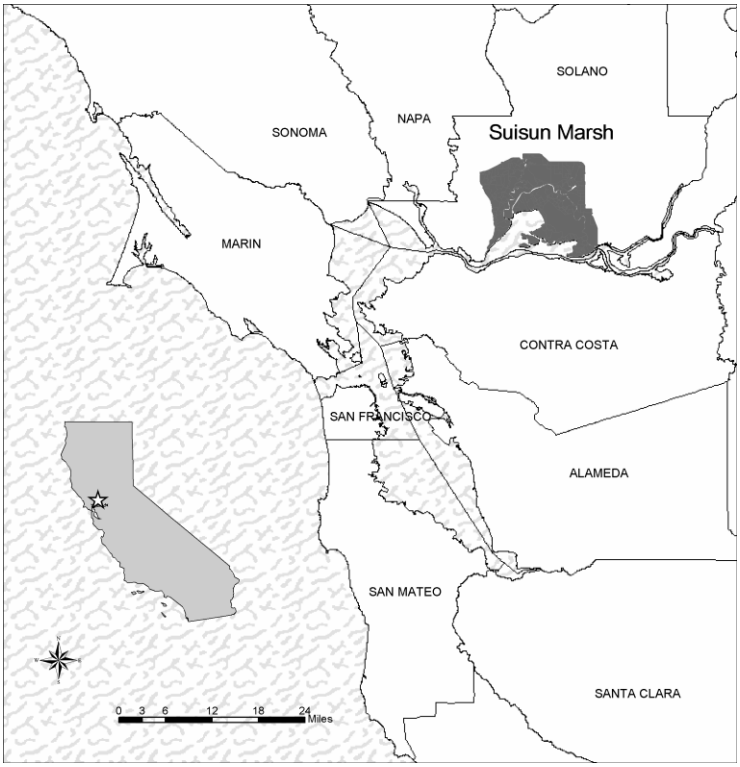
2006
Vegetation Map Update For
Suisun Marsh,
Solano County, California

A Report to the California Department of Water Resources

March 2008

Prepared by:
Vegetation Classification and Mapping Program
Biogeographic Data Branch
California Department of Fish & Game



Rachelle Boul, Vegetation Ecologist
Todd Keeler-Wolf, Senior Vegetation Ecologist

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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.

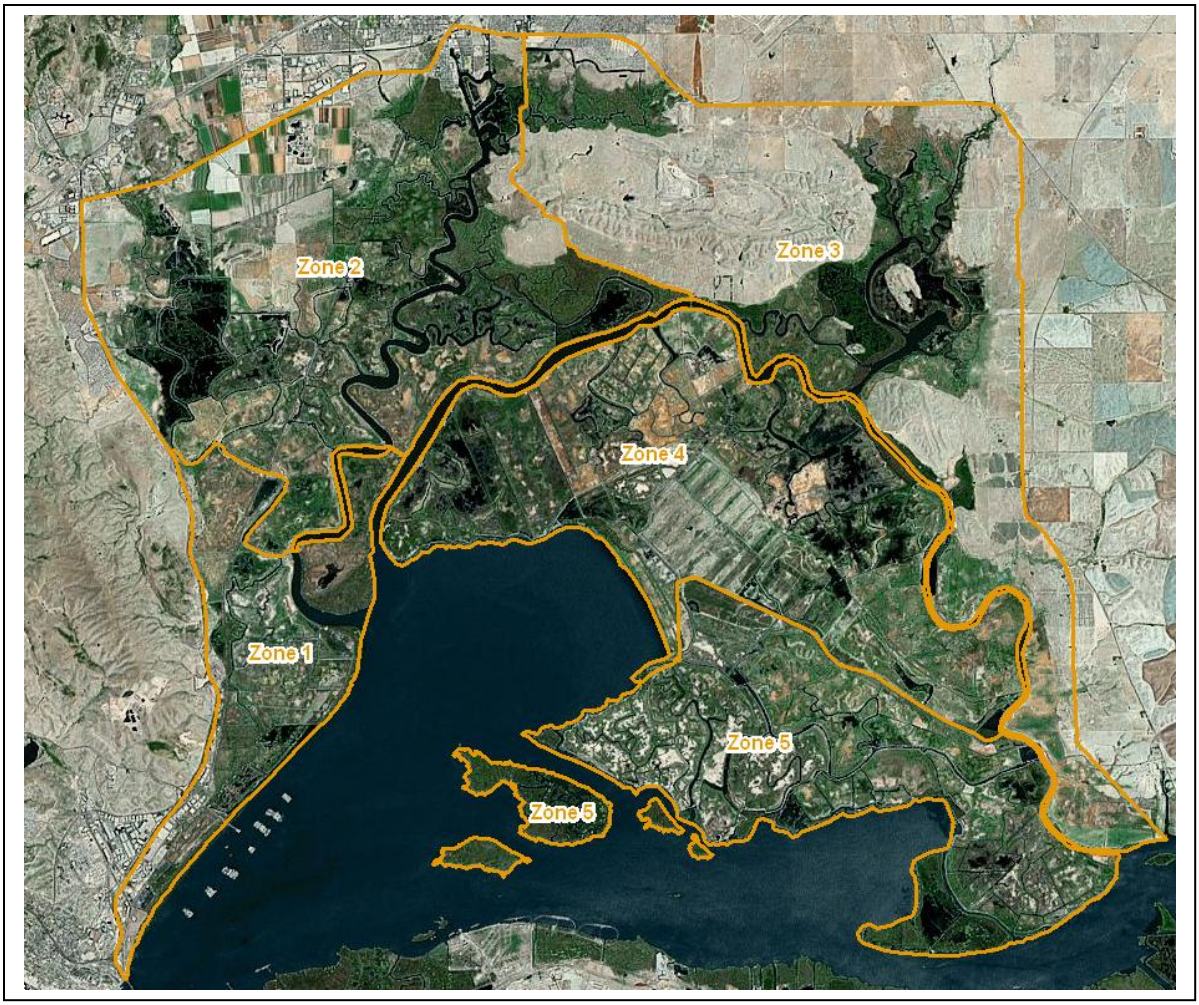
In 2000 an exploratory change detection study was implemented (Vaghti & Keeler-Wolf 2001). The goals of the change analysis were to define significant change for vegetation in the Suisun Marsh ecosystem, quantify and spatially identify such changes, improve map accuracy, and make recommendations for 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 exiting 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.

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

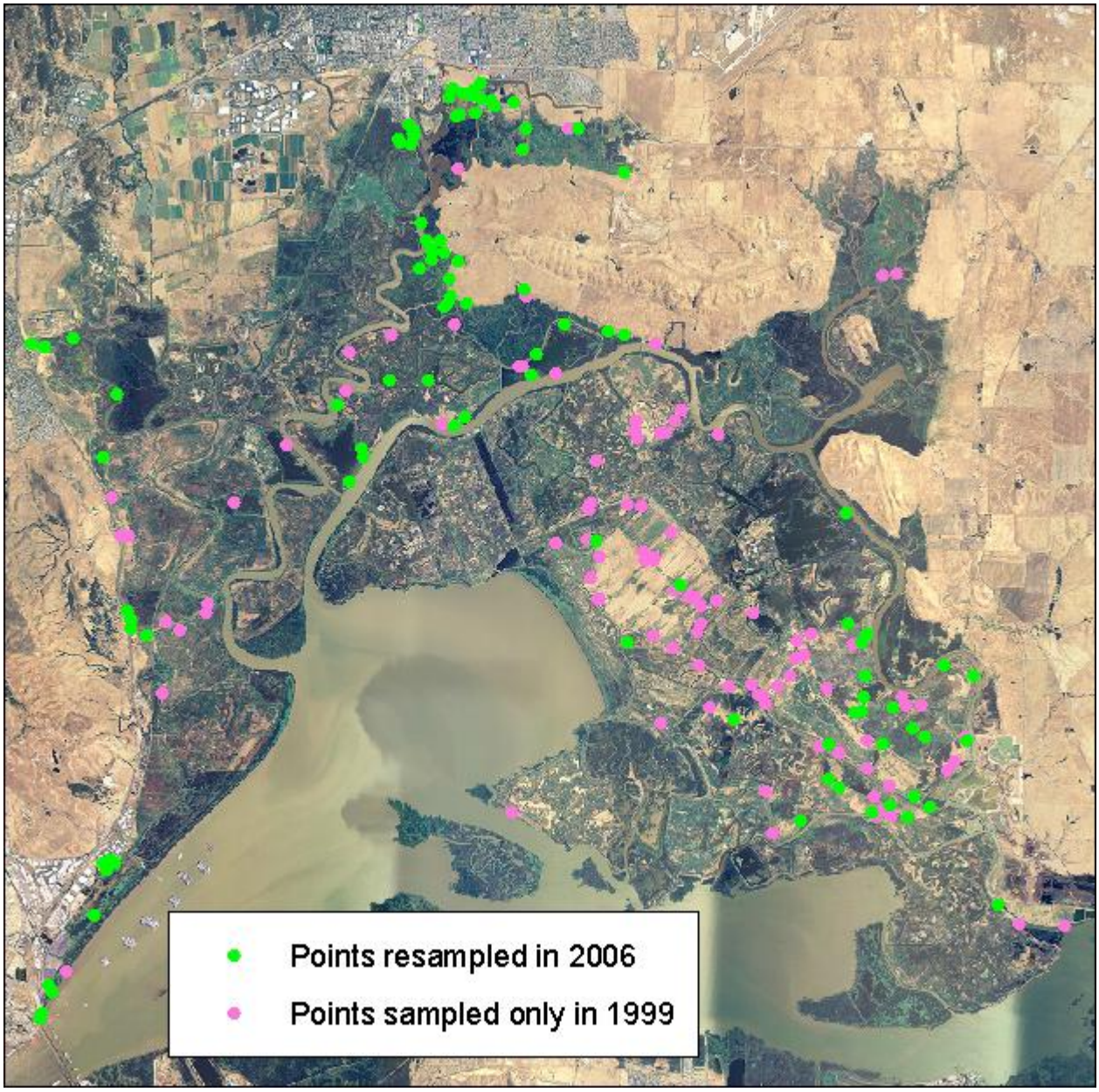
As was done in 2003, a few vegetation types were looked at more closely for various reasons. At the time of the 2003 Suisun Marsh vegetation change detection, little was know about the habitat requirements for the protected Salt Marsh Harvest Mouse (SMHM). The ten *Salicornia virginica* (SAVI) vegetation 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/ Crypsis 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 understand 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 cross-walk, 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 breeches (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 has 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 Institutes (SFEI) EcoAtlas was used to asses 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 solstialis* 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.

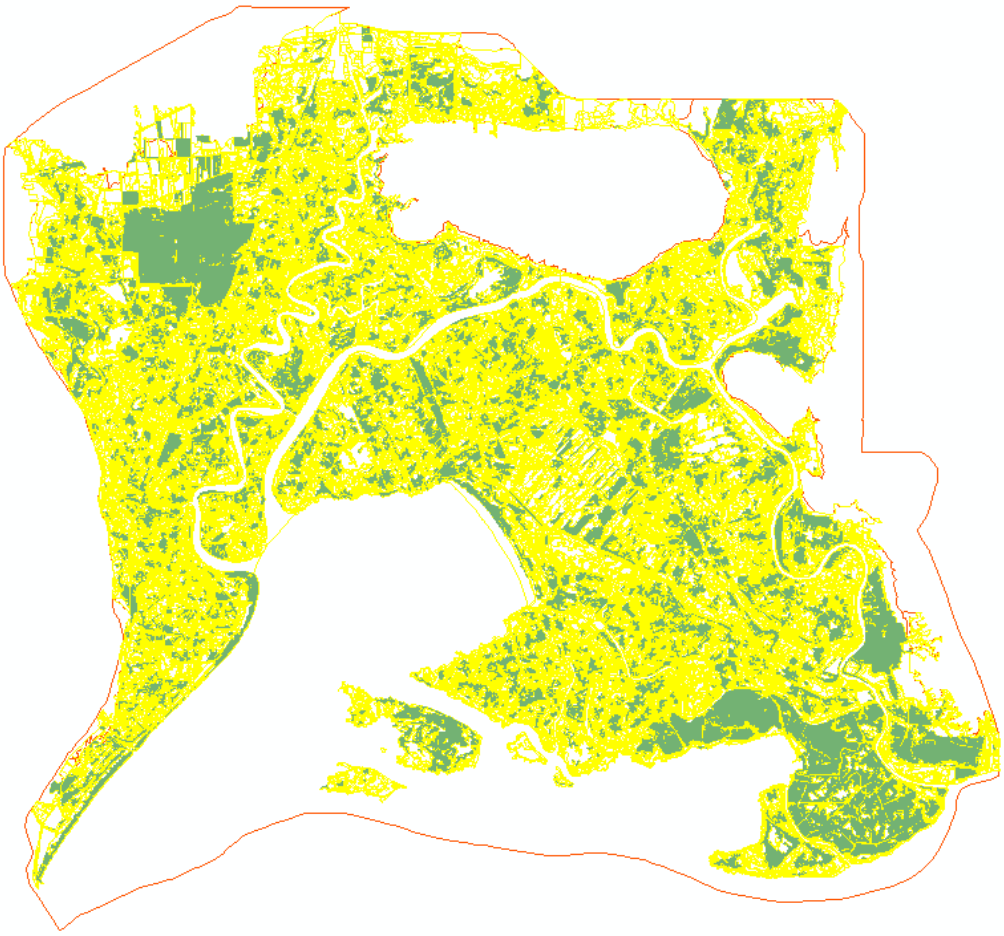


Figure 4 - Suisun Marsh vegetation mapping project area showing ownership boundaries outlined in black and tidal marsh habitat in blue.

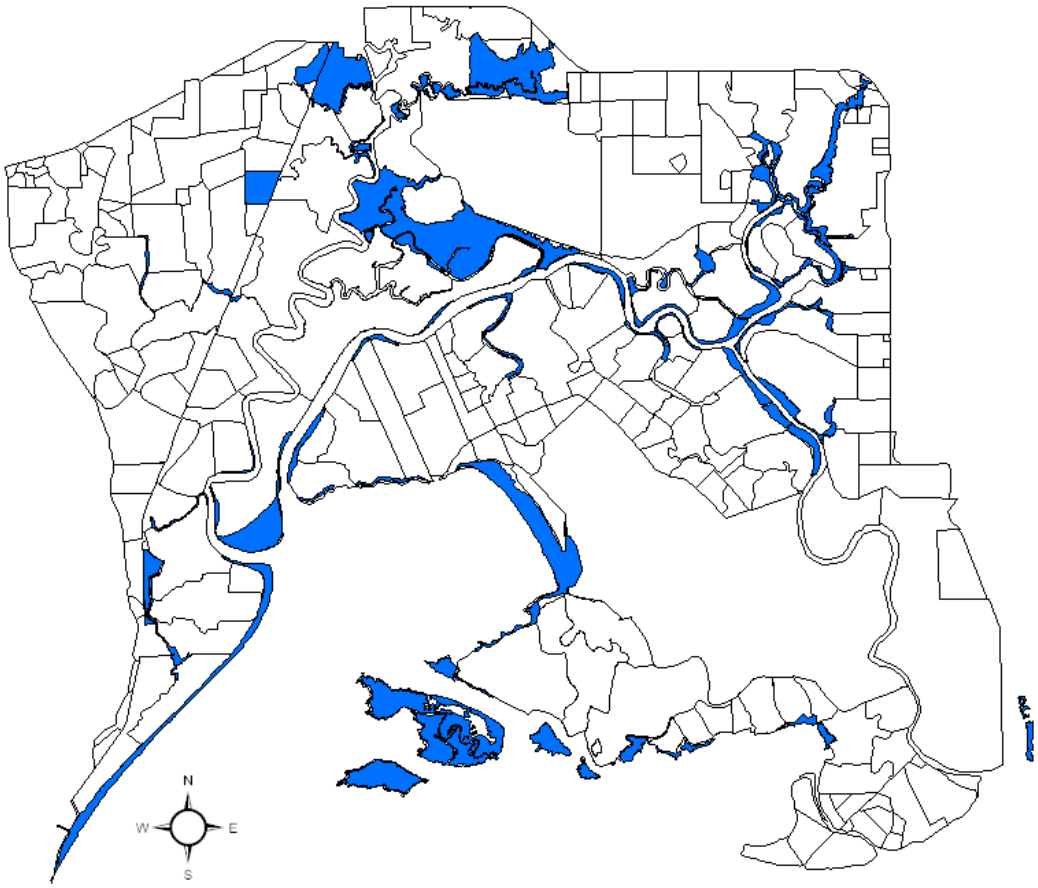


Table 1 -The distribution of acreage change across the different vegetation types for 2003 to 2006 and for 1999 to 2006.A negative acreage change or % change indicates a loss in acreage.

Veg Code	Veg 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
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
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
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 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
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 viginica* (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
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	Polypogon 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 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
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
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
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 change 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	Acres 1999	Acres 2003	Acres 2006	2003-2006 Acreage change	2003-2006 % change	1999-2006 Acreage Change	1999-2006 % change
Arundo donax	4.73	23.81	23.73	-0.08	-0.3	19.00	401.69
Carpobrotus edulis	7.03	7.40	7.39	-0.01	-0.1	0.36	5.12
Centaurea (generic)	76.91	88.15	62.39	-25.76	-29.2	-14.52	-18.88
Conium maculatum	310.48	376.40	263.79	-112.61	-29.9	-46.69	-15.04
Cortaderia selloana	9.77	9.98	9.97	-0.01	-0.1	0.20	2.05
Eucalyptus globulus	209.89	232.47	237.55	5.08	2.2	27.66	13.18
Foeniculum vulgare	140.93	145.01	130.90	-14.11	-9.7	-10.03	-7.12
Lepidium latifolium	960.8	1030.41	802.78	-227.63	-22.1	-158.02	-16.45
Phragmites australis	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
Arundo donax	3.88	10.07	9.49	-0.58	-5.8	5.61	144.59
Carpobrotus edulis	6.81	7.18	7.11	-0.07	-1.0	0.30	4.41

Centaurea (generic)	72.83	84.07	58.36	-25.71	-30.6	-14.47	-19.87
Conium maculatum	299.8	365.32	338.27	-27.05	-7.4	38.49	12.84
Cortaderia selloana	8.88	7.81	7.60	-0.21	-2.7	-1.28	-14.41
Eucalyptus sp.	189.6	210.98	215.47	4.49	2.1	25.88	13.65
Foeniculum vulgare	128.6	137.37	123.20	-14.17	-10.3	-5.39	-4.19
Lepidium latifolium	797.3	864.95	606.96	-257.99	-29.8	-190.34	-23.87
Phragmites australis	536.6	753.11	1155.39	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
Arundo donax	0.85	13.74	13.56	-0.18	-1.75	12.71	1495.29
Carpobrotus edulis	0.22	0.22	0.22	0	0	0	0
Centaurea (generic)	4.08	4.08	3.90	-0.18		-0.18	-4.41
Cortaderia selloana	0.89	2.17	2.11	-0.06	0	1.22	137.08
Eucalyptus sp.	19.40	21.49	21.41	-0.08	-0.37	2.01	10.36
Foeniculum vulgare	12.34	7.64	7.71	0.07	0.92	-4.63	-37.52
Conium maculatum	10.70	11.08	9.89	-1.19	-10.74	-0.81	-7.57
Lepidium latifolium	166.25	195.46	191.32	-4.14	-2.12	25.07	15.08
Phragmites australis	327.04	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 Disced 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
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
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 breeches. 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 north western 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		Definition
2003	**2006**	
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 oreliminated
	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%)
	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 selloana	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 Scientific and Common Name that occur within the Suisun Marsh. *=non-native.

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

Araliaceae	Ginseng Family
Hedera helix	English Ivy
Asteraceae	Sunflower Family
Achillea millefolium	Yarrow
Achyrachaena mollis	Blow wives
Ambrosia psilostachya	Western ragweed
Artemisia douglasiana	Mugwort
Aster chilensis	
Aster lentus (FC1, List I B); NDDB	Suisun Marsh aster
Aster subulatus var. ligulatus	Slim aster
Baccharis douglasii	Marsh baccharis
Baccharis pilularis	Coyote brush, Chaparral broom
Baccharis salicifolia	Mulefat, Seep willow, Water-wally
Bidens frondosa	Sticktight
Bidens laevis	Bur-marigold
*Carduus pychnocephalus	Italian thistle
*Centaurea calcitrapa	Purple star thistle
*Centaurea solstitialis	Yellow star thistle
Cirsium hydrophilum var. hydrophilum (FE, List I B); NDDB	Suisun thistle
*Cirsium vulgare	Bull thistle
*Conyza bonariensis	Hairy fleabane
Conyza canadensis	Horseweed
*Cotula coronopifolia	Brass buttons
*Cynara cardunculus	Cardoon/Artichoke thistle
Eclipta prostrata	Eclipta
Euthamia occidentalis	Western goldenrod
Gnaphalium stramineum	Cudweed
Grindelia stricta var. angustifolia (list 4)	Marsh gumplant
Helenium bigelovii	Bigelow's sneezeweed
Helenium puberulum	
Helianthus annus	Sunflower
Helianthus bolanderi	
Helianthus californicus	California sunflower
Hemizonia pungens	Spikeweed
Hemizonia pungens ssp. maritima	Common spikeweed
Heterotheca grandiflora	Telegraph weed
Heterotheca sessiliflora var. bolanderi	Hairy goldenaster
*Hypochaeris radicata	
Isocoma arguta (FC); NDDB (introduced at Rush Ranch)	Carquinez goldbush
Iva axillaris	Poverty weed

Jaumea carnosa	Fleshy jaumea
*Lactuca saligna	
*Lactuca serriola	Prickly lettuce
* Lapsana communis	Nipplewort
Lasthenia californica	California goldfields
Lasthenia chrysostoma	Goldfields
Lasthenia conjugens (FE, 1B, CE); NDDB	Contra Costa goldfields
Lasthenia glabrata	Yellowray goldfields
Layia chrysanthemoides	Smooth layia
*Matricaria matricarioides	Pineapple weed
Micropus californicus var. californicus	Slender cottonweed
Microseris douglasii ssp. douglasii	Douglas' microseris
*Picris echiodes	Bristly oxtongue
Pluchea odorata	Saltmarsh fleabane
Senecio hydrophilus	Marsh bufterweed, Swamp senecio
*Senecio vulgaris	Groundsel
*Silybum marianum	Milk thistle
*Sonchus arvensis	
*Sonchus oleraceus	Common sow thistle
*Taraxacum officianale	Dandelion
*Tragopogon porrifolius	Salsify, Oyster plant
Wyethia angustifolia	Narrow leaved mule ears
*Xanthium strumarium	Cocklebur
Betulaceae	Birch Family
Alnus rhombifolia	White alder
Boraginaceae	Borage Family
Amsinckia eastwoodiae	Common fiddleneck
Heliotropium curassavicum	Salt heliotrope
*Lappula redowskii	Western sticktight
Plagiobothrys greenei	Green's popcorn flower
Plagiobothrys stipitatus var. stipitatus	Stipitate popcorn flower
Brassicaceae	Mustard Family
*Brassica nigra	Black mustard
*Capsella bursa pastoris	Shepherd's purse
*Cardaria draba	Heart-podded hoary chess
Lepidium dictyotum var. acutidens	Sharp toothed peppergrass
*Lepidium latifolium	Perennial peppergrass
Lepidium nitidum var. nitidum	Shining peppergrass
*Raphanus sativum	Wild radish
Rorippa nasturtium-aquaticum	Watercress
Rorippa palustris	Watercress
*Sinapsis arvensis	Charlock

Callitrichaceae	Water Star Wort Family
Callitriche heteraphylla	Water star wort
Caprifoliaceae	Honeysuckle Family
*Lonicera japonica	Japanese honeysuckle
Sambucus mexicana	Blue elderberry
Caryophyllaceae	Pink Family
*Cerastium glomeratum	Mouse ear chickweed
*Silene gallica	Catchfly
*Spergula arvensis ssp. arvensis	Stickwort, starwort
Spergularia marina	Saltmarsh sand spurry
*Spergularia media	Medium sand spurry
Chenopodiaceae	Goosefoot Family
Atriplex cordulata (FSC, List 1B); NDDB	Heartscale
Atriplex depressa (List 1B); NDDB	Brittlescale
Atriplex joaquinianna (FSC; List 1B); NDDB	Valley spearscale
Atriplex lentiformis	Big saltbush
*Atriplex rosea	Tumbling oracle
*Atriplex semibaccata	Australian saltbush
Atriplex triangularis	Fathen, spearscale
*Bassia hyssopifolia	Bassia
*Beta vulgaris	Beet
*Chenopodium album	Lamb's quarters
*Chenopodum ambrosiodes	Mexican tea
*Chenopodium chenopodiodes	South American goosefoot
Nitrophila occidentalis	Nitrophila
Salicornia europaea	Annual pickleweed
Salicornia subterminalis	Parish's glasswort
Salicornia virginica	Perennial pickleweed
*Salsole tragus (S. pestifera)	Russian thistle, tumbleweed
Suaeda calceoliformis	Horned sea-blite
Convolvulaceae	Morning Glory Family
Calystegia sepium	Hedge bindweed
Calystegia sepium ssp. limnophila	Hedge bindweed
*Convolvulus arvensis	Bindweed, Orchard morning-glory
Cressa truxillensis	Alkali weed
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 melanoxylon	Blackwood acacia
Glycerrhiza 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
Vicia villosa ssp. varia	Purple winter vetch
Frankeniaceae	Frankenia Family
Frankenia salina	Alkali heath
Gentianaceae	Gentian Family
Centaurium muehlenbergii	June centaury
Geraniaceae	Geranium Family
*Erodium botrys	Filaree, Storksbill
*Erodium brachycarpum	Filaree
*Erodium cicutarium	Redstem filaree

*Geranium dissectum	Cut-leaved geranium
Haloragaceae	Water-Milfoil Family
*Myriophyllum spicatum	Eurasian Milfoil
Lamiaceae	Mint Family
Lycopus americanus	Water horehound
Lycopus asper	
Mentha arvensis	Tule mint
Stachys albens	Hedge nettle
Lythraceae	Loosetrife Family
Lythrum californicum	California loosetrife
*Lythrum hyssopifolia	Hyssop loosetrife
*Lythrum tribracteatum	
Malvaceae	Mallow Family
*Lavatera cretica	Tree mallow
*Malva neglecta	
*Malva parviflora	Cheeseweed
Malvella leprosa	Alkali mallow, White-weed
*Sida rhombifolia	Cutleaf checkerbloorn
Sidalcea malvaeflora ssp. laciniata	
Myrtaceae	Myrtle Family
*Eucalyptus globulus	Blue gum
Oleaceace	Olive Family
Fraxinus latifolia	Oregon Ash
Onagraceae	Evening Primrose Family
Epilobium brachycarpum	Willow herb
Epilobium ciliatum	Fireweed, Willow herb
Epilobium ciliatum ssp. ciliatum	Epilobium
Ludwigia peploides ssp. peploides	Yellow waterweed
Oenothera deltoide ssp. howeIlii (CE, FE, List 1B); NDDB	Antioch dunes evening primrose
Papaveraceae	Poppy Family
Eschscholzia californica	California poppy
Plantaginaceae	Plantain Family
*Plantago coronopus	
*Plantago lanceolata	English plantain
*Plantago major	Common plantain

Plantago maritima	Seaside plantain
Plantago subnuda	Mexican plantain
Plumbaginaceae	Leadwort Family
Limonium californicum	Western marsh rosemary
Polemoniaceae	Phlox Family
Gilia tricolor	Bird's eyes
Polygonaceae	Buckwheat Family
Eriogonum nudum	Nudestern buckwheat
Polygonum amphibium var. emersum	Water smartweed/kelp
*Polygonum arenastrum	Common knotweed, doorweed
*Polygonum argyrocoleon	
Polygonum lapathifolium	Willow weed
*Polygonum polystachyum	Himalayan knotweed
*Polygonum prolificum	Smartweed
Polygonum punctatum	Dotted smartweed
*Rumex acetosella	Sheep sorrel
*Rumex crispus	Curly dock
*Rumex conglomeratus	Clustered dock
Rumex occidentalis	Western dock
*Rumex pulcher	Fiddle dock
Portulacaceae	Purslane Family
Calandrinia ciliata	Redmaids
Claytonia perfoliata	Miner's lettuce
*Portulaca oleracea	Common purslane
Primulaceae	Primrose Family
*Anagallis arvensis	Scarlet pimpernel
Glaux maritima	Sea milkwort
Samolus parviflorus	Water pimpernel
Ranunculaceae	Buttercup Family
Ranunculus canus	Sacramento Valley buttercup
Roseaceae	Rose Family
Potentilla anserina ssp. pacifica	Common silverweed, marsh cinquefoil
*Prunus armeniaca	Apricot
*Pyracantha angustifolia	Firethorn
Rosa californica	California rose
*Rubus discolor	Himalayan blackberry
Rubus ursinus	California blackberry

Rubiaceae	Madder Family
Cephalanthus occidentalis var. californicus	California buttonwillow, buttonbush
Gallium trifidium var pacificum	Bedstraw
Salicaceae	Willow Family
Populus fremontii ssp. fremontii	Fremont's cottonwood
Salix exigua (formerly S. hindsiana)	Narrow leaved willow, Sandbar willow
Salix gooddingii	Goodding's black willow
Salix laevigata	Red Willow
Salix lasiolepis	Arroyo willow
Saururaceae	Lizard's Tail Family
Anemopsis californica	Lizard's tail, Yerba mansa
Saxifragaceae	Saxifrage Family
Saxifraga californica	California saxifrage
Scrophulariaceae	Figwort Family
*Bellardia trixago	Bellardia
Castilleja attenuata	Valley tassels
Castilleja exserta	Purple owl's clover
Cordylanthus mollis ssp. mollis (FE,SR, List 1B); NDDB	Soft bird's beak
Mimulus guttatus	Common monkeyflower
Scrophularia californica	California figwort
Triphysaria eriantha	Butter and eggs, Johnny-tuck
Solanaceae	Nightshade Family
Solanum americanum	American nightshade
*Solanum sarrachoides	Nightshade
Tamaricaceae	Tamarisk Family
*Tamarix gallica	African tamarisk
*Tamarix parviflora	Salt cedar, European tamarisk
Verbenaceae	Vervain Family
Phyla lanceolata	Lippia
Violaceae	Violet Family
Viola pedunculata	Johnny jump-up
Zygophyllaceae	Caltrop Family
*Tribulis terrestris	Puncture vine
FLOWERING PLANTS: MONOCOTS	

Cyperaceae	Sedge Family
Carex barbarae	Santa Barbara sedge
Carex lyngbeii	
Carex nebracensis	Nebraska sedge
Cyperus eragrostris	
*Cyperus esculentus	Yellow nutsedge
Cyperus erythrorhizos	
Cyperus strigosus	
Eleocharis acicularis	
Eleocharis macrostachya	Creeping spikerush
Scirpus acutis var. occidentalis	Hardstern bulrush, common tule
Scirpus americanus	
Scirpus californicus	California bulrush
Scirpus cernuus	Low club rush
Scirpus koilolepis	Keeled club rush
Scirpus maritimus (formerly S. robustus)	Alkali bulrush
Scirpus sp (S. Acutus X S. californicus)	
Scirpus sp (S. Californicus X S. americanus)	
Scirpus sp (S. Maritimus X ?)	
Iridaceae	Iris Family
*Iris pseudacorus	Iris
Sisyrinchium bellum	Blue-eyed grass
Juglandaceae	Walnut Family
Juglans californica	California Black Walnut
Juncaceae	Rush Family
Juncus baltiicus	Baltic rush
Juncus bufonius	Toad rush
Juncus effusus var. pacificus	Soft rush
Juncus mexicanus	Mexican rush
Juncus phaeocephalus	
Juncus xiphiodes	
Juncaginaceae	Arrow Weed Family
Triglochin concinna var. concinna	Elegant arrowgrass
Triglochin maritima	Seaside arrowgrass
Triglochin stricta	Three ribbed arrowgrass
Lemnaceae	Duckweed Family
Lemna gibba	
Liliaceae	Lily Family

*Asparagus officinalis ssp. officinalis	Asparagus
Brodiaea elegans	Harvest brodiaea
Chlorogalum pomeridianum var. pomeridianum	Soap plant
Dichelostemma capitatum	Blue dicks
Muilla maritima	Common muilla
Triteleia hyacinthina	White brodiaea
Triteleia laxa	Ithuriel's spear
Poaceae	Grass Family
*Agropyron sp	Wheatgrass
*Agrostis avenacea	
Agrostis exarata	Bentgrass
*Agrostis stolonifera	Creeping bentgrass
*Agrostis viridis	
Apera sp	
*Arundo donax	Giant reed
*Avena barbata	Slender wild oat
*Avena fatua	Wild oat
*Bromus diandrus	Ripgut brome
Bromus hordeaceus	
Cortaderia jubata	Pampas grass
*Crypsis schoenoides	Soft chess, Swamp grass
*Cynodon dactylon	Bermuda grass
Deschampsia cespitosa ssp. cespitosa	Tufted hairgrass
Distchlis spicata	Salt grass
*Echinochloa crus-galli	Japanese millet
Elymus elymoides X glaucus	Squirrel tail/Blue wild rye
Elymus multisetus	Big squirrel tail
Elytrigia pontica	Tall wheatgrass
*Hainardia cylindrica	Thintail
Hordeum depressum	Low Barley
*Hordeum marinum ssp. gussoneanum	Mediterranean barley
*Hordeum murinum ssp. leporinum	Wall barley
Hutchinsonia procumbens	
Leymus triticoides	Alkali ryegrass
*Lolium multiflorum	Italian ryegrass
Monerma cylindrica	
Nasella pulchra	Purple needlegrass
Parapholis incurva	Sicklegrass
*Paspalum dilatatum	Knotgrass
Paspalum distichum	Dallis grass
*Phalaris aquatica	Harding grass
Phalaris arundinacea	Reed canary grass

*Phalaris caroliniana	Harding grass
*Phalaris minor	Canary grass
*Phalaris paradoxa	Harding grass
Phragmites australis	Common reed
Poa secunda ssp. secunda	One sided bluegrass
*Polypogon monspeliensis	Rabbitfoot grass
Puccinellia simplex	
*Taeniatherum caput-medusae	Medusa head
*Vulpia myuros var. myuros	
*Vulpia bromoides	
Vulpia octoflora var. octoflora	Six weeks fescue
Pontederiaceae	Pickerel-Weed Family
Eichornia crassipes	Water hyacinth
Potamogetonaceae	Pondweed Family
*Potamogeton crispus	Crispatte-leaved pondweed
Potamogeton pectinatus	Fennel-leaved pondweed
Ruppia maritima	Widgeon grass
Typhaceae	Cattail Family
Typha angustifolia	Narrow leaved cattail
Typha domingensis	Southern cattail
Typha latifolia	Broad-leaved cattail
Typha sp	Typha hybrids