremontii - (QuLo-SaEx-RuDi)	25232	*Salix gooddingii*	5	association wrong but alliance correct (no pofr mentioned by aa team)
146		1382	Salix gooddingii - Populus fremontii - (QuLo-SaEx-RuDi)	24939	*Salix gooddingii*	5	correct to alliance
	146a	2230	Valley Oak Quercus lobata	25066	*Quercus lobata Alliance only*	5	fine
147		1382	Salix gooddingii - Populus fremontii - (QuLo-SaEx-RuDi)	24890	*Salix gooddingii-Populus fremontii*	5	this matches at association
148		4701	Ruderal Herbaceous Grasses & Forbs	24228	ruderal herbaceous (non-native annual forbland)	5	this stand in 2005 was dominated by salsola tragus (tumbleweed)
149		1382	Salix gooddingii - Populus fremontii - (QuLo-SaEx-RuDi)	24593	*Salix gooddingii-Populus fremontii*	5	aa mentions only pofr, but ground photo clearly shows sago too.
150		1383	Salix gooddingii - Quercus lobata / Wetland Herbs	23876	*Salix gooddingii-Populus fremontii*	4	suggest redrawing poly to individuate the qulo at the w and nw ends from the sago-pofr closer to the river.

Waypt	GPS AA Waypoint	AIS Code	AIS Name	Delta V_id	Field-checked Classification Name	AA Score	Comments
197		1321	Alnus rhombifolia / Salix exigua (Rosa californica)	21218	*Cephalanthus occidentalis Alliance only*	3	difficult to determine ecological relationship due to lack of ceoc plots in data set, conservatively a 3/5

APPENDIX H SELECTED OUTCOMES ANALYSIS

Sacramento-San Joaquin Delta Vegetation Mapping 2007

Selected Outcomes Analysis

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January 2, 2007

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Introduction

The primary purpose of the following discussion is to compare the methodologies used in two independent vegetation mapping projects and examine: (1) the success of each methodology in meeting established mapping criteria; (2) labeling and positional accuracy within each project including the consistent treatment of linear features; and (3) the efficiency of each methodology in terms of personnel hours.

Sacramento-San Joaquin Delta Mapping Project. Please refer to the main Sacramento-San Joaquin Delta Vegetation and Land Use Classification and Mapping Project (Delta Project) Report for detailed information on the goals, methods and outcomes.

Suisun Marsh Vegetation Mapping Project. The Suisun Marsh is one of the largest contiguous brackish marshes remaining in the United States covering over 69,000 acres of tidal and seasonally managed wetland and located just west of the Delta Project study area. In 1977 the Suisun Marsh Preservation Act was legislated and a subsequent Plan of Protection developed. As part of the monitoring program in the Plan of Protection, a Triennial Vegetation Survey was developed to document the overall vegetation composition of the marsh and to monitor habitat with the use of aerial photography in combination with ground verification. Concerns about early survey methodologies led to the 1999 Suisun Marsh Vegetation Mapping Project (Suisun Project) based on interpretation of aerial photographs combined with field investigation. Polygon delineation and attribution were performed using 341 diapositive aerial photographs (1:9600 scale) analyzed by photo interpreters on a light table, then later digitized, corrected for distortion, and mosaiced. Vegetation patches were drawn with a 0.2 mm water-soluble pen directly on mylar sheets taped to the diapositives. During digitization these lines were redrawn on-screen. The resulting polygons were interpreted for vegetative composition by field data collection personnel. See Keeler-Wolf et al. (2000) for detailed information on the goals, methods and outcomes of the Suisun Project.

Mapping Criteria

Mapping criteria are established in land cover mapping projects to ensure consistent and meaningful representation of features in the map product. Imagery resolution may constrain mapping detail however the delineation of practical and meaningful polygons tends to drive current mapping criteria. The Delta and Suisun Projects established a minimum mapping unit; additionally, the Delta Project had a minimum polygon width. Mapping criteria for the Delta project are further described in Appendices A and B.

Methods. The minimum mapping unit (MMU) attempts to define the smallest vegetation patch size that can be reliably represented in the land cover map. The predetermined MMU for both the Suisun and Delta Projects was 0.5 acre. To assess how well the mapping processes adhered to the MMU, polygon acreage was calculated in ArcView (Ver. 3.3 ESRI, Inc.) using the following formula (area in m^2):

Equation 1: $\text{Acres} = [\text{area}]*0.0002471$

A simple query was run in ArcView to select those polygons whose acreage was less than the MMU.

Similarly, the minimum polygon width was 10 meters. Short of measuring the narrowest portion of each polygon, creating a meaningful way to analyze minimum width is arbitrary and approximate. To generally assess how well the mapping process adhered to this requirement, a simple index of polygon perimeter to area was created in ArcView using the following formula:

Equation 2: Index = [perimeter]/[area]

The larger the index the greater the perimeter to area ratio which generally corresponded to longer, narrower polygons. The index ranged from <0.01 to 1.15. Polygons were randomly selected and the narrowest portion measured to determine at what index the minimum width requirement was met for all portions of the polygon. At an index value of 0.13 polygons tended to have significant portions less than 10 m in width, especially those less than 2 acres in area. A simple query was run in ArcView to select those polygons whose index was less than or equal to 0.13.

During the index inquiry, it was observed that several mapping units of lesser value to the Delta Project goals tended to be coarsely mapped. A simple query revealed that three non-vegetative mapping units comprised 82% of the Delta study area: agriculture; urban/built environment; and water. To shift focus to the naturally vegetated land cover units (naturally vegetated study area; vegetation polygons) these mapping units were removed from the analysis.

Though the Suisun Project tended to delineate all features to the same level of detail, for consistency ten non-vegetative mapping units, comprising 14% of the Suisun study area were removed from the analysis: road; trail; water treatment pond; urban area; bare ground; parking lot; structure; slough; ditch; and railroad track. Although there was no minimum width criterion for the Suisun Project, the same perimeter to area analysis was performed for comparison.

Results. Results for the minimum mapping criteria inquiry are given in Table 1.

For this comparison, the Delta Project contained 19,609 vegetation polygons with areas ranging from 0.01 to 1,923 acres. Less than 1% (0.76%) of the naturally-vegetated study area was mapped below the MMU and accounted for 17% of vegetation polygons. Thirty-seven percent of vegetation polygons, representing 6.7% of the naturally-vegetated study area had an index ≥0.13.

The Suisun Project had 29,273 vegetation polygons with areas ranging from 0.04 to 215 acres. Approximately 2.3% of the vegetative study area was mapped below the MMU and accounted for 14.7% of vegetation polygons. Thirty-two percent of vegetation polygons representing 10.9% of the vegetative study area had an index ≥0.13.

Table 1 – Acreage and Polygon Information Related to Minimum Mapping Criteria

	Delta Project			Suisun Project		
	acres	#	%	acres	#	%
Total Area	725,582		100.0	69,291		100.0
Vegetated Area†	131,005		18.1	59,334		85.6
Non-Vegetated Area‡	594,577		81.9	9,957		14.4
Vegetated Area <MMU*	996		0.8	1,575		2.3
Vegetated Area Index ≥0.13	8,777		6.7	7,572		10.9
Total Polygons		25,579	100.0		31,152	100.0
Vegetated Polygons†		19,609	76.7		29,273	94.0
Non-Vegetated Polygons‡		5,970	23.3		1,879	6.0
Vegetated Polygons <MMU*		3,276	16.7		4,302	14.7
Vegetated Polygons Index ≥0.13		7,581	38.7		9,280	31.7

† All naturally vegetated types and mapping units except those listed below (‡).

‡ Delta: agriculture; urban/built environment; and water. Suisun: road; trail; water treatment pond; urban area; bare ground; parking lot; structure; slough; ditch; and railroad track.

* Minimum mapping unit (MMU) = 0.5 acres for both projects.

Linear Features

The delineation of linear features in vegetation mapping frequently present challenges in meeting the minimum mapping criteria while maintaining consistent representation. Common linear features in the Delta and Suisun Projects included roads, levees, riprap and ditches. These features generally have ecological significance, typically driving micro-topography, hydraulic regime, and/or disturbance regime.

The Suisun Project had no predetermined guidelines for delineation of linear features. This lack of guidance coupled with multiple people performing delineations resulted in inconsistent treatment of linear features across the study area. For example, roads were treated in three ways: fully delineated; delineated on one edge; or cut across. Such inconsistencies resulted in attribution challenges and occasionally retrospective corrective action.

Consequently, mapping guidelines were required for the Delta Project. These guidelines were created by the mapping personnel and amended as needed. For the purposes of this discussion, only those guidelines pertinent to natural vegetation will be included. The complete Mapping Criteria and Criteria Decisions documents are given in Appendices A and B, respectively.

The following is taken directly from the Mapping Criteria for linear vegetation features:

> 1. Windrows will not be mapped. However, a row of trees occurring naturally (along a watercourse, for example) will be delineated as a vegetation polygon. Trees flanking either side of a narrow road will be collected in one vegetation polygon,

where the polygon will be wider than 10 meters. Also, any row of trees where the width of the signature exceeds 10 meters will be mapped.

2. Natural vegetation often occurs along minor canals and ditches (those that are too narrow to map). The total width from the outside of the vegetation on one side to the outside of the vegetation on the other side sometimes exceeds 10 meters, which is the minimum width for a vegetation polygon.

In these situations, a polygon will be drafted only if the vegetation on one side of the ditch bank is wider than 10 meters, and the entire polygon will be larger than one acre.

If one bank has vegetation wider than 10 meters and the other bank has vegetation narrower than 10 meters, the delineation would include vegetation on both sides of the bank.

3. Although normally road centerlines are used to separate land use types, exceptions may occur where trees are involved. For instance, there may be a large area of trees on one side of a road, and a narrow (<10 m) strip of trees on the other side of the road, which is in turn flanked by cropland. Rather than using the road to separate the natural vegetation from the cropland, the delineation will be made on the tree/cropland interface.

4. Trees are of more concern than weedy vegetation. Areas of weedy vegetation that exceed 10 meters in width but are less than an acre total will not be collected. If the same situation occurred with trees, areas smaller than an acre may be collected."

Methods. A systematic review of linear feature delineations was beyond the scope of this report, thus two areas were selected for ocular review and qualitative analysis: the central Delta between Highways 4 and 12; and Calhoun Cut.

For the Calhoun Cut inquiry an area 4500m x 4500m directly adjacent and west of aerial photo sections 10sfh090360, 10sfh090345 and 10sfh090330 was selected for viewing. This area was selected intentionally because it contains complex natural vegetation beyond the coverage of the high-resolution aerial photography. The mosaiced imagery (Naip_1-1_1n_s_ca095_2005_1.sid) was overlaid with the land cover delineations and viewed at 1:7000 scale. The treatment of linear vegetative features was compared with the 4 criteria discussed above.

For the central Delta inquiry, 12 high-resolution aerial photo sections (Table 2) were selected for viewing. These 12 were selected intentionally to contain waterways (and thus levees and likely linear vegetation) and to be well distributed. The photos were overlaid with the land cover delineations and viewed at 1:7000 scale. The treatment of linear vegetative features was compared with the 4 criteria discussed above. Photos were scored based on 95% adherence to the mapping criteria for linear vegetation.

Results. The area scrutinized for the Calhoun Cut inquiry conformed very well to the mapping criteria; one exception was a canal >10m wide that was not mapped. There were several natural vegetation polygons that did not meet the minimum mapping criteria.

Table 2 lists the photos scrutinized for the central Delta inquiry, DVD number, 95% adherence to the linear vegetation mapping criteria, and other observations pertinent to this outcomes analysis. All the photos analyzed conformed very well to the mapping criteria described above. All of the concerns noted were issues of MMU and minimum width.

Table 2 - Qualitative Review of Adherence to Linear Vegetation Mapping Criteria

Photo #	DVD #	>95% Adherence to Linear Vegetation Mapping Criteria	Notes
10SFH120165	8	Y	Some polygons <minimum width
10SFH105120	8	Y	Very little natural vegetation
10SFH150120	8	Y	Some polygons <MMU and/or minimum width
10SFH165075	9	Y	Some polygons <minimum width
10SFH180150	9	Y	Some polygons <MMU and/or minimum width
10SFH240180	9	Y	Some polygons <MMU and/or minimum width
10SFH240135	9	Y	Some polygons <MMU and/or minimum width
10SFH240105	9	Y	Several polygons <MMU and/or minimum width
10SFH255015	6	Y	Some polygons <MMU and/or minimum width
10SFH285120	10	Y	A few polygons <MMU and/or minimum width
10SFH285060	10	Y	Portions of polygons ~1m wide
10SFH285000	6	Y	Portions of polygons ~1m wide

Selected Vegetation Types

The far western boundary of the Delta Project study area is adjacent to the southeastern study area boundary of the Suisun Project. These study areas were known to contain some areas of similar vegetation.

Methods. To determine which mapping units were shared between the two projects the mapping units were compared manually and the Delta mapping units were assigned the corresponding Suisun Project mapping unit code. A simple query in Access (Microsoft Corporation 2002) was used to create a table of common vegetation including total acreage and number of polygons.

Results. The Suisun Project utilized 133 mapping units while the Delta Project utilized 128 to attribute the respective study areas. Of these, 31 mapping units were shared between the two projects (Table 3). The average polygon size for these shared mapping units is given in Table

4; the Delta Project average polygon size was 5 times that of the Suisun Project. It was noted that three mapping units were coarsely mapped in the Delta Project and thus were likely skewing the results: California Annual Grassland; Managed Annual Wetland Vegetation; and Tidal Mudflats. When these three were excluded from the analysis the average polygon size for the Delta Project was reduced to 1.8 times that of the Suisun Project (Table 4).

Table 3 - Vegetation Types Occurring in both the Suisun and Delta Projects

Delta Veg Code	Delta Veg Type	Delta Veg Polys	Delta Veg Acres	Average Poly Size	Suisun Veg Code	Suisun Veg Type	Suisun Veg Polys	Suisun Veg Acres	Average Poly Size
9320	Tree-of-Heaven	5	2.64	0.53	911	Ailanthus altissima	1	0.74	0.74
4710	California Annual Grasslands - Herbaceous	947	34916.49	36.87	231	Annual Grasses generic	2761	7505.90	2.72
4310	Giant Cane Arundo donax	96	61.28	0.64	102	Arundo donax	8	4.73	0.59
3211	Baccharis pilularis / Annual Grasses & Herbs	30	63.24	2.11	603	Baccharis/Annual Grasses	66	85.88	1.30
5120	Poison Hemlock Conium maculatum Alliance	131	777.74	5.94	402	Conium maculatum	172	247.60	1.44
4110	Pampas Grass Cortaderia (SeJu)	13	18.61	1.43	202	Cortaderia selloana	6	9.77	1.63
4210	Saltgrass Distichlis spicata	48	138.07	2.88	141	Distichlis spicata	1613	2895.00	1.79
4211	Distichlis spicata - Annual Grasses	156	1292.74	8.29	142	Distichlis/Annual Grasses	1177	1982.23	1.68
4213	Distichlis spicata - Juncus balticus	6	24.26	4.04	145	Distichlis/Juncus	251	390.52	1.56
4212	Distichlis spicata - Salicornia virginica	2	20.29	10.15	148	Distichlis/Salicornia	1404	2409.57	1.72
9310	Eucalyptus	92	213.92	2.33	801	Eucalyptus globulus	118	204.74	1.74
5201	Managed Annual Wetland Vegetation	56	591.13	10.56	11	Flooded Managed Wetland	665	3801.4	5.72
5510	Alkali Heath Frankenia salina	4	2.43	0.61	320	Frankenia (generic)	70	114.12	1.63
5511	Frankenia salina - Distichlis spicata	12	24.18	2.02	318	Frankenia/Distichlis	32	53.15	1.66
4403	Juncus balticus-meadow vegetation	19	45.41	2.39	132	Juncus balticus	246	336.28	1.37
5530	Perennial Pepperweed Lepidium latifolium	364	1730.12	4.75	324	Lepidium (generic)	432	649.27	1.50
4320	Creeping Wild Rye Grass Leymus triticoides	2	2.55	1.28	215	Leymus (generic)	23	21.53	0.94
4630	Common Reed Phragmites australis	312	418.78	1.34	103	Phragmites australis	432	549.73	1.27
4514	Scirpus acutus - (Typha latifolia) - Phragmites australis	548	1714.24	3.13	104	Phragmites/Scirpus	75	133.86	1.78
6201	Pondweed - Potamogeton	8	5.15	0.64	371	Potamogeton pectinatus	6	32.55	5.43
2110	Coast Live Oak Quercus agrifolia	36	78.77	2.19	901	Quercus agrifolia	4	10.99	2.75
2230	Valley Oak Quercus lobata	596	2035.05	3.41	903	Quercus lobata	1	1.36	1.36
3420	California Wild Rose Rosa californica	53	95.23	1.80	604	Rosa californica	83	140.02	1.69
3410	Blackberry Rubus Discolor	617	1204.12	1.95	606	Rubus discolor	70	119.17	1.70
5520	Pickleweed Salicornia virginica	12	12.73	1.06	346	Salicornia virginica	3554	6115.42	1.72
5522	Salicornia virginica - Cotula coronopifolia	2	2.54	1.27	365	Salicornia/Cotula	195	264.30	1.36
3460	Arroyo Willow Salix lasiolepis	267	503.56	1.89	702	Salix laevigata/S. lasiolepis	5	4.92	0.98
4530	American Bulrush Scirpus americanus	5	5.81	1.16	114	Scirpus americanus (generic)	358	704.01	1.97
4522	Scirpus californicus - Scirpus acutus	197	663.58	3.37	116	Scirpus californicus/S. acutus	960	2026.01	2.11
9403	Tidal mudflats	28	27.93	1.00	7	Tidal Mudflat	59	375.57	6.37
4611	Typha angustifolia - Distichlis spicata	1	3.01	3.01	126	Typha angustifolia/Distichlis	614	971.00	1.58

Table 4 - Total Acreage & Average Polygon Acreage for Shared Vegetation Types

	Delta Project			Suisun Project		
	acres	polygons	ave. polygon size (ac)	acres	polygons	ave. polygon size (ac)
All Shared Vegetation Types	46,696	4,665	10.01	32,161	15,461	2.08
Selected Shared Vegetation Types[1]	11,160	3,634	**3.07**	20,478	11,976	**1.71**

[1] Excluded types: California Annual Grassland; Managed Wetlands; Tidal Mudflats.

Project Efficiency

The Suisun and Delta Projects differed markedly in the experience and qualifications of personnel performing certain tasks. All the delineation and attribution work for the Suisun Project was completed by assistant biologists with little or no prior experience with these tasks. The delineation and attribution work for the Delta Project was contracted out to highly qualified aerial photo interpreters.

Methods. To compare and assess the amount of personnel hours dedicated to each project, estimates of person-hours for seven project sub-categories were compiled: delineation; attributions; miscellaneous geographic information systems (GIS) and management; accuracy assessment (management); releve plots; rapid assessment plots; and accuracy assessment plots.

Results. Table 5 lists the number of hours spent on each of seven sub-categories identified as central to the Delta and Suisun Projects. The Delta Project required approximately 60% of the personnel resources dedicated to the Suisun Project. For both projects, mapping and management required about twice the time as field data collection.

Table 5 - Personnel Resources in Hours for the Delta and Suisun Projects

	Delta	Suisun
Mapping & Management		
Delineation	3371	3360
Attribution		2304
Misc GIS & Project Management		240
Accuracy Assessment	90	45
Subtotal	**3461**	**5949**
Field Data Collection		
Releve	0	1336
Rapid Assessment	1270	864
Accuracy Assessment	240	280
Subtotal	**1510**	**2480**
TOTAL	**4971**	**8429**
Total Per Polygon	**0.19**	**0.27**
Mapping & Mgmnt Per Polygon	**0.14**	**0.19**

Discussion

Mapping Criteria. The results indicate that adherence to the mapping criteria was similar for both mapping projects. There are two possible conclusions: (1) improved methods are required to help meet the mapping criteria; or (2) the mapping criteria for these projects should be reevaluated and potentially adjusted.

The following suggestions could help maintain the mapping criteria throughout the mapping process. To help meet the MMU, maximum scaling guidelines in the GIS could be established during delineation. For example, all delineations might be performed at a consistent scale of 1:4,000 or greater. Additionally, a daily query or script could be developed to screen for polygon features which do not meet mapping criteria. Early and continued attention to these criteria is more efficient than corrective measures later on in the mapping process.

Determinations regarding adjustments to the mapping criteria are unique to each project. However, mapping vegetation units to widths less than 10m may compromise the ecological significance of the delineations, because this is smaller than we can accurately map given base imagery, and smaller than USGS accuracy standards at any rate.

Linear Features. The Suisun Project brought to light the importance of consistent and meaningful treatment of linear features. Consequently, the Delta Project established delineation guidelines; introducing these rules upfront resulted in more consistent treatment of linear features in the Delta project, particularly in areas with relatively high abundance of natural vegetation.

Selected Vegetation Types. The Delta and Suisun Projects had 31 shared mapping units or vegetation types. When the three most coarsely mapped units were excluded, the average polygon size for the Delta Project was 3.07 acres while it was 1.71 acres for the Suisun Project. Part of the discrepancy was due to lack of high-resolution aerial photography for parts of the Delta Project study area, which contained shared vegetation types. However, it should be noted that the small average polygon size for the Suisun Project had disadvantages: much of the project area was "over-delineated" in the sense that some polygons were drawn based on non-vegetation differences such as differences in substrate reflectance or color saturation differences between abutting imagery . This resulted in delineation and attribution inefficiencies as well as subsequent difficulties with change detection. Furthermore, the Suisun Project had a higher percentage of the naturally vegetated study area mapped below the MMU.

Project Efficiency. The Delta Project required three-fifths the personnel resources of the Suisun Project. Although the Delta Project mapped approximately ten times the area it used about 5,000 fewer polygons because low priority land cover units such as agriculture where coarsely mapped. When analyzed on a per-polygon basis and accounting for all project sub-categories listed in Table 5, the Delta Project required 12 minutes and Suisun 16 minutes per

polygon. Focusing on the Mapping and Management portion, the Delta required 8 minutes and Suisun 11 minutes per polygon for delineation, attribution and project management.

Conclusion

Generally, a more consistent map product can be achieved more efficiently through the following procedure: (1) assemble personnel with experience and expertise with the vegetation of the study area and in vegetation mapping, and discuss potential challenges or past problems; (2) translate this information into guidelines for the mapping project; (3) provide sufficient training to mapping personnel on these guidelines as well as good communication between mapping and field personnel; and (4) develop an adaptive mapping approach to allow flexibility for challenges unique to the situation without compromising consistency.

The Delta mapping project based on these comparisons compares favorably in spatial resolution, rule-based consistency, and time efficiency to the Suisun project. Based on this analysis we would recommend wetland mapping projects of similar intent and scale to be mapped using similar criteria to the Delta project.

Literature Cited

Keeler-Wolf, T., M. Vaghti & A. Kilgore. 2000. Vegetation Mapping of Suisun Marsh, Solano County, California. Department of Fish & Game, Habitat Conservation Division, Sacramento, CA.

Appendix A – Delta Land Use Classification: Mapping Criteria

DELTA LAND USE CLASSIFICATION

MAPPING CRITERIA

BACKGROUND

This project involves mapping land use and vegetation in the Sacramento River Delta area, using high-resolution imagery compiled to USGS 1:24,000 topographic quadrangles. All interpretations and delineations are done on-screen.

A third coding layer of Water/Natural Vegetation/Human Disturbance was introduced. This information is to give guidance to vegetation sampling crews in the field. The boundaries drawn in this preliminary mapping effort will be preserved for the land use and vegetation mapping, with the polygons being further subdivided into land use and vegetation types.

The coding structure allows for dual-coding where applicable: Natural vegetation coded in a polygon coded as "water" in land use (for aquatic vegetation); Natural vegetation coded in an "urban" land use polygon (native trees in a residential area), etc.

The following are the minimum mapping units (MMU) and minimum widths for the project:

	MMU	Minimum width
Land use:	2 acres	25 meters
Isolated land use:	1 acre	10 meters
Water:	1 acre	10 meters
Vegetation:	2 acres	10 meters
Critical veg:	1 acre	10 meters

MAPPING GUIDELINES

Land/Water Interface

1. This is one of the most challenging aspects of this project, due to tidal fluctuations in the Delta and all the gradations between "open water" and "upland" that are visible on the imagery. Here is a summary of guidelines for delineating the land/water interface:

a) Natural vegetation (LU=vacant, NatVeg=natural vegetation):
-clearly dry land
-bright, medium green color, dense texture, filling in waterways (probably bulrushes)
-mudflats that appear more dry than wet; brown, gray, or green tinge to the photo signature

-dense, textured emergent vegetation; has height above water surface

b) Natural vegetation, water (LU=water; NatVeg=natural vegetation)
-floating aquatics (often light, lime green; seems level with water surface; may have small patches of water interspersed with vegetation signature)

c) Water (LU=water; NatVeg=water)
-clearly open water
-mudflats that appear more wet than dry, or just below the surface; very dark signature
-weak signature, or small isolated vegetation or land signatures
-Note: wet mudflats or weak-signature aquatic vegetation may be included in land polygons if they form a link between islands that are individually below resolution.

2. These guidelines will be followed even if the unit in question is below the vegetation minimum mapping unit. For instance, a small patch of strong-signature emergent vegetation will be lumped in with "land", even though the unit is too small to be mapped as a separate polygon and will be an inclusion with the trees on shore.

3. Although the land/water interface is being delineated at a large scale, all the intricate detail visible at that scale will not be captured. The shoreline will be smoothed rather than capturing every small bump, especially when the detail is created by vegetation. The photo signature will be followed more closely when the intricacies are caused by the actual landform.

4. If large trees line the land/water interface, the shoreline delineation won't follow the outside edge of the canopy, but will be shown closer to where the tree trunks along the actual shoreline are assumed to be, using glimpses of water underneath the canopy as a guide.

5. Islands and isolated water bodies may be mapped below the minimum mapping unit. Shorelines may be exaggerated slightly if the size of the islands is borderline for inclusion.

6. Streams that appear as polygons on the USGS 1:24,000 topographic maps will be mapped as water bodies, even where their width tapers to less than 10 meters on the imagery.

Canals/ditches

1. Canals or ditches will only be mapped as water in the land use category if the width of the water signature itself is greater than or equal to 10 meters, and that width continues for the majority of the length of the canal. If the width decreases to be consistently less than 10 meters, a good visual break (bend, road crossing, etc.) will be selected to end the canal polygon. If the width of the water is less than 10 meters, the canal or ditch will not be delineated, even if the berm-to-berm width is greater than 10 meters.

2. If the width of the water in a canal or ditch is less than 10 meters, but there are two or more parallel ditches or there is disturbance alongside the water feature with a width totaling 25 meters or more, the whole corridor will be mapped in land use as a Transportation, Communications, and Utilities polygon. The delineation will be made on the outside edge of the disturbance on both sides of the corridor. The water itself will not be mapped. If the corridor of "ditch/canal-related disturbance" measures less than 25 meters in width, the corridor will not be mapped.

3. If there is a corridor as described in #2 above, and it contains a ditch less than ten meters wide, but the ditch eventually widens to 10 meters or more, for continuity the entire length of the corridor will be mapped as a land use polygon. The water will not be pulled out separately.

Land Use – General

Fencelines or the centerlines of roads, streams, ditches, etc. will be used to separate adjacent land use types. Where these features aren't present, land use polygons will be delineated being mindful of vegetation polygons that may be added later. Boundaries will be drawn so that sliver polygons created by vegetation mapping can be avoided. It will be acceptable for vegetation units to have straight boundaries due to land use delineations.

Transportation Corridor

This land use class is reserved for freeways and for city streets that exceed 25 meters in width. Median vegetation is not pulled out separately. The delineations will follow a visible right of way indicator (such as fenceline) where present. Otherwise they will follow the edge of the paved surface for freeways, or the bottom of the curb for city streets. On-ramps and off-ramps are not included.

Other Urban of Built-up Land

This land use class includes golf courses, parks, cemeteries, campgrounds, driving ranges, and marinas. Some of these areas may have natural vegetation, so even though they will have a land use code, part or all of the polygons may be coded as natural vegetation in the NatVeg field. Docks and other portions of marinas that extend into water will be included in the water polygon.

Cropland and Pasture

1. It can be difficult to differentiate fallow cropland from vacant land. Fallow cropland occurs in close proximity to in-crop areas. It will appear unkept, with weeds and grasses growing, but will show some evidence of recent agricultural activity. Fallow fields will not be included in natural vegetation delineations. Similar fields on the fringe of in-crop areas, where shrubs and tall weeds are growing, probably have not been farmed for 5 years or more. These fields will be included in natural vegetation delineations.

2. It can be difficult to differentiate pasture from vacant land. If there aren't clear signs of pasture usage, the areas will be mapped as vacant land. Many of these will be flagged for field checking.

3. At this writing, we may have a subcategory for rice, for flooded agriculture, or both.

Orchards

Recently abandoned orchards should be collected as orchards in land use. Only long-abandoned orchards should be collected as vacant land use and as natural vegetation. Some areas, especially along the Cosumnes River, may have the signature of regularly-spaced trees associated with orchards, but they may be part of a project to re-introduce native trees. Any such questionable areas will be marked with a comment point and/or flagged for field checking.

Vacant areas

1. Areas that are coded as vacant in land use may be subdivided in the Natural Vegetation categories if the signatures warrant. For instance, if part of the area is vegetated and part of the area is bare dirt, only the vegetated area will be included in delineating natural vegetation.

2. Vacant areas between two (2) and five (5) acres will be included in the natural vegetation delineations if they adjoin other types of natural vegetation. Such areas will be coded as "human disturbance" if they are isolated from natural vegetation.

Linear vegetation features

1. Windrows will not be mapped. However, a row of trees occurring naturally (along a watercourse, for example) will be delineated as a vegetation polygon. Trees flanking either side of a narrow road will be collected in one vegetation polygon, where the polygon will be wider than 10 meters. Also, any row of trees where the width of the signature exceeds 10 meters will be mapped.

2. Natural vegetation often occurs along minor canals and ditches (those that are too narrow to map). The total width from the outside of the vegetation on one side to the outside of the vegetation on the other side sometimes exceeds 10 meters, which is the minimum width for a vegetation polygon.

In these situations, a polygon will be drafted only if the vegetation on one side of the ditch bank is wider than 10 meters, and the entire polygon will be larger than one acre.

If one bank has vegetation wider than 10 meters and the other bank has vegetation narrower than 10 meters, the delineation would include vegetation on both sides of the bank.

3. Although normally road centerlines are used to separate land use types, exceptions may occur where trees are involved. For instance, there may be a large area of trees on one side of a road, and a narrow (<10 m) strip of trees on the other side of the road, which is in turn flanked by cropland. Rather than using the road to separate the natural vegetation from the cropland, the delineation will be made on the tree/cropland interface.

4. Trees are of more concern than weedy vegetation. Areas of weedy vegetation that exceed10 meters in width but are less than an acre total will not be collected. If the same situation occurred with trees, areas smaller than an acre may be collected.

Appendix B – Delta Land Use Classification: Criteria Decisions

DELTA LAND USE CLASSIFICATION

CRITERIA DECISIONS

As a starting point, the following have been proposed as minimum mapping units (MMU) and minimum widths:

	MMU	Minimum width
Land use:	2 acres	25 meters
Isolated land use:	1 acre	10 meters
Water:	1 acre	10 meters
Vegetation:	2 acres	10 meters
Critical veg:	1 acre	10 meters

It was decided to make a preliminary mapping pass through the Delta study area, separating water, natural vegetation, and land use/disturbed areas. To make these delineations, the following criteria have been discussed:

Delineation placement

If we were only mapping vegetation, polygon delineations would follow vegetation signatures closely. Because land use will also be mapped, it is acceptable to use features such as roads, canals, fencelines, etc. as boundaries for natural vegetation polygons where it will avoid the creation of sliver polygons.

Canals/ditches

1. We will only map canals or ditches as water (code=5300) if the width of the water signature itself is greater than or equal to 10 meters. If the width of the water is less than 10 meters, the canal or ditch will not be delineated, even if the berm-to-berm width is greater than 10 meters. (revised 4-18-05)

2. If the width of the water in a canal or ditch is less than 10 meters, but there are two or more parallel ditches or there is disturbance alongside the water feature with a width totaling 25 meters or more, the whole corridor will be mapped in land use as Transportation, Communications, and Utilities (code=1400). The water itself will not be mapped. If the corridor of "ditch/canal-related disturbance" measures less than 25 meters in width, the corridor will not be mapped. (revised 4-18-05)

Streams

1. Recently exposed mud should be included as part of the water.

2. Wetland vegetation should be excluded from the water polygon unless it is less than an acre in size and doesn't serve as a connection between two other natural vegetation types.

3. On the Liberty Island quad, for example, the Cache Slough had flooded adjacent agricultural lands at the time of the imagery, making the "normal" boundaries of the stream hard to detect. We are referencing USGS topographic maps in such cases to depict the water boundaries based on what those maps show.

Vacant areas

1. For the preliminary natural vegetation delineations, areas that would be mapped as "vacant" for land use will be included in the natural polygons if they are larger than five (5) acres. This includes areas that have been disturbed, are crossed by trails, etc.

2. Vacant areas between two (2) and five (5) acres should be included in the natural vegetation delineations if they adjoin other types of natural vegetation. Such areas will be lumped in with land use delineations if they are isolated from natural vegetation.

Linear vegetation features

1. Windrows will not be mapped. However, a row of trees occurring naturally (along a watercourse, for example) would be delineated as a vegetation polygon.

2. Natural vegetation often occurs along minor canals and ditches (those that are too narrow to map). The total width from the outside of the vegetation on one side to the outside of the vegetation on the other side sometimes exceeds 10 meters, which is the minimum width for a vegetation polygon.

In these situations, vegetation will only be mapped if the vegetation on one side of the ditch bank is wider than 10 meters, and the entire polygon will be larger than one acre.

If one bank has vegetation wider than 10 meters and the other bank has vegetation narrower than 10 meters, the delineation would include vegetation on both sides of the bank.

Levees

1. Levees will not be collected in vegetation or in land use unless the levee itself meets the 25m minimum width criteria for land use, or the vegetation on the levee meets the 10m minimum width criteria for vegetation.

Miscellaneous land use decisions

1. On the Brentwood quad we saw a greenway flanking a flood control channel. The greenway adjoined a park. When mapping land use, the greenway will be included with the park delineation.