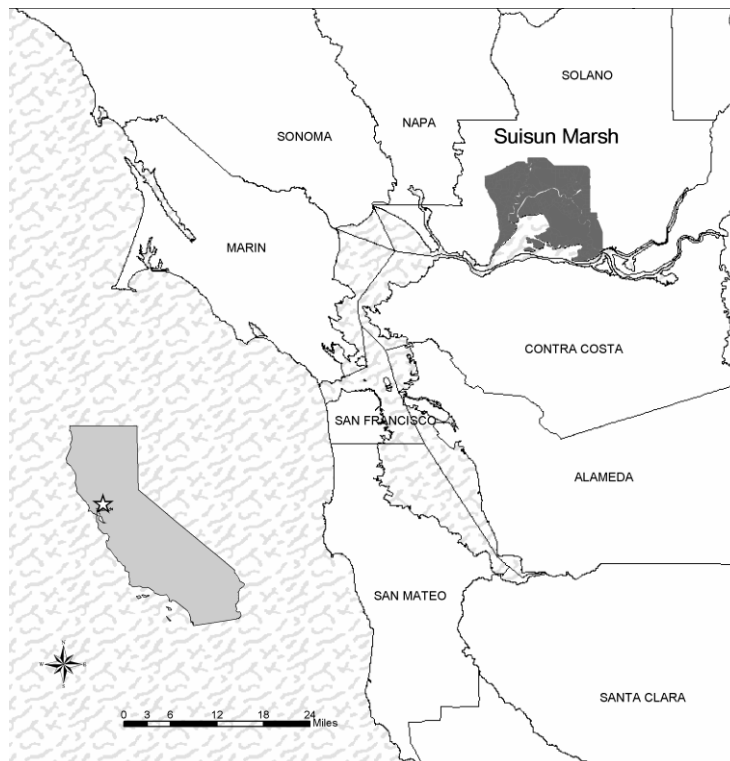


**2006
Vegetation Map Update For
Suisun Marsh,
Solano County, California**

A Report to the California Department of Water Resources

March 2008

**Prepared by:
Vegetation Classification and Mapping Program
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Executive Summary

This report summarizes the methods and results of the 2006 Suisun Marsh vegetation map update. This is part of an ongoing monitoring project that the Biogeographic Data Branch (BDB) of the California Department of Fish and Game (DFG), in collaboration with the Department of Water Resources (DWR) and the DFG Bay Delta Region (formerly Bay-Delta Branch) (BDR), started in 1999 to track changes in the Suisun Marsh vegetation over time. This is the third update since the original map was made in 1999. The first update, conducted in 2000, is summarized in *Vegetation Mapping of Suisun Marsh, Solano County: A Report to the California Department of Water Resources* (Keeler-Wolf et al. 2000). The second update, done three years later in 2003, is summarized in *Suisun Marsh Vegetation Mapping Change Detection 2003* (Vaghti and Keeler-Wolf 2004).

In total, 69,381 acres were assessed for vegetation changes. The final map contains 30,631 polygons ranging from 0.03 acres to 2,071 acres averaging 2.27 acres. Within this area 100 releves were collected from July 17th, 2006, to September 19th, 2006, and 31,117 vegetation polygons were examined against aerial photography.

Over the 3-year study period, 16,275 acres or 6,092 vegetation polygons from 2003 was interpreted to have changed either in vegetation type or size. Several major environmental factors contributed to this change. The first and greatest factor was extremely high water. The second factor was extremely high tides added to the increased water elevations in Suisun. And thirdly, high winds associated with winter storms pushed water onto and over fragile levees. All of these factors contributed to levee breaches at Van Sickle Island, Wheeler Island, and along Chadbourn Slough that covered 6,000 to 8,000 acres. On February 3rd, 2006, Solano County was declared a Federal Disaster Area, DR – 1628, for the incident period December 17th, 2005, thru January 3rd, 2006. According to the Suisun Resource Conservation District (SRCD), 40% of the total marsh levees sustained noticeable damage.

Introduction

Background

The Suisun Marsh is one of the largest contiguous brackish marshes remaining in the United States, covering over 69,000 acres of tidal and managed seasonal wetlands. This marsh is a key wintering area for waterfowl and supports a number of sensitive plant and animal species. In 1977 the Suisun Marsh Preservation Act was enacted and required that the marsh be managed for its wildlife resources. Consequently, the Plan of Protection for the Suisun Marsh (Plan of Protection) was developed. In 1981 the U.S. Fish and Wildlife Service produced a Section 7 Biological Opinion for the Plan of Protection. Their Biological Opinion accepted the monitoring program in the Plan of Protection and added specific conservation measures to protect salt marsh harvest mouse (SMHM) habitat.

As part of the Suisun Marsh Management Plan (SMMP) consultation with the United States Fish and Wildlife Service (USFWS) the resulting Conservation Measures accepted the SMMP's monitoring program to "monitor preferred mouse habitat in each of five zones" (Figure 1) in the Suisun Marsh. The Triennial Vegetation Survey was developed to document the overall vegetation composition of the marsh and to monitor SMHM habitat by the use of aerial photography in combination with ground verification. In 1981, prior to the final SMMP, a baseline vegetation survey was conducted. However, since completion of the Suisun Marsh Salinity Control Gates, as described in the Plan of Protection, was delayed until 1988, the 1988 vegetation survey was the closest to the start of facility operations. The Triennial Vegetation Survey was conducted in Suisun Marsh in 1981, 1988, 1991, and 1994 to document any changes in vegetation composition over time.

There were concerns about the methodology used and the lack of useful maps from the 1988, 1991, and 1994 surveys. In 1996 the newly developed Suisun Marsh Environmental Coordination and Advisory Team (ECAT) reviewed the current survey methodology and recommend a more detailed monitoring system to document the overall vegetation changes in the marsh. Consequently, in July 1997 the ECAT agreed to implement a new survey methodology for the 1998 vegetation survey.

The new methodology and results for the 1999 survey are described in detail in *Vegetation Mapping of Suisun Marsh, Solano County: A Report to the California Department of Water Resources* (Keeler-Wolf *et al.* 2000). The survey methodology is designed to meet the goal of documenting changes in preferred habitat for the SMHM as well as to gather vegetation information to be used for a variety of other purposes. These may include correlating management activities with vegetation changes, gathering data to support the use of a GIS format that will allow queries and overlaying of additional information, and creation of a base map for future studies. This methodology is based on work by the Department of Fish and Game, BDB and has been widely used throughout the state.

In 2000 an exploratory change detection study was implemented (Vaghti & Keeler-Wolf 2001). The goals of the change analysis were to define significant change for vegetation in the Suisun Marsh ecosystem, quantify and spatially identify such changes, improve map accuracy, and make recommendations for future revisions of the map to best support management efforts for endangered species habitat, waterfowl and other wildlife. Given that the 2000 map update was conducted only one year after the 1999 baseline map was created, the changes detected were relatively minor. Less than 1% of the polygons were shown to have changed between June 16, 1999, and July 2, 2000. These minor changes include a net loss of 65 acres for *Salicornia virginica* vegetation types, an 18 acre increase in vegetation dominated by *Lepidium latifolium*, and a 143 acre decrease in Annual Grasses. From this exploratory change detection, it was determined that the map update process would continue to occur every three years.

The 2003 remap effort showed a 16.8% change across the entire study area since the 1999 product. "Medium Wetland Graminoids, *Scirpus maritimus*, Short Wetland Herbs, Medium Wetland Herbs and *S. maritimus/Salicornia virginica* were the five types with the greatest increase in acreage. *Distichlis spicata*, *Salicornia*, *Distichlis*/Annual Grasses, *Distichlis/Salicornia*, and Flooded Managed Wetlands were the five types with the greatest

decrease in acreage over the study period.” Also determined was a 16.7% change in leveed wetlands.

The 2006 change detection analysis described herein uses the 1999 vegetation map as the baseline and follows the 2000 and 2003 change detection methodology. Please refer to *Vegetation Mapping of Suisun Marsh, Solano County: A Report to the California Department of Water Resources* (Keeler-Wolf *et al.* 2000) *Suisun Marsh Vegetation Mapping: Change Detection 2000* (Vaghti and Keeler-Wolf 2001), and *Suisun Marsh Vegetation Mapping: Change Detection 2003* (Vaghti and Keeler-Wolf 2004) for further details.

Figure 1 - Suisun Marsh SMHM Habitat Zones.



Methods

2006 Field Data Collection

In keeping with the monitoring focus of the Suisun Marsh Vegetation Surveys (Keeler-Wolf *et al.* 2000), in 2006, 100 of the original 198 Suisun Marsh vegetation plots were selected to be revisited for the first time since their establishment in the summer of 1999 (Figure 2). To enable regular re-sampling into the future without any access issues, only those plots located on DFG land, Rush Ranch, or other publicly accessible lands were considered for resampling. These resample plots were selected by the DFG Vegetation Classification and Mapping Program to capture the diversity of vegetation types that represent the Marsh's vegetation as a whole. Due to the construction of the new Benicia-Martinez Bridge, two of the selected 100 plots are no longer in existence. Therefore, 98 plots were resampled. Each plot was located based on careful interpretation of GPS coordinates, field sample photos, aerial photos, and plot descriptions provided in the original 1999 field data. For more detailed information on the field data collection protocol and analysis refer to *The Vegetation of Suisun Marsh, Solano County, California: First Permanent Plot Resample Study 1999 vs. 2006* (Boul *et al.* 2007).

Aerial Photograph Interpretation

Orthorectified, true color imagery was flown on June 2006 to mimic as close as possible the June 1999 and June 2003 Suisun imagery time frame and plant phenology. This imagery was received as 427 high quality, individual, flight line ortho-photographs. The aerial imagery was interpreted, and changes were made to the vegetation polygon shapefile using ArcMap 9.2 (ESRI™).

The criteria for a polygon to be considered “changed” is described in the change detection report for 2003 (Vaghti and Keeler-Wolf 2004).

The following changes were considered significant and consistently interpretable, and were assessed:

- A greater than 20% change in acreage of an existing small polygon (<1 acre)
- A greater than 10% change in acreage of a mid-sized polygon (1-5 acres)
- A greater than 5% change in a large polygon (>5 acres)
- A type conversion of a vegetation polygon dominated by perennial species.

Type conversion, as defined here, occurs when a previously mapped vegetation type dominated by perennial species has changed based on the decision rules set forth in the vegetation mapping unit key defined in Table 5 of *Vegetation Mapping of Suisun Marsh, Solano County* (Keeler-Wolf *et al.* 2000), or when an annual species dominated vegetation type is converted to a perennial vegetation type.

- A persistent physical change has altered any vegetation polygon and partially or entirely replaced it with a non-vegetated area (non-vegetated areas include buildings, dredged ditches, new levees, roads, or other human engineered structures).
- A change in management style, which includes a conversion or restoration from an actively managed situation (annual burning, disking, plowing, flooding, or

other management practice which annually disturbs the vegetation) to a passively managed, or un-managed, situation.

A copy of the 2003 vegetation polygon shapefile was made and modified for the 2003-2006 change detection and then it was linked to a new 2006 Microsoft Access® table for data entry. For consistency the attributes (Appendix 1) and vegetation types (Appendix 2) for the 2006 change detection remained the same as in 2003. When a change in size of shape of polygons were detected, they were cut using the “Cut Polygon Features” task and they were merged using the “Merge” option in ArcMap

Analysis

Analysis of the 2003-2006 Suisun Marsh vegetation change closely followed the analysis of the 2000-2003 vegetation change. The percent change (acreage) for each vegetation type was calculated for 2003 to 2006, as well as for 1999 to 2006.

$$\frac{(2006 \text{ Acreage} - 2003 \text{ Acreage})}{2003 \text{ Acreage}} * 100$$

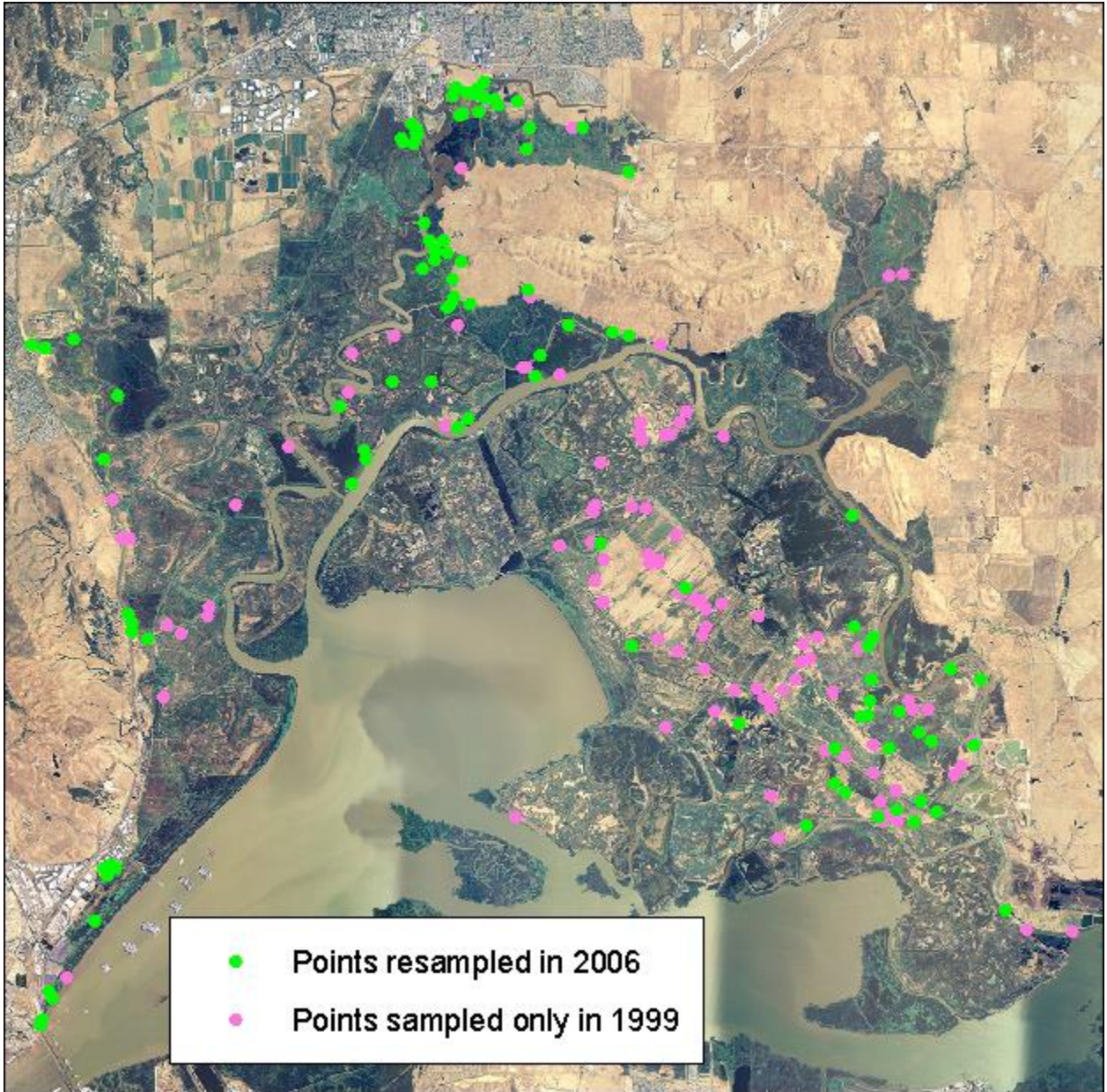
As was done in 2003, a few vegetation types were looked at more closely for various reasons. At the time of the 2003 Suisun Marsh vegetation change detection, little was known about the habitat requirements for the protected Salt Marsh Harvest Mouse (SMHM). The ten *Salicornia virginica* (SAVI) vegetation types or mapping units were considered important habitat for the SMHM in 2003. These include: (1) *Scirpus maritimus/Salicornia*; (2) *Distichlis spicata/Salicornia*; (3) *Salicornia*; (4) *Salicornia/Annual Grasses*; (5) *Salicornia/Atriplex triangularis*; (6) *Salicornia/ Crysopsis schoenoides*; (7) *Salicornia/Sesuvium verrucosum*; (8) *Salicornia* (generic); (9) *Salicornia/Echinochloa crus-galli Polygonum lapathifolium-Xanthium strumarium*; and (10) *Salicornia/Cotula coronopifolia*. Since then, the DFG -BDR and DWR conducted a 2 year study (2002-2004) to gain a better understanding of “demographic performance and habitat use of salt marsh harvest mice (*Reithrodontomys raviventris halicoetes*) in the Suisun Marsh” (Sustaita et al 2011). It was determined that, in addition to vegetation dominated by *Salicornia virginica*, microhabitats dominated by mixed wetland species also support SMHM. In addition to the previously assessed SAVI vegetation types, the following vegetation types were also considered important habitat for the Salt Marsh Harvest Mouse and were assessed for changes:

We attempted to obtain a list of mixed wetland species as described within this habitat defined in Sustaita (2009). This would enable us to crosswalk, or “translate” the vegetation classification used in this mapping project to the habitat found to be suitable for harvest mouse. However, we have not yet been able to obtain this list.

These types were examined to determine what they changed into by 2006 from 2003 and 1999 (loss of SMHM habitat in 2006) and what types they changed from in 1999 and 2003 to 2006

(gain of SMHM vegetation in 2006). The same analysis was done for *Distichlis spicata* (as an indicator of salinity) types, *Phragmites australis* types, eight invasive non-native types of concern, and the flooded wetlands.

Figure 2 - Location of 2006 Field Data Collection Points



Results

Vegetation Type Changes

Of the 31,117 polygons from 2003, 6,092 were changed or deleted in 2006 representing 16,218 acres of the total 69,316 acres. This means that approximately 20% of the polygons have either changed vegetation types or have significantly changed in size since 2003. The changes are not restricted to a specific portion of the marsh, although there are concentrated changes in the northwest and southeast corners because of increased flooding primarily due to levee breaches (Figure 3). From 2003 to 2006, the greatest change in land cover in Suisun Marsh is the 5,684 acre (173%) increase in flooded wetlands (Table 1). Following (but much smaller than the increase of flooded wetlands) is an increase in *Salicornia*/Annual Grasses, *Distichlis/Salicornia*, *Scirpus (californicus or acutus)-Typha sp.* and *Phragmites australis*. The top 5 vegetation types that lost acreage between 2003 and 2006 are *Scirpus maritimus*, *Salicornia virginica*, *Distichlis spicata*, *Typha* species, and Medium Wetland Gaminoids.

Changes to potential Salt Marsh Harvest Mouse habitat

The total acreage of *Salicornia virginica* (SAVI) vegetation types between 1999 and 2006 have declined by a net 945.34 acres, or 7.32% of the total SAVI acreage in 1999 (Table 2). Most of this loss occurred between 1999 and 2003 as only 293 acres of SAVI vegetation was lost between 2003 and 2006. Between 1999 and 2006 there was a loss of 1,259.48 acres of SAVI vegetation due to levee breaches and subsequent flooded wetlands (Table 3). Flooding is, by far, the cause of the greatest loss of SAVI vegetation in the Suisun Marsh. The greatest gain of SAVI vegetation between 1999 and 2006 is the conversion of *Distichlis spicata* to SAVI vegetation. The change in *Salicornia virginica* between 2003 and 2006 reflects these same patterns (Table 2).

For the 2009 re-map we hope to be able to show the translated types of vegetation that equate all or in part to the habitat known as mixed wetland herbs as described by Sustaita *et al.* (2009). This will give a more accurate depiction of any potential change in the acreage of true salt marsh harvest mouse habitat in the Marsh.

Changes to *Distichlis spicata*

Between 1999 and 2006 there was a decrease in DISP (includes all types considered DISP types) of 2200.63 acres, which is a loss of approximately 20% of the DISP acreage from 1999 (Table 4). As with SAVI, this loss is primarily due to the acreage increase of flooded wetlands. Since 1999, 1043.02 acres of DISP vegetation has been lost to flooding (Table 5). The change in *Distichlis spicata* between 2003 and 2006 reflects these same patterns (Table 4).

Tidal Wetlands

The 2003 San Francisco Estuary Invertebrates (SFEI) EcoAtlas was used to assess the tidal habitat in 2006. It shows 6,684 acres of tidal habitat within the Suisun marsh study area as of 2003. Due to the fine scale nature of the vegetation map, we were able to eliminate roads that should not be considered tidal, as well as vegetation polygons that were smaller than 0.2 acres that fell within the tidal habitat boundaries. This leaves 6,509 acres of tidal vegetation within Suisun marsh in 2006, or about 9.4% of the total area of the marsh (Figure 4). The remainder of the area, approximately 62,493 acres, is considered leveed wetlands. Refer to the section below on non-natives to see how the tidally influenced and leveed areas have been affected by invasive species.

Invasive Vegetation

Non-Natives including Phragmites

Since 1999 *Phragmites australis* has increased by 780.33 acres or 90.35% (Table 7a) within the entire marsh. Most of this acreage conversion has occurred between 2003 and 2006 from stands of wetland graminoids such as *Typha* spp., *Scirpus maritimus*, and *Scirpus (californicus or acutus)-Typha* sp. vegetation types being invaded by the non-native form of *Phragmites* (Table 6). Since 1999 *P. australis* has increased by 53.73% or 175.71 acres within the tidal wetlands (Table 7c) accounting for 7.7% of the 6,509 acres of total tidal wetlands within the marsh. Since 1999, within the leveed areas of the marsh, *P. australis* has increased by about 115 % or 620 acres (Table 7b) accounting for 1.8% of the 62,493 acres of total leveed wetlands within the marsh

With in the entire marsh none of the other non-native species of concern were shown to have appreciably increased since 2003 (Table 7a). *Centaurea solstitialis* and *Foeniculum vulgare* have actually decreased since 2003. *Lepidium latifolium* has decreased by 22% since 2003, but about 800 acres are still in need of eradication. *Arundo donax* and *Cortaderia selloana* have neither increased nor decreased since 2003 (Table 7a).

Within the tidal wetlands, the vegetation that is dominated by *Lepidium latifolium* has increased by approximately 15% (Table 7c) accounting for almost 3% of the total tidal vegetation. However, the 2006 vegetation map indicates that from 2003 to 2006 across the entire marsh *L. latifolium* has decrease by about 2% (Table 7a). *L. latifolium* decreased within the leveed wetlands as well by 24% since 1999 accounting for less than 1% of the leveed vegetation. Add section for control program

Flooded Wetlands

The greatest acreage gain from 1999 to 2006 is Flooded wetland (5055.77 acres), which has increased by 131% (Table 8). Virtually all of this gain occurred over the winter of 2006 due to flooding events in (need to add language from SRCD here) (5653.55 acre increase from 2003 to 2006). An increase in flooded land means a decrease in vegetation as was seen in the decline of *Salicornia virginica* and *Distichlis spicata* vegetation.

Figure 3 - Distribution of the modified polygons (green) in 2006.

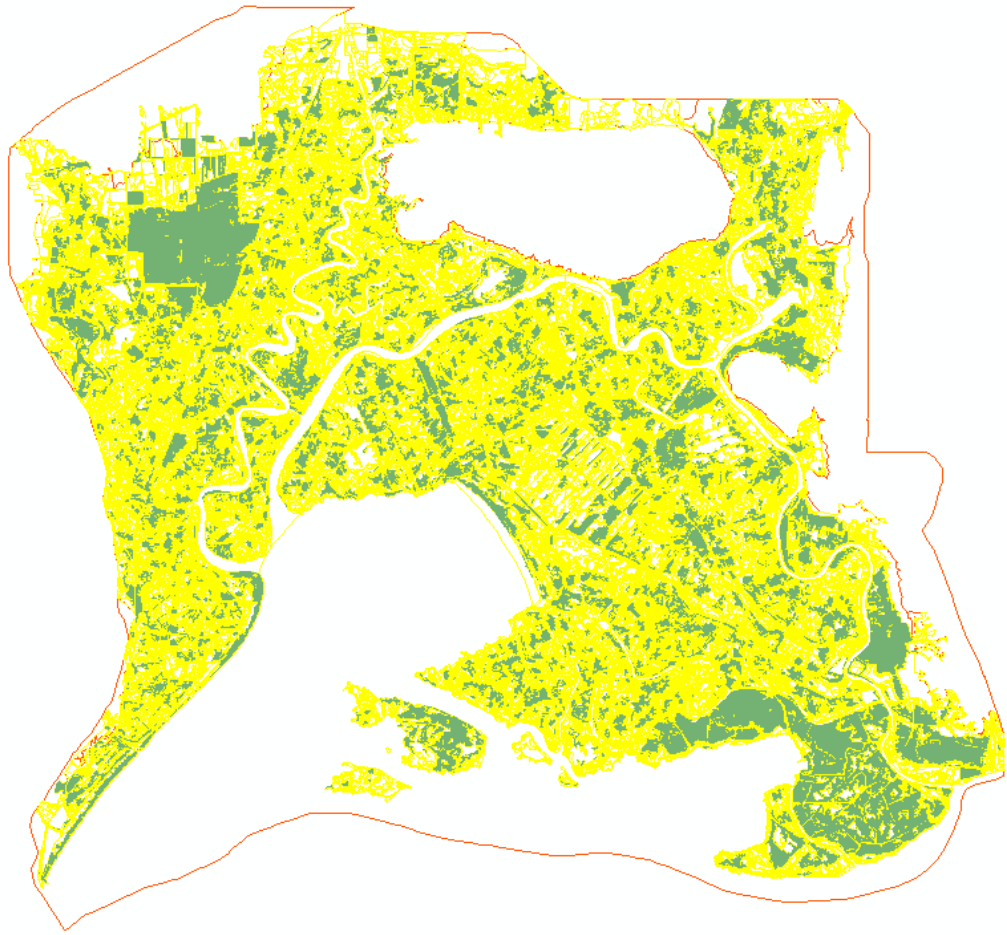


Figure 4 - Suisun Marsh vegetation mapping project area showing ownership boundaries outlined in black and tidal marsh habitat in blue.

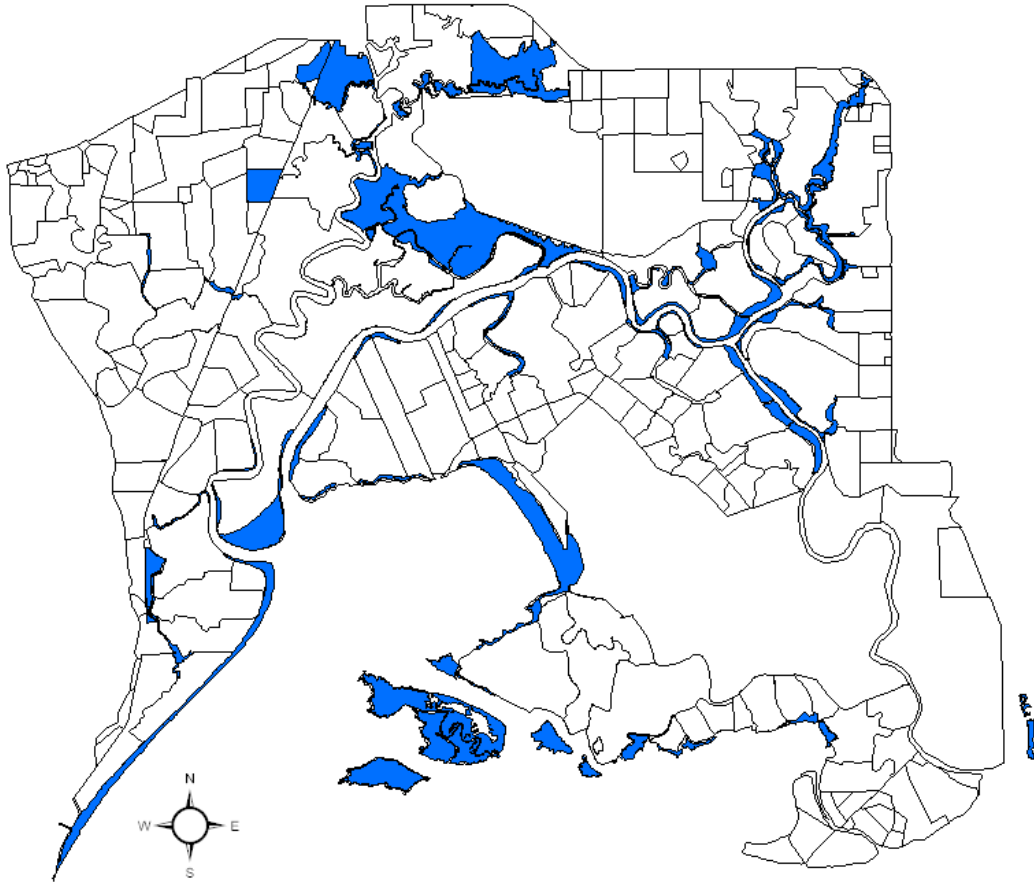


Table 1 -The distribution of acreage changes across the different vegetation types for 2003 to 2006 and for 1999 to 2006.A negative acreage change or % change indicates a loss in acreage.

Veg Code	Vegetation Name	2003-2006 Acreage Change	2003-2006 % Change	1999-2006 Acreage Change	1999-2006 % Change
1	Bare Ground	-368.59	-18.62	-535.76	-24.95
2	Fallow Disced Field	-178.80	-66.08	-79.80	-46.51
3	Parking Lot	2.71	1.00	13.22	5.10
4	Road	-39.76	-3.57	13.87	1.31
5	Structure	3.50	1.58	10.33	4.83
6	Slough	-7.39	-0.18	-86.62	-2.06
7	Tidal Mudflat	-14.80	-4.01	-19.32	-5.17
8	Railroad Track	0	0	0	0
9	Ditch	-5.34	-0.34	39.12	2.55
10	Trail	-0.36	-7.30	-0.55	-10.72
11	Flooded Wetland	5653.55	172.79	5055.77	130.65
12	Freshwater Drainage	4.28	12.82	1.72	4.79
13	Water Treatment Pond	9.34	376.45	9.34	376.45
14	Urban Area	9.39	2.11	112.20	32.81
101	Tall Wetland Graminoids	-28.66	-28.16	27.89	61.68
102	Arundo donax	0	0	19.08	403.38
103	Phragmites australis	257.87	42.10	333.66	62.17
104	Phragmites/Scirpus	97.53	68.13	110.22	84.48
105	Phragmites/Xanthium	3.34	50.29	3.34	50.29
112	Scirpus americanus/Potentilla	2.41	1.11	-45.88	-17.25
113	Scirpus americanus/S. Californicus-S. acutus	-21.33	-16.95	-43.52	-29.40
114	Scirpus americanus (generic)	-109.21	-17.70	-192.04	-27.44
116	Scirpus californicus/S. acutus	-106.46	-5.66	-197.96	-10.03
120	Typha angustifolia/Polygonum-Xanthium-Echino	30.24	8.06	-26.84	-6.21
121	Typha angustifolia/S. americanus	129.60	11.88	73.18	6.38
123	Typha species (generic)	-628.70	-15.33	-668.99	-16.15
125	Typha angustifolia (dead stalks)	2.17	3.36	-48.37	-42.08
126	Typha angustifolia/Distichlis	11.57	1.30	-58.80	-6.14
127	Scirpus americanus/Lepidium	0.44	1.40	-7.84	-19.66
129	Typha angustifolia/Phragmites	221.65	77.72	336.69	197.89
130	Medium Wetland Graminoids	-407.30	-33.14	817.29	18574.75
132	Juncus balticus	-41.35	-14.18	-81.91	-24.66
133	Juncus balticus/Conium	-4.99	-5.00	31.93	50.78
134	Juncus balticus/Lepidium	-13.55	-32.12	12.59	78.38
135	Juncus balticus/Potentilla	2.28	78.33	-5.92	-53.29
137	Scirpus maritimus	-1343.32	-49.87	-416.47	-23.57

Veg Code	Vegetation Name	2003-2006 Acreage Change	2003-2006 % Change	1999-2006 Acreage Change	1999-2006 % Change
138	Scirpus maritimus/Salicornia	-180.66	-18.30	272.49	51.02
139	Scirpus maritimus/Sesuvium	-92.85	-37.36	-69.10	-30.74
140	Short Wetland Graminoids	58.06	388.11	53.91	282.11
141	Distichlis spicata	-437.49	-21.49	-1228.70	-43.46
142	Distichlis/Annual Grasses	55.84	3.87	-394.15	-20.81
145	Distichlis/Juncus	-19.21	-5.06	-27.74	-7.15
147	Distichlis/Lotus	-8.59	-6.49	-66.74	-35.05
148	Distichlis/Salicornia	374.73	19.91	-127.03	-5.33
149	Distichlis/S. americanus	99.56	26.16	-1.67	-0.35
153	Distichlis/Cotula	-17.10	-12.54	-55.61	-31.81
154	Distichlis/S. maritimus	-54.04	-10.80	91.63	25.84
155	Crypsis schoenoides	-13.66	-14.11	-9.32	-10.08
156	Distichlis (generic)	-187.77	-23.55	-163.10	-21.11
157	Scirpus (californicus or acutus)- Typha sp.	314.83	15.94	212.35	10.22
158	Scirpus (californicus or acutus)/Wetland Her	-5.57	-0.87	208.77	49.38
160	Distichlis-Juncus-Triglochin-Glaux	18.32	5.80	-9.43	-2.75
161	Cynodon dactylon	0	0	0.54	3.33
162	Scirpus (californicus or acutus)/Rosa	6.81	2.12	-42.65	-11.51
202	Cortaderia selloana	0	0	0.21	2.15
210	Medium Upland Graminoids	-1.14	-0.84	-6.81	-4.80
211	Elytrigia pontica	73.73	68.10	95.53	110.47
215	Leymus (generic)	-4.79	-23.71	-6.12	-28.43
218	Lolium (generic)	-14.02	-5.95	-25.79	-10.43
220	Lolium/Lepidium	-5.42	-14.68	-23.74	-42.98
222	Lolium/Rumex	0	0	0	0
223	Phalaris aquatica	0	0	-5.14	-20.64
225	Cultivated Annual Graminoid	111.24	20.68	107.93	19.94
226	Perennial Grass	-197.05	-42.72	-178.61	-40.34
227	Annual Grasses/Weeds	-114.74	-7.70	-162.78	-10.59
228	Agrostis avenacea	0	0	-5.20	-15.46
230	Short Upland Graminoids	0	0	-1.16	-35.47
231	Annual Grasses generic	-394.62	-5.30	-383.45	-5.16
232	Bromus spp/Hordeum	1.03	13.31	0.72	8.96
234	Hordeum/Lolium	-2.35	-85.14	0	0
235	Vulpia/Euthamia	0	0	0	0
238	Polypogon monspeliensis (generic)	-5.43	-17.80	-27.62	-52.42
300	Wetland Herbs	-15.44	-37.55	-21.26	-45.29

Veg Code	Vegetation Name	2003-2006 Acreage Change	2003-2006 % Change	1999-2006 Acreage Change	1999-2006 % Change
301	Tall Wetland Herbs	-1.16	-9.34	3.20	39.70
310	Medium Wetland Herbs	-221.86	-25.79	332.43	108.67
311	Atriplex triangularis	-132.15	-30.09	-222.58	-42.03
312	Atriplex/Distichlis	-41.94	-12.38	-98.23	-24.87
315	Atriplex/S. maritimus	2.07	3.41	-2.02	-3.11
316	Atriplex/Sesuvium	2.12	57.31	-3.00	-34.01
317	Frankenia/Agrostis	0	0	0	0
318	Frankenia/Distichlis	-9.26	-21.98	-20.29	-38.17
320	Frankenia (generic)	-27.94	-29.35	-45.05	-40.12
321	Grindelia stricta var stricta	0	0	0	0
323	Lepidium/Distichlis	-41.96	-20.99	-49.34	-23.80
324	Lepidium (generic)	-201.58	-26.77	-87.58	-13.70
329	Polygonum-Xanthium-Echinochloa	-184.70	-19.52	-473.88	-38.36
336	Rumex (generic)	-1.89	-23.77	-14.13	-69.99
337	Atriplex/Annual Grasses	-30.89	-11.20	-67.24	-21.54
338	Potentilla anserina (generic)	0.25	0.68	-24.37	-40.31
339	Atriplex triangularis(generic)	-32.39	-43.91	-55.81	-57.43
340	Short Wetland Herbs	-302.01	-40.87	372.22	575.65
342	Cotula coronopifolia	-87.43	-27.02	-143.05	-37.73
344	Lotus corniculatus	-42.29	-17.72	-52.52	-21.10
346	Salicornia virginica	-1009.94	-18.21	-1516.83	-25.06
347	Salicornia/Annual Grasses	689.24	33.47	465.81	20.41
348	Salicornia/Atriplex	18.38	3.60	-94.56	-15.18
350	Salicornia/Crypsis	0	0	0	0
356	Salicornia/Sesuvium	-7.55	-8.10	-34.92	-28.95
357	Sesuvium verrucosum	-66.86	-23.36	-126.16	-36.51
358	Sesuvium/Distichlis	-5.48	-16.43	-0.85	-2.97
359	Sesuvium/Lolium	-1.67	-10.64	-1.67	-10.64
360	Spergularia/Cotula	0.53	9.67	0.53	9.67
361	Salicornia (generic)	-169.14	-20.21	116.09	21.05
364	Salicornia/Polygonum-Xanthium-Echinochloa	15.89	17.00	2.90	2.72
365	Salicornia/Cotula	-23.96	-9.31	-29.30	-11.16
401	Upland Herbs	-11.66	-5.86	-0.18	-0.10
402	Conium maculatum	-21.73	-7.88	7.66	3.11
403	Foeniculum vulgare	-12.44	-8.67	-8.36	-6.00
405	Raphanus sativus (generic)	-4.77	-1.64	-8.96	-3.04
406	Brassica nigra (generic)	-22.64	-70.93	-22.64	-70.93
410	Medium Upland Herbs	-2.70	-6.68	-2.40	-5.99
413	Centaurea (generic)	-14.96	-19.48	-14.05	-18.51
421	Carpobrotus edulis	0	0	0.37	5.26

Veg Code	Vegetation Name	2003-2006 Acreage Change	2003-2006 % Change	1999-2006 Acreage Change	1999-2006 % Change
514	Atriplex lentiformis (generic)	-0.73	-2.05	3.29	10.50
601	Medium Upland Shrubs	-3.00	-21.85	3.62	50.91
603	Baccharis/Annual Grasses	28.28	29.45	38.45	44.77
604	Rosa californica	-4.77	-3.77	-18.20	-13.00
605	Rosa/Baccharis	3.40	5.59	1.83	2.93
606	Rubus discolor	4.04	3.21	10.90	9.15
700	Willow Trees	0.70	6.15	0.70	6.15
702	Salix laevigata/S. lasiolepis	0.25	4.99	0.25	4.99
705	Salix lasiolepis/Quercus agrifolia	0	0	0	0
800	Eucalyptus	0	0	1.53	29.71
801	Eucalyptus globulus	2.77	1.23	23.82	11.63
900	Oaks	0	0	3.22	107.69
901	Quercus agrifolia	1.76	16.03	1.76	16.03
903	Quercus lobata	0	0	0	0
910	Landscape Trees	0	0	0.72	6.90
912	Fraxinus latifolia	0	0	0	0

Table 2 - The change in acreage of the ten *Salicornia virginica* (SAVI) vegetation types in 2003 to 2006 and 1999 to 2006. A negative acreage changes or % change indicates a loss in acreage.

VEG Code	Vegetation Name	2003-2006 Acreage Change	2003-2006 % Change	1999-2006 Acreage Change	1999-2006 % Change
138	Scirpus maritimus/Salicornia	-180.66	-18.30	272.49	51.02
148	Distichlis/Salicornia	374.73	19.91	-127.03	-5.33
346	Salicornia virginica	-1009.94	-18.21	-1516.83	-25.06
347	Salicornia/Annual Grasses	689.24	33.47	465.81	20.41
348	Salicornia/Atriplex	18.38	3.60	-94.56	-15.18
350	Salicornia/Crypsis	0.00	0.00	0.00	0.00
356	Salicornia/Sesuvium	-7.55	-8.10	-34.92	-28.95
361	Salicornia (generic)	-169.14	-20.21	116.09	21.05
364	Salicornia/Polygonum-Xanthium-Echinochloa	15.89	17.00	2.90	2.72
365	Salicornia/Cotula	-23.96	-9.31	-29.30	-11.16
	Total SAVI Acreage Change	-293.00	-2.39	-945.34	-7.32

Table 3 - The net change (in acres) of the vegetation types that the *Salicornia virginica* (SAVI) vegetation types changed into [loss of SAVI indicated with the negative sign (-)] and changed from (acreage gain of SAVI) in 2003 to 2006 and 1999 to 2006

Veg Code	Vegetation Name	SAVI Net Change 2003 to 2006	SAVI Net Change 1999 to 2006
1	Bare Ground	28.43	-14.15
2	Fallow Disced Field	43.73	-24.74
3	Parking Lot	0	-0.19
4	Road	0	5.58
6	Slough	0	0.92
9	Ditch	-4.27	-3.33
11	Flooded Wetland	-1029.42	-1259.48
101	Tall Wetland Graminoids	5	-9.95
103	Phragmites australis	-21.31	-40.64
104	Phragmites/Scirpus	-5.65	-15.88
114	Scirpus americanus (generic)	5.49	5.99
116	Scirpus californicus/S. acutus	0	-1.11
120	Typha angustifolia/Polygonum-Xanthium-Echinochloa	6.51	7.05
121	Typha angustifolia/S. americanus	2.66	5.19
123	Typha species (generic)	63.48	32.86
125	Typha angustifolia (dead stalks)	-5.55	-16.47
126	Typha angustifolia/Distichlis	-7.65	-9.9
129	Typha angustifolia/Phragmites	0.98	-11.3
130	Medium Wetland Graminoids	70.56	-199.06
132	Juncus balticus	0	3.45
133	Juncus balticus/Conium	0	-3.8
137	Scirpus maritimus	89.56	-48.79
139	Scirpus maritimus/Sesuvium	2.2	2.56
140	Short Wetland Graminoids	0	-3.69
141	Distichlis spicata	103.71	284.64
142	Distichlis/Annual Grasses	-23.65	73.68
145	Distichlis/Juncus	15.51	20.02
147	Distichlis/Lotus	0	6.71
149	Distichlis/S. americanus	-8.6	1.66
153	Distichlis/Cotula	6.73	13.82
154	Distichlis/S. maritimus	5.34	-1.79
155	Crypsis schoenoides	0	-4.34
156	Distichlis (generic)	22.43	9.39
157	Scirpus (californicus or acutus)-Typha sp.	-5.64	6.36
160	Distichlis-Juncus-Triglochin-Glaux	-0.82	8.46
161	Cynodon dactylon	0	-0.54
210	Medium Upland Graminoids	0	3.21

Veg Code	Vegetation Name	SAVI Net Change 2003 to 2006	SAVI Net Change 1999 to 2006
211	Elytrigia pontica	0	-0.93
218	Lolium (generic)	1.39	1.39
220	Lolium/Lepidium	0	2.84
223	Phalaris aquatica	0	3.61
226	Perennial Grass	0	-0.92
227	Annual Grasses/Weeds	22.23	5.92
230	Short Upland Graminoids	0	1.16
231	Annual Grasses generic	-52.65	-15.06
238	Polygonum monspeliensis (generic)	4.41	5.6
310	Medium Wetland Herbs	25.06	-111.23
311	Atriplex triangularis	59.21	66.21
312	Atriplex/Distichlis	6.34	21.64
315	Atriplex/S. maritimus	0	0.63
316	Atriplex/Sesuvium	-2.53	-2.53
318	Frankenia/Distichlis	5.27	5.27
320	Frankenia (generic)	1.91	5.21
323	Lepidium/Distichlis	4.66	0
324	Lepidium (generic)	31.42	13.8
329	Polygonum-Xanthium-Echinochloa	12.72	22.82
337	Atriplex/Annual Grasses	1.52	4.88
339	Atriplex triangularis(generic)	0	-1.16
340	Short Wetland Herbs	20.14	-171.38
342	Cotula coronopifolia	16.15	36.15
344	Lotus corniculatus	2.86	4.92
357	Sesuvium verrucosum	9.82	22.63
358	Sesuvium/Distichlis	0	0.71
371	Potamogeton pectinatus	0	8.66
401	Upland Herbs	1.49	-1.95
402	Conium maculatum	2.08	-1.23
403	Foeniculum vulgare	-2.82	0
410	Medium Upland Herbs	0	-1
603	Baccharis/Annual Grasses	0	4.22
801	Eucalyptus globulus	-2.1	-4.21

Table 4 - The change in acreage of the fourteen *Distichlis spicata* (DISP) vegetation types in 2003 to 2006 and 1999 to 2006. A negative acreage changes or % change indicates a loss in acreage.

VEG Code	Vegetation Name	2003-2006 Acreage Change	2003-2006 % Change	1999-2006 Acreage Change	1999-2006 % Change
126	Typha angustifolia/Distichlis	11.57	1.30	-58.80	-6.14
141	Distichlis spicata	-437.49	-21.49	-1228.70	-43.46
142	Distichlis/Annual Grasses	55.84	3.87	-394.15	-20.81
145	Distichlis/Juncus	-19.21	-5.06	-27.74	-7.15
147	Distichlis/Lotus	-8.59	-6.49	-66.74	-35.05
148	Distichlis/Salicornia	374.73	19.91	-127.03	-5.33
149	Distichlis/S. americanus	99.56	26.16	-1.67	-0.35
153	Distichlis/Cotula	-17.10	-12.54	-55.61	-31.81
154	Distichlis/S. maritimus	-54.04	-10.80	91.63	25.84
156	Distichlis (generic)	-187.77	-23.55	-163.10	-21.11
312	Atriplex/Distichlis	-41.94	-12.38	-98.23	-24.87
318	Frankenia/Distichlis	-9.26	-21.98	-20.29	-38.17
323	Lepidium/Distichlis	-41.96	-20.99	-49.34	-23.80
358	Sesuvium/Distichlis	-5.48	-16.43	-0.85	-2.97
	Total DISP Acreage Change	-281.15	-3.06	-2200.63	-19.81

Table 5 - The net change (in acres) of the vegetation types that the *Distichlis spicata* (DISP) vegetation types changed into [loss of DISP indicated with the negative sign (-)] and changed from (acreage gain of DISP) in 2003 to 2006 and 1999 to 2006.

Veg Code	Vegetation Name	DISP Net Change 2003 to 2006	DISP Net Change 1999 to 2006
11	Flooded Wetland	-890.56	-1043.02
340	Short Wetland Herbs	19.29	-227.84
310	Medium Wetland Herbs	39.00	-173.06
130	Medium Wetland Graminoids	30.73	-138.57
231	Annual Grasses generic	-29.33	-137.86
361	Salicornia (generic)	61.70	-116.78
1	Bare Ground	14.04	-110.68
137	Scirpus maritimus	130.21	-88.20
103	Phragmites australis	-48.81	-84.84
138	Scirpus maritimus/Salicornia	29.41	-64.30
123	Typha species (generic)	47.06	-48.16
157	Scirpus (californicus or acutus)-Typha sp.	-37.95	-46.73
129	Typha angustifolia/Phragmites	-16.18	-38.76
347	Salicornia/Annual Grasses	-6.89	-26.24
227	Annual Grasses/Weeds	2.10	-19.88
2	Fallow Disced Field	-0.73	-19.54
121	Typha angustifolia/S. americanus	-7.72	-16.09
401	Upland Herbs	0	-13.62
101	Tall Wetland Graminoids	0	-13.60
211	Elytrigia pontica	-17.87	-13.23
116	Scirpus californicus/S. acutus	-7.69	-11.65
324	Lepidium (generic)	29.18	-8.53
330	Calystegia/Euthamia	0	-7.72
402	Conium maculatum	2.08	-6.91
134	Juncus balticus/Lepidium	0	-6.38
104	Phragmites/Scirpus	-1.97	-4.06
365	Salicornia/Cotula	7.30	-3.55
133	Juncus balticus/Conium	3.02	-3.45
6	Slough	0	-2.84
139	Scirpus maritimus/Sesuvium	0	-2.54
603	Baccharis/Annual Grasses	0	-2.32
413	Centaurea (generic)	0	-2.16
604	Rosa californica	0	-2.07
162	Scirpus (californicus or acutus)/Rosa	0	-2.03
801	Eucalyptus globulus	-0.40	-2.02
127	Scirpus americanus/Lepidium	0	-1.90
5	Structure	-1.66	-1.66
158	Scirpus (californicus or acutus)/Wetland Herbs	0	-1.66

Veg Code	Vegetation Name	DISP Net Change 2003 to 2006	DISP Net Change 1999 to 2006
226	Perennial Grass	3.35	-1.26
346	Salicornia virginica	158.77	-1.18
102	Arundo donax	0	-0.94
9	Ditch	-0.62	-0.62
161	Cynodon dactylon	0	-0.54
410	Medium Upland Herbs	0	-0.45
403	Foeniculum vulgare	-2.82	-0.04
160	Distichlis-Juncus-Triglochin-Glaux	-2.23	0.14
132	Juncus balticus	8.32	0.62
125	Typha angustifolia (dead stalks)	4.09	0.79
357	Sesuvium verrucosum	1.23	1.11
348	Salicornia/Atriplex	4.88	2.29
228	Agrostis avenacea	0	2.77
356	Salicornia/Sesuvium	0	3.37
336	Rumex (generic)	0	3.54
320	Frankenia (generic)	5.00	4.26
223	Phalaris aquatica	0	5.14
238	Polypogon monspeliensis (generic)	5.43	5.43
339	Atriplex triangularis(generic)	0	5.84
120	Typha angustifolia/Polygonum-Xanthium-Echinochloa	0	7.76
218	Lolium (generic)	1.39	7.99
405	Raphanus sativus (generic)	0	8.46
337	Atriplex/Annual Grasses	4.54	10.24
342	Cotula coronopifolia	18.30	16.09
311	Atriplex triangularis	8.77	20.74
329	Polygonum-Xanthium-Echinochloa	1.70	24.06
344	Lotus corniculatus	28.23	35.71
114	Scirpus americanus (generic)	38.49	43.53

Table 6 - The net change (in acres) of the vegetation types that the Phragmites australis (PHAU) vegetation types changed into [loss of PHAU indicated with the negative sign (-)] and changed from (acreage gain of PHAU) in 2003 to 2006 and 1999 to 2006.

Veg Code	Vegetation Name	PHAU Net Change 2003 to 2006	PHAU Net Change 1999 to 2006
1	Bare Ground	2.65	-5.45
3	Parking Lot	0	0.88
6	Slough	0	2.96
9	Ditch	-12.07	0
11	Flooded Wetland	-20.64	3.73
101	Tall Wetland Graminoids	6.65	-4.64
113	Scirpus americanus/S. Californicus-S. acutus	0	0.97
114	Scirpus americanus (generic)	8.34	14.01
116	Scirpus californicus/S. acutus	11.32	25.93
120	Typha angustifolia/Polygonum-Xanthium-Echinochloa	3.03	19.17
121	Typha angustifolia/S. americanus	3.60	17.04
123	Typha species (generic)	90.99	95.19
125	Typha angustifolia (dead stalks)	0.52	0.52
126	Typha angustifolia/Distichlis	1.05	1.26
130	Medium Wetland Graminoids	33.82	-17.85
132	Juncus balticus	7.06	6.66
134	Juncus balticus/Lepidium	3.09	0
135	Juncus balticus/Potentilla	0	1.74
137	Scirpus maritimus	46.58	38.60
138	Scirpus maritimus/Salicornia	1.35	1.00
141	Distichlis spicata	39.83	64.16
142	Distichlis/Annual Grasses	-0.58	7.83
145	Distichlis/Juncus	1.14	1.14
147	Distichlis/Lotus	0.88	5.59
148	Distichlis/Salicornia	6.59	14.99
149	Distichlis/S. americanus	-1.77	-0.17
153	Distichlis/Cotula	0	1.98
154	Distichlis/S. maritimus	12.76	7.61
156	Distichlis (generic)	3.89	4.35
157	Scirpus (californicus or acutus)-Typha sp.	18.31	51.31
158	Scirpus (californicus or acutus)/Wetland Herbs	1.54	-6.38
162	Scirpus (californicus or acutus)/Rosa	0	2.91
227	Annual Grasses/Weeds	3.88	6.15
228	Agrostis avenacea	0	1.75
231	Annual Grasses generic	-3.26	0
238	Polypogon monspeliensis (generic)	0	0.73

Veg Code	Vegetation Name	PHAU Net Change 2003 to 2006	PHAU Net Change 1999 to 2006
310	Medium Wetland Herbs	15.80	-24.34
311	Atriplex triangularis	2.50	3.35
312	Atriplex/Distichlis	0	4.10
315	Atriplex/S. maritimus	0	3.43
323	Lepidium/Distichlis	0	1.37
324	Lepidium (generic)	3.46	0.32
329	Polygonum-Xanthium-Echinochloa	51.32	75.81
330	Calystegia/Euthamia	0	-3.93
337	Atriplex/Annual Grasses	0	1.17
339	Atriplex triangularis(generic)	2.11	2.09
340	Short Wetland Herbs	2.35	-9.07
342	Cotula coronopifolia	0.74	4.19
344	Lotus corniculatus	0.76	0.76
346	Salicornia virginica	7.89	19.68
347	Salicornia/Annual Grasses	-12.06	-8.82
348	Salicornia/Atriplex	-0.62	2.40
357	Sesuvium verrucosum	0	2.25
361	Salicornia (generic)	3.40	18.14
364	Salicornia/Polygonum-Xanthium-Echinochloa	2.38	0
365	Salicornia/Cotula	0	3.39
401	Upland Herbs	6.75	6.75
403	Foeniculum vulgare	7.66	6.81
405	Raphanus sativus (generic)	3.79	3.79
604	Rosa californica	0	0.52
606	Rubus discolor	0	1.13

Table 7a, 7b, and 7c - The change in acreage of the nine invasive, non-native vegetation types in 2003 to 2006 and 1999 to 2006. A negative acreage changes or % change indicates a loss in acreage. Non-native species *Arundo donax*, *Carpobrotus edulis*, *Centaurea solstitialis*, *Conium maculatum*, *Cortaderia selloana*, *Eucalyptus* species, *Foeniculum vulgare*, *Lepidium latifolium*, and *Phragmites australis* represented by the following vegetation types or map units: (1) *Arundo donax*; (2) *Carpobrotus edulis*; (3) *Centaurea solstitialis*; (4) *Conium maculatum* (generic); (5) *Juncus balticus/Conium*; (6) *Cortaderia selloana*; (7) *Eucalyptus* (generic); (8) *Eucalyptus globulus*; (9) *Foeniculum vulgare*; (10) *Lepidium latifolium* (generic); (11) *Lepidium/Distichlis spicata*; (12) *Scirpus americanus/Lepidium*; (13) *Juncus balticus/Lepidium*; (14) *Lolium multiflorum/Lepidium*; (15) *Phragmites australis*; (16) *Phragmites/Scirpus (acutus or californicus)*; (17) *Phragmites/Xanthium strumarium*; and (18) *Typha spp./Phragmites*. 11a shows data for the entire marsh. 11b shows data for the leveed wetland of the marsh. 11c shows data for the tidal wetlands.

Table 7a) Entire Study Area

Vegetation Name	Acre 1999	Acre 2003	Acre 2006	2003- 2006 Acreage change	2003- 2006 % change	1999- 2006 Acreage Change	1999- 2006 % change
<i>Arundo donax</i>	4.73	23.81	23.73	-0.08	-0.3	19.00	401.69
<i>Carpobrotus edulis</i>	7.03	7.40	7.39	-0.01	-0.1	0.36	5.12
<i>Centaurea (generic)</i>	76.91	88.15	62.39	-25.76	-29.2	-14.52	-18.88
<i>Conium maculatum</i>	310.48	376.40	263.79	-112.61	-29.9	-46.69	-15.04
<i>Cortaderia selloana</i>	9.77	9.98	9.97	-0.01	-0.1	0.20	2.05
<i>Eucalyptus globulus</i>	209.89	232.47	237.55	5.08	2.2	27.66	13.18
<i>Foeniculum vulgare</i>	140.93	145.01	130.90	-14.11	-9.7	-10.03	-7.12
<i>Lepidium latifolium</i>	960.8	1030.41	802.78	-227.63	-22.1	-158.02	-16.45
<i>Phragmites australis</i>	863.65	1035.55	1643.98	608.43	58.8	780.33	90.35

Table 7b) Leveed Wetlands

Vegetation Name	Acres 1999	Acres 2003	Acres 2006	2003- 2006 Acreage change	2003- 2006 % change	1999- 2006 Acreage Change	1999- 2006 % change
<i>Arundo donax</i>	3.88	10.07	9.49	-0.58	-5.8	5.61	144.59
<i>Carpobrotus edulis</i>	6.81	7.18	7.11	-0.07	-1.0	0.30	4.41
<i>Centaurea (generic)</i>	72.83	84.07	58.36	-25.71	-30.6	-14.47	-19.87
<i>Conium maculatum</i>	299.8	365.32	338.27	-27.05	-7.4	38.49	12.84
<i>Cortaderia selloana</i>	8.88	7.81	7.60	-0.21	-2.7	-1.28	-14.41
<i>Eucalyptus sp.</i>	189.6	210.98	215.47	4.49	2.1	25.88	13.65
<i>Foeniculum vulgare</i>	128.6	137.37	123.20	-14.17	-10.3	-5.39	-4.19
<i>Lepidium latifolium</i>	797.3	864.95	606.96	-257.99	-29.8	-190.34	-23.87
<i>Phragmites australis</i>	536.6	753.11	1155.3 9	402.28	53.4	618.78	115.31

Table 7c) Tidal Wetlands

Vegetation Name	Acres 1999	Acres 2003	Acres 2006	2003-2006 Acreage Change	2003- 2006 % Change	1999- 2006 Acreage Change	1999- 2006 % Change
<i>Arundo donax</i>	0.85	13.74	13.56	-0.18	-1.75	12.71	1495.29
<i>Carpobrotus edulis</i>	0.22	0.22	0.22	0	0	0	0
<i>Centaurea (generic)</i>	4.08	4.08	3.90	-0.18		-0.18	-4.41
<i>Cortaderia selloana</i>	0.89	2.17	2.11	-0.06	0	1.22	137.08
<i>Eucalyptus sp.</i>	19.40	21.49	21.41	-0.08	-0.37	2.01	10.36
<i>Foeniculum vulgare</i>	12.34	7.64	7.71	0.07	0.92	-4.63	-37.52
<i>Conium maculatum</i>	10.70	11.08	9.89	-1.19	-10.74	-0.81	-7.57
<i>Lepidium latifolium</i>	166.2 5	195.46	191.32	-4.14	-2.12	25.07	15.08
<i>Phragmites australis</i>	327.0 4	312.44	502.75	190.31	60.91	175.71	53.73

Table 8 - The net change (in acres) of the vegetation types that the polygons from 2003 labeled as Flooded Managed Wetlands changed into [loss of flooded wetlands indicated with the negative sign (-)] and changed from (acreage gain of flooded wetlands)

Veg Code	Vegetation Name	Net Change in Flooded Wetland 2003 to 2006	Net Change in Flooded Wetland 1999 to 2006
1	Bare Ground	437.71	611.89
2	Fallow Discd Field	2.73	2.73
3	Parking Lot	0.92	0.92
4	Road	42.20	42.20
6	Slough	12.95	13.90
9	Ditch	23.27	23.27
101	Tall Wetland Graminoids	7.28	2.93
103	Phragmites australis	11.51	7.60
104	Phragmites/Scirpus	-5.27	-2.15
113	Scirpus americanus/S. Californicus-S. acutus	3.31	8.13
114	Scirpus americanus (generic)	37.58	51.54
116	Scirpus californicus/S. acutus	13.63	14.83
120	Typha angustifolia/Polygonum-Xanthium-Echinochloa	43.89	47.47
121	Typha angustifolia/S. americanus	1.24	3.01
123	Typha species (generic)	299.95	276.29
125	Typha angustifolia (dead stalks)	13.94	19.33
126	Typha angustifolia/Distichlis	73.83	54.00
127	Scirpus americanus/Lepidium	1.46	2.22
129	Typha angustifolia/Phragmites	-0.21	-32.65
130	Medium Wetland Graminoids	109.27	-179.07
132	Juncus balticus	24.25	16.25
133	Juncus balticus/Conium	3.30	1.22
134	Juncus balticus/Lepidium	19.18	0.52
137	Scirpus maritimus	911.17	630.94
138	Scirpus maritimus/Salicornia	190.66	130.24
139	Scirpus maritimus/Sesuvium	75.41	67.49
140	Short Wetland Graminoids	-51.01	-50.20
141	Distichlis spicata	151.70	274.15
142	Distichlis/Annual Grasses	121.50	168.28
145	Distichlis/Juncus	30.73	41.93
147	Distichlis/Lotus	7.60	7.60
148	Distichlis/Salicornia	144.34	188.47
149	Distichlis/S. americanus	0	1.72
153	Distichlis/Cotula	10.11	18.95
154	Distichlis/S. maritimus	160.39	100.48

Veg Code	Vegetation Name	Net Change in Flooded Wetland 2003 to 2006	Net Change in Flooded Wetland 1999 to 2006
155	Crypsis schoenoides	10.28	10.28
156	Distichlis (generic)	111.35	91.57
157	Scirpus (californicus or acutus)-Typha sp.	-20.32	-29.64
158	Scirpus (californicus or acutus)/Wetland Her	5.97	5.97
160	Distichlis-Juncus-Triglochin-Glaux	-0.72	-0.72
210	Medium Upland Graminoids	1.14	1.14
215	Leymus (generic)	4.79	7.38
220	Lolium/Lepidium	5.42	5.42
225	Cultivated Annual Graminoid	50.83	50.83
226	Perennial Grass	144.33	121.71
227	Annual Grasses/Weeds	103.94	98.94
231	Annual Grasses generic	732.36	650.17
234	Hordeum/Lolium	2.35	0.00
300	Wetland Herbs	13.00	13.00
301	Tall Wetland Herbs	1.16	1.16
310	Medium Wetland Herbs	57.56	3.13
311	Atriplex triangularis	24.72	35.68
312	Atriplex/Distichlis	4.36	6.32
315	Atriplex/S. maritimus	4.15	4.65
316	Atriplex/Sesuvium	0	5.12
320	Frankenia (generic)	6.96	6.96
323	Lepidium/Distichlis	25.14	29.96
324	Lepidium (generic)	118.60	107.84
329	Polygonum-Xanthium-Echinochloa	111.79	200.57
336	Rumex (generic)	1.89	1.89
337	Atriplex/Annual Grasses	21.05	22.82
339	Atriplex triangularis(generic)	16.07	17.43
340	Short Wetland Herbs	183.79	6.60
342	Cotula coronopifolia	35.96	43.10
344	Lotus corniculatus	7.35	8.58
346	Salicornia virginica	614.77	789.82
347	Salicornia/Annual Grasses	-45.59	21.07
348	Salicornia/Atriplex	12.57	34.81
356	Salicornia/Sesuvium	5.62	25.14
357	Sesuvium verrucosum	38.34	55.77
358	Sesuvium/Distichlis	1.30	0.00
361	Salicornia (generic)	52.08	1.77
364	Salicornia/Polygonum-Xanthium-Echinochloa	14.42	12.32
365	Salicornia/Cotula	13.08	20.78
371	Potamogeton pectinatus	5.79	5.79
401	Upland Herbs	1.58	1.58

Veg Code	Vegetation Name	Net Change in Flooded Wetland 2003 to 2006	Net Change in Flooded Wetland 1999 to 2006
402	Conium maculatum	19.63	13.34
405	Raphanus sativus (generic)	4.02	4.59
406	Brassica nigra (generic)	21.48	21.48
410	Medium Upland Herbs	3.64	4.42
514	Atriplex lentiformis (generic)	0	0.63
604	Rosa californica	0.28	0.28
801	Eucalyptus globulus	7.60	0.84
999	New or Eliminated	0	0.00

Conclusions and Recommendations

Several vegetation changes found in this 2006 update are of note: 1) The 131% increase in flooded wetlands (since 1999), 2) the net loss of 945 acres of *Salicornia virginica* vegetation types since 1999 that are SMHM habitat, 3) the net gain of 780.33 acres of the invasive form of *Phragmites australis* since 1999 over the entire marsh, 580 acres of which have established since 2003, and 4) The acreage decrease or stabilization of several of the non-native species of concern.

At least a few of these significant changes can be explained in part by increased rain fall, increased outflow, high tides, and subsequent levee breaches. On February 3rd, 2006, Solano County was declared a Federal Disaster Area, DR – 1628, for the incident period December 17th, 2005, thru January 3rd, 2006. These storm events combined with high tides and high Sacramento-San Joaquin River Delta out-flow, resulted in numerous exterior levee breaches and extended flooding of diked areas throughout the Marsh. Also, during this time, the levee at Jack Snipe D.C. failed and flooded over 1,820 acres off of Chadborne Road in the northwestern Marsh. These events contributed to the huge increase in flooded wetlands in 2006 which account for a 1259.48 acre decrease of *Salicornia virginica* vegetation and 1043.02 decrease of *Distichlis spicata* vegetation. While these incidences may have resulted in a decrease in Salt Marsh Harvest Mouse habitat, these can be considered as “Acts of God” and were not intentionally caused.

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Appendix 1 - Crosswalk and description of attributes used for Suisun Marsh vegetation change detection data entry in 2003 and 2006.

Map Attributes of 2003	Map Attributes of 2006	Definition
Poly_ID	PolyID_99	Unique identifier in 1999 (should be the same as PolyID_06)
Veg_99	Veg_99	Assessed vegetation code in 1999
Ht_99	Ht_99	Assessed height class in 1999; 0=N/A, 1=(<0.5m), 2=(0.5-1m), 3=(1-2m), 4=(2-5m), 5=(5-10m), 6=(>10m)
Cov_99	Cover_99	Assessed cover class in 1999; 0=N/A, 1=(<2%), 2=(2-10%), 3=(10-25%), 4=(25-50%), 5=(50-75%), 6=(>75%)
Dist_99	Dist_99	Assessed disturbance class in 2006; 0=N/A, 1=Not evident, 2=Low, 3=Medium, 4=High
id	ID	How assessment was determined in 2003: P=photo interpretation, R=reconnaissance, S03=sampled in 2003 (Releve), U=updated
Acres_99	PolyArea99	Area (in acres) of each polygon in 1999
Poly_size	PolySize99	Size class of polygon in 1999; 1=(<1ac), 2=(1-5ac), 3=(>5ac)
Veg_03	Veg_03	Assessed vegetation code in 2003
Ht_03	Ht_03	Assessed height class in 2003; 0=N/A, 1=(<0.5m), 2=(0.5-1m), 3=(1-2m), 4=(2-5m), 5=(5-10m), 6=(>10m)
Cov_03	Cover_03	Assessed cover class in 2003; 0=N/A, 1=(<2%), 2=(2-10%), 3=(10-25%), 4=(25-50%), 5=(50-75%), 6=(>75%)
Dist_03	Dist_03	Assessed disturbance class in 2006; 0=N/A, 1=Not evident, 2=Low, 3=Medium, 4=High
Acres_03	PolyArea03	Area (in acres) of each polygon in 2003
Chnge_sz	ChngeSize03	Size class of polygon in 2003; 1=(<1ac), 2=(1-5ac), 3=(>5ac)
Chnge_veg	ChngeVeg03	0=no change in vegetation type from 2003 to 2006; 1=change
Chnge_cls	ChngeCls03	Change is size class of polygon since 1999; 0=none, 1=(5-10%), 2=(10-20%), 3=(20-50%), 4=(>50%), 999=new or eliminated
	PolyID_06	Unique polygon identifier in 2006 (should be the same as PolyID_99)
	ID_06	How assessment was determined in 2006: P=photo interpretation, R=reconnaissance, S06=sampled in 2006 (Releve), U=updated
	PolySize06	Size class of polygon in 2006; 1=(<1ac), 2=(1-5ac), 3=(>5ac)
	ChngeCls06	Change is size class of polygon since 2003; 0=none, 1=(5-10%), 2=(10-20%), 3=(20-50%), 4=(>50%), 999=new or eliminated
	ChngeVeg06	0=no change in vegetation type from 2003 to 2006; 1=change
	PolyArea06	Area (in acres) of each polygon in 2006
	Veg_06	Assessed vegetation code in 2006
	Ht_06	Assessed height class in 2006; 0=N/A, 1=(<0.5m), 2=(0.5-1m), 3=(1-2m), 4=(2-5m), 5=(5-10m), 6=(>10m)
	Cover_06	Assessed cover class in 2006; 0=N/A, 1=(<2%), 2=(2-10%), 3=(10-25%), 4=(25-50%), 5=(50-75%), 6=(>75%)

Map Attributes of 2003	Map Attributes of 2006	Definition
	Dist_06	Assessed disturbance class in 2006; 0=N/A, 1=Not evident, 2=Low, 3=Medium, 4=High
	Notes_06	2006 Notes

Appendix 2 - A list of all vegetation types and mapping units (mu) used for the 2003-2006 change detection. The types highlighted in yellow were not assessed if one changed to another because they were considered non-significant and/or unreliably interpretable (Vaghti and Keeler-Wolf 2003).

1	Bare Ground mu	231	Annual Grasses generic
2	Fallow Disced Field mu	232	Bromus spp./Hordeum spp.
3	Parking Lot mu	234	Hordeum/Lolium
4	Road mu	235	Vulpia/Euthamia
5	Structure mu	238	Polypogon monspeliensis (generic)
6	Slough mu	300	Wetland Herbs
7	Tidal Mudflat mu	301	Tall Wetland Herbs
8	Railroad Track mu	310	Medium Wetland Herbs
9	Ditch mu	311	Atriplex triangularis
10	Trail mu	312	Atriplex/Distichlis
11	Flooded Wetland mu	315	Atriplex/S. maritimus
12	Freshwater Drainage mu	316	Atriplex/Sesuvium
13	Water Treatment Pond mu	317	Frankenia/Agrostis
14	Urban Area mu	318	Frankenia/Distichlis
101	Tall Wetland Graminoids mu	320	Frankenia (generic)
102	Arundo donax	321	Grindelia stricta var stricta
103	Phragmites australis	323	Lepidium/Distichlis
104	Phragmites/Scirpus	324	Lepidium (generic)
105	Phragmites/Xanthium	329	Polygonum-Xanthium-Echinochloa
112	Scirpus americanus/Potentilla	336	Rumex (generic)
113	Scirpus americanus/S. Californicus-S. acutus	337	Atriplex/Annual Grasses
114	Scirpus americanus (generic)	338	Potentilla anserina (generic)
116	Scirpus californicus/S. acutus	339	Atriplex triangularis(generic)
120	Typha angustifolia/Polygonum-Xanthium-Echinochloa	340	Short Wetland Herbs
121	Typha angustifolia/S. americanus	342	Cotula coronopifolia
123	Typha species (generic)	344	Lotus corniculatus
125	Typha angustifolia (dead stalks)	346	Salicornia virginica
126	Typha angustifolia/Distichlis	347	Salicornia/Annual Grasses
127	Scirpus americanus/Lepidium	348	Salicornia/Atriplex
129	Typha angustifolia/Phragmites	350	Salicornia/Crypsis
130	Medium Wetland Graminoids	356	Salicornia/Sesuvium
132	Juncus balticus	357	Sesuvium verrucosum
133	Juncus balticus/Conium	358	Sesuvium/Distichlis
134	Juncus balticus/Lepidium	359	Sesuvium/Lolium
135	Juncus balticus/Potentilla	360	Spergularia/Cotula
137	Scirpus maritimus	361	Salicornia (generic)
138	Scirpus maritimus/Salicornia	364	Salicornia/Polygonum-Xanthium-Echinochloa

139	Scirpus maritimus/Sesuvium	365	Salicornia/Cotula
140	Short Wetland Graminoids	371	Potamogeton pectinatus
141	Distichlis spicata	401	Upland Herbs
142	Distichlis/Annual Grasses	402	Conium maculatum
145	Distichlis/Juncus	403	Foeniculum vulgare
147	Distichlis/Lotus	405	Raphanus sativus (generic)
148	Distichlis/Salicornia	406	Brassica nigra (generic)
149	Distichlis/S. americanus	410	Medium Upland Herbs
153	Distichlis/Cotula	413	Centaurea (generic)
154	Distichlis/S. maritimus	421	Carpobrotus edulis
155	Crypsis schoenoides	502	Salix exigua
156	Distichlis (generic)	514	Atriplex lentiformis (generic)
157	Scirpus (californicus or acutus)-Typha sp.	601	Medium Upland Shrubs
158	Scirpus (californicus or acutus)/Wetland Herb	603	Baccharis/Annual Grasses
160	Distichlis-Juncus-Triglochin-Glaux	604	Rosa californica
161	Cynodon dactylon	605	Rosa/Baccharis
162	Scirpus (californicus or acutus)/Rosa	606	Rubus discolor
202	Cortaderia seloana	700	Willow Trees
210	Medium Upland Graminoids	702	Salix laevigata/S. lasiolepis
211	Elytrigia pontica	705	Salix lasiolepis/Quercus agrifolia
215	Leymus (generic)	800	Eucalyptus
218	Lolium (generic)	801	Eucalyptus globulus
220	Lolium/Lepidium	900	Oaks
222	Lolium/Rumex	901	Quercus agrifolia
223	Phalaris aquatica	903	Quercus lobata
225	Cultivated Annual Graminoid	910	Landscape Trees
226	Perennial Grass	911	Ailanthus altissima
227	Annual Grasses/Weeds	912	Fraxinus latifolia
228	Agrostis avenacea	330	Calystegia/Euthamia
230	Short Upland Graminoids	999	New or Eliminated

Appendix 3 - A list of species by Group Name, Scientific Name, and Common Name that occur within the Suisun Marsh. *=non-native.

Group Name	Scientific Name	Common Name
NONFLOWERING PLANTS: PTERIDOPHYTES	Azollaceae	Mosquito Fern Family
	<i>Azolla filiculoides</i>	
	Equisitaceae	Horsetail Family
	<i>Equisetum hyemale</i> ssp. affine	Common scouring rush
FLOWERING PLANTS: DICOTYLEDONS	Aizoaceae	Fig-Marigold Family
	* <i>Carpobrotus chilensis</i>	Sea fig (often mistaken for ice plant)
	* <i>Sesuvium verrucosum</i>	Western sea purslane
	Amaranthaceae	Pigweed Family
	* <i>Amaranthus albus</i>	Tumble pigweed
	<i>Amaranthus blitoides</i>	Prostrate pigweed
	* <i>Amaranthus retroflexus</i>	Redroot pigweed
	Anacardiaceae	Sumac or Cashew Family
	<i>Toxicodendron diversilobum</i>	Poison oak
	Apiaceae	Carrot Family
	* <i>Apium graveolens</i>	Celery
	<i>Cicuta maculata</i> var. <i>bolanderi</i>	Water hemlock
	* <i>Conium maculatum</i>	Poison hemlock
	<i>Eryngium articulatum</i>	Coyote thistle
	<i>Eryngium vaseyi</i>	Vasey's button celery
	* <i>Foeniculum vulgare</i>	Fennel
	<i>Hydrocotyle verticillata</i>	Marsh pennywort
	<i>Lilaeopsis masonii</i> (CR;FC1; List 1 B); NDDB	Mason's lilaeopsis
	<i>Lilaeopsis occidentalis</i>	
	<i>Lomatium urticulatum</i>	Foothill lomatium
	<i>Oenanthe sarmentosa</i>	Oenanthe
	<i>Sanicula bipinnatifida</i>	Purple sanicle
<i>Sanicula crassicaulis</i>	Pacific snakeroot	

Group Name	Scientific Name	Common Name
	<i>Sium suave</i>	
	Apocynaceae	Dogbane Family
	<i>Apocynum cannabinum</i>	Indian hemp
	Araliaceae	Ginseng Family
	<i>Hedera helix</i>	English Ivy
	Asteraceae	Sunflower Family
	<i>Achillea millefolium</i>	Yarrow
	<i>Achyrachaena mollis</i>	Blow wives
	<i>Ambrosia psilostachya</i>	Western ragweed
	<i>Artemisia douglasiana</i>	Mugwort
	<i>Aster chilensis</i>	
	<i>Aster lentus</i> (FC1, List I B); NDDB	Suisun Marsh aster
	<i>Aster subulatus</i> var. <i>ligulatus</i>	Slim aster
	<i>Baccharis douglasii</i>	Marsh baccharis
	<i>Baccharis pilularis</i>	Coyote brush, Chaparral broom
	<i>Baccharis salicifolia</i>	Mulefat, Seep willow, Water-wally
	<i>Bidens frondosa</i>	Sticktight
	<i>Bidens laevis</i>	Bur-marigold
	* <i>Carduus pycnocephalus</i>	Italian thistle
	* <i>Centaurea calcitrapa</i>	Purple star thistle
	* <i>Centaurea solstitialis</i>	Yellow star thistle
	<i>Cirsium hydrophilum</i> var. <i>hydrophilum</i> (FE, List I B); NDDB	Suisun thistle
	* <i>Cirsium vulgare</i>	Bull thistle
	* <i>Conyza bonariensis</i>	Hairy fleabane
	<i>Conyza canadensis</i>	Horseweed
	* <i>Cotula coronopifolia</i>	Brass buttons
	* <i>Cynara cardunculus</i>	Cardoon/Artichoke thistle
	<i>Eclipta prostrata</i>	Eclipta
	<i>Euthamia occidentalis</i>	Western goldenrod
	<i>Gnaphalium stramineum</i>	Cudweed

Group Name	Scientific Name	Common Name
	<i>Grindelia stricta</i> var. <i>angustifolia</i> (list 4)	Marsh gumplant
	<i>Helenium bigelovii</i>	Bigelow's sneezeweed
	<i>Helenium puberulum</i>	
	<i>Helianthus annuus</i>	Sunflower
	<i>Helianthus bolanderi</i>	
	<i>Helianthus californicus</i>	California sunflower
	<i>Hemizonia pungens</i>	Spikeweed
	<i>Hemizonia pungens</i> ssp. <i>maritima</i>	Common spikeweed
	<i>Heterotheca grandiflora</i>	Telegraph weed
	<i>Heterotheca sessiliflora</i> var. <i>bolanderi</i>	Hairy goldenaster
	* <i>Hypochaeris radicata</i>	
	<i>Isocoma arguta</i> (FC); NDDDB (introduced at Rush Ranch)	Carquinez goldbush
	<i>Iva axillaris</i>	Poverty weed
	<i>Jaumea carnosa</i>	Fleshy jaumea
	* <i>Lactuca saligna</i>	
	* <i>Lactuca serriola</i>	Prickly lettuce
	* <i>Lapsana communis</i>	Nipplewort
	<i>Lasthenia californica</i>	California goldfields
	<i>Lasthenia chrysostoma</i>	Goldfields
	<i>Lasthenia conjugens</i> (FE, 1B, CE); NDDDB	Contra Costa goldfields
	<i>Lasthenia glabrata</i>	Yellowray goldfields
	<i>Layia chrysanthemoides</i>	Smooth layia
	* <i>Matricaria matricarioides</i>	Pineapple weed
	<i>Micropus californicus</i> var. <i>californicus</i>	Slender cottonweed
	<i>Microseris douglasii</i> ssp. <i>douglasii</i>	Douglas' microseris
	* <i>Picris echiodes</i>	Bristly oxtongue
	<i>Pluchea odorata</i>	Saltmarsh fleabane
	<i>Senecio hydrophilus</i>	Marsh butterweed, Swamp senecio
	* <i>Senecio vulgaris</i>	Groundsel

Group Name	Scientific Name	Common Name
	* <i>Silybum marianum</i>	Milk thistle
	* <i>Sonchus arvensis</i>	
	* <i>Sonchus oleraceus</i>	Common sow thistle
	* <i>Taraxacum officinale</i>	Dandelion
	* <i>Tragopogon porrifolius</i>	Salsify, Oyster plant
	<i>Wyethia angustifolia</i>	Narrow leaved mule ears
	* <i>Xanthium strumarium</i>	Cocklebur
	Betulaceae	Birch Family
	<i>Alnus rhombifolia</i>	White alder
	Boraginaceae	Borage Family
	<i>Amsinckia eastwoodiae</i>	Common fiddleneck
	<i>Heliotropium curassavicum</i>	Salt heliotrope
	* <i>Lappula redowskii</i>	Western sticktight
	<i>Plagiobothrys greenei</i>	Green's popcorn flower
	<i>Plagiobothrys stipitatus</i> var. <i>stipitatus</i>	Stipitate popcorn flower
	Brassicaceae	Mustard Family
	* <i>Brassica nigra</i>	Black mustard
	* <i>Capsella bursa pastoris</i>	Shepherd's purse
	* <i>Cardaria draba</i>	Heart-podded hoary chess
	<i>Lepidium dictyotum</i> var. <i>acutidens</i>	Sharp toothed peppergrass
	* <i>Lepidium latifolium</i>	Perennial peppergrass
	<i>Lepidium nitidum</i> var. <i>nitidum</i>	Shining peppergrass
	* <i>Raphanus sativum</i>	Wild radish
	<i>Rorippa nasturtium-aquaticum</i>	Watercress
	<i>Rorippa palustris</i>	Watercress
	* <i>Sinapis arvensis</i>	Charlock
	Callitrichaceae	Water Star Wort Family
	<i>Callitriche heterophylla</i>	Water star wort
	Caprifoliaceae	Honeysuckle Family
	* <i>Lonicera japonica</i>	Japanese honeysuckle
	<i>Sambucus mexicana</i>	Blue elderberry

Group Name	Scientific Name	Common Name
	Caryophyllaceae	Pink Family
	* <i>Cerastium glomeratum</i>	Mouse ear chickweed
	* <i>Silene gallica</i>	Catchfly
	* <i>Spergula arvensis</i> ssp. <i>arvensis</i>	Stickwort, starwort
	<i>Spergularia marina</i>	Saltmarsh sand spurry
	* <i>Spergularia media</i>	Medium sand spurry
	Chenopodiaceae	Goosefoot Family
	<i>Atriplex cordulata</i> (FSC, List 1B); NDDB	Heartscale
	<i>Atriplex depressa</i> (List 1B); NDDB	Brittlescale
	<i>Atriplex joaquianna</i> (FSC; List 1B); NDDB	Valley spearscale
	<i>Atriplex lentiformis</i>	Big saltbush
	* <i>Atriplex rosea</i>	Tumbling oracle
	* <i>Atriplex semibaccata</i>	Australian saltbush
	<i>Atriplex triangularis</i>	Fathen, spearscale
	* <i>Bassia hyssopifolia</i>	Bassia
	* <i>Beta vulgaris</i>	Beet
	* <i>Chenopodium album</i>	Lamb's quarters
	* <i>Chenopodium ambrosioides</i>	Mexican tea
	* <i>Chenopodium chenopodioides</i>	South American goosefoot
	<i>Nitrophila occidentalis</i>	Nitrophila
	<i>Salicornia europaea</i>	Annual pickleweed
	<i>Salicornia subterminalis</i>	Parish's glasswort
	<i>Salicornia virginica</i>	Perennial pickleweed
	* <i>Salsola tragus</i> (<i>S. pestifera</i>)	Russian thistle, tumbleweed
	<i>Suaeda calceoliformis</i>	Horned sea-blite
	Convolvulaceae	Morning Glory Family
	<i>Calystegia sepium</i>	Hedge bindweed
	<i>Calystegia sepium</i> ssp. <i>limnophila</i>	Hedge bindweed
	* <i>Convolvulus arvensis</i>	Bindweed, Orchard morning-glory
	<i>Cressa truxillensis</i>	Alkali weed

Group Name	Scientific Name	Common Name
	Cucurbitaceae	Gourd Family
	Marah fabaceus	California man-root
	Cuscutaceae	Dodder Family
	Cuscuta indecora	Roadside dodder
	Cuscuta salina var. major	Saltmarsh dodder
	Dipsacaceae	Teasel Family
	*Dipsacus sylvestris	Common teasel
	Euphorbiaceae	Spurge Family
	Eremocarpus setigerus	Turkey mullein, Dove weed
	Fabaceae	Legume Family
	*Acacia melanoxyton	Blackwood acacia
	Glycyrrhiza lepidota	Wild licorice
	Hoita macrostachya	
	Lathyrus jepsonii var. jepsonii (FCi, List 1B); NDDB	Delta tule pea
	*Lotus corniculatus	Bird's foot trefoil
	Lotus purshianus var. purshianus	Spanish clover
	Lotus wrangelianus	Chilean trefoil
	Lupinus bicolor	Miniature lupine
	Lupinus formosus	Summer lupine
	Lupinus nanus	
	Lupinus succulentus	Arroyo lupine
	*Medicago polymorpha	California burclover
	*Melilotus alba	White sweetclover
	*Melilotus indica	Sourclover
	*Spartium junceum	Spanish Broom
	Trifolium depauperatum var. amplectens	Pale sack-clover
	*Trifolium hirtum	Rose clover
	*Trifolium pratense	Red clover
	Trifolium wormskioldii	Cow clover
	*Vicia sativa ssp. nigra	Narrow-leaved vetch
	*Vicia sativa ssp. sativa	Spring vetch, Common vetch

Group Name	Scientific Name	Common Name
	<i>Vicia villosa</i> ssp. <i>varia</i>	Purple winter vetch
	Frankeniaceae	Frankenia Family
	<i>Frankenia salina</i>	Alkali heath
	Gentianaceae	Gentian Family
	<i>Centaurium muehlenbergii</i>	June centaury
	Geraniaceae	Geranium Family
	* <i>Erodium botrys</i>	Filaree, Storksbill
	* <i>Erodium brachycarpum</i>	Filaree
	* <i>Erodium cicutarium</i>	Redstem filaree
	* <i>Geranium dissectum</i>	Cut-leaved geranium
	Haloragaceae	Water-Milfoil Family
	* <i>Myriophyllum spicatum</i>	Eurasian Milfoil
	Lamiaceae	Mint Family
	<i>Lycopus americanus</i>	Water horehound
	<i>Lycopus asper</i>	
	<i>Mentha arvensis</i>	Tule mint
	<i>Stachys albens</i>	Hedge nettle
	Lythraceae	Loosetrife Family
	<i>Lythrum californicum</i>	California loosetrife
	* <i>Lythrum hyssopifolia</i>	Hyssop loosetrife
	* <i>Lythrum tribracteatum</i>	
	Malvaceae	Mallow Family
	* <i>Lavatera cretica</i>	Tree mallow
	* <i>Malva neglecta</i>	
	* <i>Malva parviflora</i>	Cheeseweed
	<i>Malvella leprosa</i>	Alkali mallow, White-weed
	* <i>Sidalcea rhombifolia</i>	Cutleaf checkerbloom
	<i>Sidalcea malvaeflora</i> ssp. <i>laciniata</i>	
	Myrtaceae	Myrtle Family
	* <i>Eucalyptus globulus</i>	Blue gum
	Oleaceae	Olive Family
	<i>Fraxinus latifolia</i>	Oregon Ash

Group Name	Scientific Name	Common Name
	Onagraceae	Evening Primrose Family
	<i>Epilobium brachycarpum</i>	Willow herb
	<i>Epilobium ciliatum</i>	Fireweed, Willow herb
	<i>Epilobium ciliatum</i> ssp. <i>ciliatum</i>	Epilobium
	<i>Ludwigia peploides</i> ssp. <i>peploides</i>	Yellow waterweed
	<i>Oenothera deltoide</i> ssp. <i>howellii</i> (CE, FE, List 1B); NDDB	Antioch dunes evening primrose
	Papaveraceae	Poppy Family
	<i>Eschscholzia californica</i>	California poppy
	Plantaginaceae	Plantain Family
	* <i>Plantago coronopus</i>	
	* <i>Plantago lanceolata</i>	English plantain
	* <i>Plantago major</i>	Common plantain
	<i>Plantago maritima</i>	Seaside plantain
	<i>Plantago subnuda</i>	Mexican plantain
	Plumbaginaceae	Leadwort Family
	<i>Limonium californicum</i>	Western marsh rosemary
	Polemoniaceae	Phlox Family
	<i>Gilia tricolor</i>	Bird's eyes
	Polygonaceae	Buckwheat Family
	<i>Eriogonum nudum</i>	Nudestern buckwheat
	<i>Polygonum amphibium</i> var. <i>emersum</i>	Water smartweed/kelp
	* <i>Polygonum arenastrum</i>	Common knotweed, doorweed
	* <i>Polygonum argyrocoleon</i>	
	<i>Polygonum lapathifolium</i>	Willow weed
	* <i>Polygonum polystachyum</i>	Himalayan knotweed
	* <i>Polygonum prolificum</i>	Smartweed
	<i>Polygonum punctatum</i>	Dotted smartweed
	* <i>Rumex acetosella</i>	Sheep sorrel
	* <i>Rumex crispus</i>	Curly dock
	* <i>Rumex conglomeratus</i>	Clustered dock
	<i>Rumex occidentalis</i>	Western dock

Group Name	Scientific Name	Common Name
	* <i>Rumex pulcher</i>	Fiddle dock
	Portulacaceae	Purslane Family
	<i>Calandrinia ciliata</i>	Redmaids
	<i>Claytonia perfoliata</i>	Miner's lettuce
	* <i>Portulaca oleracea</i>	Common purslane
	Primulaceae	Primrose Family
	* <i>Anagallis arvensis</i>	Scarlet pimpernel
	<i>Glaux maritima</i>	Sea milkwort
	<i>Samolus parviflorus</i>	Water pimpernel
	Ranunculaceae	Buttercup Family
	<i>Ranunculus canus</i>	Sacramento Valley buttercup
	Roseaceae	Rose Family
	<i>Potentilla anserina</i> ssp. <i>pacifica</i>	Common silverweed, marsh cinquefoil
	* <i>Prunus armeniaca</i>	Apricot
	* <i>Pyracantha angustifolia</i>	Firethorn
	<i>Rosa californica</i>	California rose
	* <i>Rubus discolor</i>	Himalayan blackberry
	<i>Rubus ursinus</i>	California blackberry
	Rubiaceae	Madder Family
	<i>Cephalanthus occidentalis</i> var. <i>californicus</i>	California buttonwillow, buttonbush
	<i>Gallium trifidum</i> var. <i>pacificum</i>	Bedstraw
	Salicaceae	Willow Family
	<i>Populus fremontii</i> ssp. <i>fremontii</i>	Fremont's cottonwood
	<i>Salix exigua</i> (formerly <i>S. hindsiana</i>)	Narrow leaved willow, Sandbar willow
	<i>Salix gooddingii</i>	Goodding's black willow
	<i>Salix laevigata</i>	Red Willow
	<i>Salix lasiolepis</i>	Arroyo willow
	Saururaceae	Lizard's Tail Family
	<i>Anemopsis californica</i>	Lizard's tail, Yerba mansa
	Saxifragaceae	Saxifrage Family
	<i>Saxifraga californica</i>	California saxifrage

Group Name	Scientific Name	Common Name
	Scrophulariaceae	Figwort Family
	* <i>Bellardia trixago</i>	Bellardia
	<i>Castilleja attenuata</i>	Valley tassels
	<i>Castilleja exserta</i>	Purple owl's clover
	<i>Cordylanthus mollis</i> ssp. <i>mollis</i> (FE,SR, List 1B); NDDB	Soft bird's beak
	<i>Mimulus guttatus</i>	Common monkeyflower
	<i>Scrophularia californica</i>	California figwort
	<i>Triphysaria eriantha</i>	Butter and eggs, Johnny-tuck
	Solanaceae	Nightshade Family
	<i>Solanum americanum</i>	American nightshade
	* <i>Solanum sarrachoides</i>	Nightshade
	Tamaricaceae	Tamarisk Family
	* <i>Tamarix gallica</i>	African tamarisk
	* <i>Tamarix parviflora</i>	Salt cedar, European tamarisk
	Verbenaceae	Vervain Family
	<i>Phyla lanceolata</i>	Lippia
	Violaceae	Violet Family
	<i>Viola pedunculata</i>	Johnny jump-up
	Zygophyllaceae	Caltrop Family
	* <i>Tribulis terrestris</i>	Puncture vine
FLOWERING PLANTS: MONOCOTS		
	Cyperaceae	Sedge Family
	<i>Carex barbarae</i>	Santa Barbara sedge
	<i>Carex lyngbeii</i>	
	<i>Carex nebrascensis</i>	Nebraska sedge
	<i>Cyperus eragrostis</i>	
	* <i>Cyperus esculentus</i>	Yellow nutsedge
	<i>Cyperus erythrorhizos</i>	
	<i>Cyperus strigosus</i>	
	<i>Eleocharis acicularis</i>	
	<i>Eleocharis macrostachya</i>	Creeping spikerush
	<i>Scirpus acutis</i> var. <i>occidentalis</i>	Hardstern bulrush, common tule

Group Name	Scientific Name	Common Name
	<i>Scirpus americanus</i>	
	<i>Scirpus californicus</i>	California bulrush
	<i>Scirpus cernuus</i>	Low club rush
	<i>Scirpus koilolepis</i>	Keeled club rush
	<i>Scirpus maritimus</i> (formerly <i>S. robustus</i>)	Alkali bulrush
	<i>Scirpus</i> sp (<i>S. Acutus</i> X <i>S. californicus</i>)	
	<i>Scirpus</i> sp (<i>S. Californicus</i> X <i>S. americanus</i>)	
	<i>Scirpus</i> sp (<i>S. Maritimus</i> X ?)	
	Iridaceae	Iris Family
	* <i>Iris pseudacorus</i>	Iris
	<i>Sisyrinchium bellum</i>	Blue-eyed grass
	Juglandaceae	Walnut Family
	<i>Juglans californica</i>	California Black Walnut
	Juncaceae	Rush Family
	<i>Juncus balticus</i>	Baltic rush
	<i>Juncus bufonius</i>	Toad rush
	<i>Juncus effusus</i> var. <i>pacificus</i>	Soft rush
	<i>Juncus mexicanus</i>	Mexican rush
	<i>Juncus phaeocephalus</i>	
	<i>Juncus xiphioides</i>	
	Juncaginaceae	Arrow Weed Family
	<i>Triglochin concinna</i> var. <i>concinna</i>	Elegant arrowgrass
	<i>Triglochin maritima</i>	Seaside arrowgrass
	<i>Triglochin stricta</i>	Three ribbed arrowgrass
	Lemnaceae	Duckweed Family
	<i>Lemna gibba</i>	
	Liliaceae	Lily Family
	* <i>Asparagus officinalis</i> ssp. <i>officinalis</i>	Asparagus
	<i>Brodiaea elegans</i>	Harvest brodiaea

Group Name	Scientific Name	Common Name
	<i>Chlorogalum pomeridianum</i> var. <i>pomeridianum</i>	Soap plant
	<i>Dichelostemma capitatum</i>	Blue dicks
	<i>Muilla maritima</i>	Common muilla
	<i>Triteleia hyacinthina</i>	White brodiaea
	<i>Triteleia laxa</i>	Ithuriel's spear
	Poaceae	Grass Family
	* <i>Agropyron</i> sp	Wheatgrass
	* <i>Agrostis avenacea</i>	
	<i>Agrostis exarata</i>	Bentgrass
	* <i>Agrostis stolonifera</i>	Creeping bentgrass
	* <i>Agrostis viridis</i>	
	<i>Apera</i> sp	
	* <i>Arundo donax</i>	Giant reed
	* <i>Avena barbata</i>	Slender wild oat
	* <i>Avena fatua</i>	Wild oat
	* <i>Bromus diandrus</i>	Rippgut brome
	<i>Bromus hordeaceus</i>	
	<i>Cortaderia jubata</i>	Pampas grass
	* <i>Crypsis schoenoides</i>	Soft chess, Swamp grass
	* <i>Cynodon dactylon</i>	Bermuda grass
	<i>Deschampsia cespitosa</i> ssp. <i>cespitosa</i>	Tufted hairgrass
	<i>Distichlis spicata</i>	Salt grass
	* <i>Echinochloa crus-galli</i>	Japanese millet
	<i>Elymus elymoides</i> X <i>glaucus</i>	Squirrel tail/Blue wild rye
	<i>Elymus multisetus</i>	Big squirrel tail
	<i>Elytrigia pontica</i>	Tall wheatgrass
	* <i>Hainardia cylindrica</i>	Thintail
	<i>Hordeum depressum</i>	Low Barley
	* <i>Hordeum marinum</i> ssp. <i>gussoneanum</i>	Mediterranean barley
	* <i>Hordeum murinum</i> ssp. <i>leporinum</i>	Wall barley

Group Name	Scientific Name	Common Name
	<i>Hutchinsonia procumbens</i>	
	<i>Leymus triticoides</i>	Alkali ryegrass
	* <i>Lolium multiflorum</i>	Italian ryegrass
	<i>Monerma cylindrica</i>	
	<i>Nasella pulchra</i>	Purple needlegrass
	<i>Parapholis incurva</i>	Sicklegrass
	* <i>Paspalum dilatatum</i>	Knotgrass
	<i>Paspalum distichum</i>	Dallis grass
	* <i>Phalaris aquatica</i>	Harding grass
	<i>Phalaris arundinacea</i>	Reed canary grass
	* <i>Phalaris caroliniana</i>	Harding grass
	* <i>Phalaris minor</i>	Canary grass
	* <i>Phalaris paradoxa</i>	Harding grass
	<i>Phragmites australis</i>	Common reed
	<i>Poa secunda</i> ssp. <i>secunda</i>	One sided bluegrass
	* <i>Polypogon monspeliensis</i>	Rabbitfoot grass
	<i>Puccinellia simplex</i>	
	* <i>Taeniatherum caput-medusae</i>	Medusa head
	* <i>Vulpia myuros</i> var. <i>myuros</i>	
	* <i>Vulpia bromoides</i>	
	<i>Vulpia octoflora</i> var. <i>octoflora</i>	Six weeks fescue
	Pontederiaceae	Pickerel-Weed Family
	<i>Eichornia crassipes</i>	Water hyacinth
	Potamogetonaceae	Pondweed Family
	* <i>Potamogeton crispus</i>	Crispatte-leaved pondweed
	<i>Potamogeton pectinatus</i>	Fennel-leaved pondweed
	<i>Ruppia maritima</i>	Widgeon grass
	Typhaceae	Cattail Family
	<i>Typha angustifolia</i>	Narrow leaved cattail
	<i>Typha domingensis</i>	Southern cattail
	<i>Typha latifolia</i>	Broad-leaved cattail
	<i>Typha</i> sp	<i>Typha</i> hybrids