

The Status of Perennial Estuarine Wetlands in the State of California

Overview

The statewide initiative to monitor the condition of wetlands has produced a report on the status of wetlands in California’s estuaries. The report is the most comprehensive evaluation ever conducted on the overall health of any class of wetlands in California. It provides an estimate of how much estuarine wetland exists in California and the health of those wetlands.

Benefits of the Report

The report offers multiple benefits to wetland managers and policy makers:

- It establishes a baseline of data in estuaries against which to measure future progress toward the state’s “No Net Loss of Wetlands” policy. Legislators and other policy makers can use the data to determine if wetland protection policies and programs are working and if the public is getting a return for its investment in wetlands.
- It helps local wetland managers compare the condition of their estuarine wetland or restoration project against the baseline for their region.
- It satisfies some important legal requirements, including a federal requirement that the state report on the status of wetlands to the U.S. Environmental Protection Agency (U.S. EPA) every two years.

The Basics

The report studied four questions:

1. Where are the state’s estuarine wetlands, and how much do we have?
2. What is the condition of existing estuarine wetlands statewide, and how does their condition vary by region?
3. What are the primary causes of stress to wetland health, and do those causes vary among different coastal regions?
4. How does the overall health of estuarine wetland restoration projects compare with similar wetlands in their region?

Water Facts

.....
3,936,972 Acres of wetlands, found in estuaries, beaches and rocky intertidal shorelines, rivers, lakes, and other freshwater aquatic habitats.
.....

440,048 Acres of Estuaries
.....

1,515,483 Acres of Lakes and Reservoirs
.....

1,716,798 Acres of Palustrine Wetlands (Freshwater Ponds, Marshes, Wet Meadows, Vernal Pools, etc.)
.....

410,222 Miles of Streams and Rivers
.....

59,058 Miles of Streams and Rivers Engineered by Humans
.....

251,222 Acres of Riverine Wetlands

Table 1
Summary of CRAM attribute results, severe stressors identified, and recommended management action.

Region	% marsh area with CRAM Index or attribute scores within the lower two categories of CRAM scores					Major Stressors Identified	Recommended Management Actions
	Index	LC	Hydro	PS	BS		
North Coast	0	3	0	17	24	Invasive plants, dikes and levees, excessive sedimentation, ditching	<ol style="list-style-type: none"> 1. Remove invasive plant species from estuarine wetlands regionally, and include measures to control re-invasion in restoration and enhancement projects. Reestablish or reintroduce native species. 2. Use BMPs, where feasible, to reduce sedimentation from upland land uses in wetland watersheds. 3. Assure adequate tidal circulation in estuarine restoration or enhancement projects through levee removal or setback, tidegate removal, and tidal circulation improvement. 4. Develop mosquito management approaches that are consistent with reduced hydrological impacts to wetlands.
SF Estuary	0	3	14	64	10	Levees, predators, ditching heavy metal and organic contaminants	<ol style="list-style-type: none"> 1. Remove invasive plant species from estuarine wetlands regionally, and include measures to control re-invasion in restoration and enhancement projects. Re-establish or reintroduce native species. 2. Increase the size of estuarine wetlands to reduce the effects of terrestrial predators and other stressors. 3. Improve tidal circulation to minimize the need for ditching. 4. Assess the opportunity to integrate estuarine wetland restoration and enhancement to infrastructure repair and replacement 5. Link estuarine wetland restoration to upstream management of sediment and water quality by integrating estuarine wetland management to watershed management
Central Coast	17	5	20	64	57	NPS runoff, contaminants, dikes/ levees and trash	<ol style="list-style-type: none"> 1. Restore aquatic transitions (creeks, drainage swales and brackish systems) to increase filtration of water prior to discharge into estuaries. 2. Expand use of agriculture and urban BMPs within watersheds. 3. Remove or redesign flow restrictions to establish more stable marsh plain and/or replicate historic estuarine tidal exchange. 4. Implement enhancement projects through levee removal, setback, tidegate removal/redesign, and tidal circulation management to allow for expansion of marsh plain.
South Coast	42	11	49	71	25	Dikes/levees, NPS runoff, contaminants, trash, excessive sediment	<ol style="list-style-type: none"> 1. Assure adequate tidal circulation in estuarine restoration or enhancement projects through levee removal or setback, tidegate removal, and tidal circulation improvement. 2. Expand use of agriculture and urban BMPs within watersheds 3. Restore aquatic transitions (creeks, drainage swales and brackish systems) to increase filtration of water prior to discharge into estuaries. 4. Remove invasive plants from upland transitions zones and buffer. 5. Incorporate historical ecology to guide restoration planning, particularly with respect to the distribution of subhabitat types.

Perennial Estuarine Wetlands

The report provides a solid baseline from which we can measure future changes in the extent and health of California's estuarine wetlands.

The study used a set of innovative tools developed for California by a group of scientists and agency staff, with the help of the U.S. EPA. These tools include:

- Methods to document the location of estuarine wetlands on a map, based on the most recent data from the U.S. Fish and Wildlife Service's National Wetlands Inventory and their partners within the state.
- The California Rapid Assessment Method (CRAM), which cost-effectively evaluates the health of California's wetlands (www.cramwetlands.org).
- A web-based tool for the public to view the locations of their wetlands and track the progress of projects that can impact the size and health of their wetlands (www.wetlandtracker.org).

The Method

Estuaries are the places where freshwater runoff from a river meets and mixes with saltwater from the ocean. They support unique and diverse communities of plants and animals and provide a number of important benefits to humans.

First, the researchers summarized from maps how much estuarine wetland is present in each of four regions: North Coast, San Francisco Bay, Central Coast, and South Coast. Using the maps, the researchers selected randomly distributed sites among the four regions, totaling 150 sites: 30 sites per region; an additional 30 sites in South Coast to address additional questions of the wetland managers in that region; and 30 restoration projects within San Francisco Bay, Central Coast, and South Coast.

The researchers then used CRAM to assess wetland health and identify stressors at each of the sites. CRAM assesses wetland health through four major visible components. These components, referred to as "attributes," include:

- Landscape Context — what's happening in the land around the wetland
- Physical Structure — the physical shape and form of the wetland itself
- Hydrology — the source of water for the wetland and how it moves through the site
- Biotic Structure — the diversity and expected patterns of the plant community

The CRAM attribute or index scores (the average of all four attribute scores) were compared among regions. The health of wetland restoration projects was compared to the randomly selected sites in each of the regions. Results were reported as the percentage of the total estuarine wetland area that fell within four categories of CRAM index or attribute scores:

- 82 to 100 = good to excellent health
- 63 to 82 = medium to good health
- 44 to 63 = medium to poor health
- 44 to 25 = poor health

CRAM also features a stressor checklist to determine causes that may be responsible for poor wetland health.

Additional studies are being conducted over the next couple of years for other classes of freshwater wetlands. In particular, the Surface Water Ambient Monitoring Program (SWAMP) is including CRAM in its statewide Perennial Streams Assessment, which will allow the state to report on the health of the wetlands associated with rivers and streams.

The Findings

Baseline Health of Estuarine Wetlands

California has 44,456 acres of salt marsh, 77 percent of which is found in the San Francisco Bay Estuary. The rest of the estuarine wetland is equally distributed among the estuaries and coastal lagoons in the South, Central, and North Coast regions.

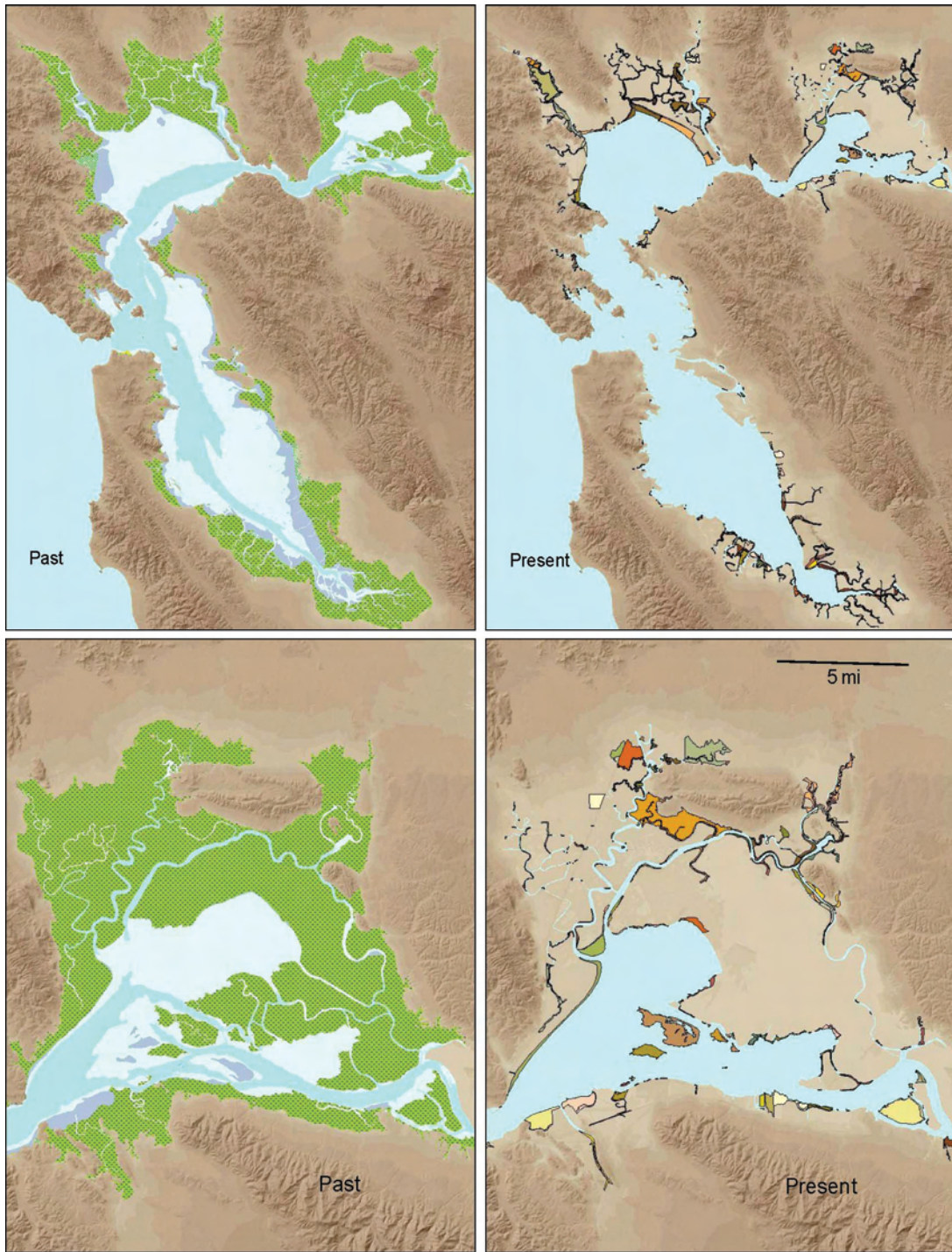


Figure 4. Historical and present distribution of wetlands in the SF Estuary downstream of its inland Delta (top panel), with a close up of the Suisun sub-region of SF Estuary (bottom panel).

SWAMP on the Web

For more information regarding the Wetlands, visit:
http://www.waterboards.ca.gov/water_issues/programs/swamp/wetlands.shtml and
<ftp://ftp.sccwrp.org/pub/download/DOCUMENTS/TechnicalReports/571PerennialEstuarineWetlands.pdf>



Land use practices along the California coastline over the last 200 years have drastically decreased the amount of estuarine wetland and changed the sizes, shapes, and distances among wetlands. In urbanized estuaries, many wetlands are impacted by intensive land uses and bounded by levees. These impacts isolate the animals that live within them, make the wetlands more vulnerable to stress, and affect the ability of wetlands to function and provide ecological services. This trend has an overall downward effect on the wetland health scores reported in the study.

The statewide and regional stressors identified give guidance to wetland managers and policy makers for management actions, including conservation and restoration priorities.

Eighty-five percent of the statewide acreage scored within the top two categories of CRAM index scores (medium to excellent health). This result is largely driven by estuarine wetlands in the San Francisco Estuary because it represents most of the state’s wetlands. Sixty-four percent of the state’s estuarine wetlands had Landscape Context scores within the good to excellent category, while 35 percent of acreage had scores within the good to excellent category for the Hydrology and Biotic Structure attributes.

Conversely, 62 percent of the acreage was found in the bottom two categories (medium to poor health) for CRAM Physical Structure scores. Human impacts, particularly the building of levees for flood control, railroad, and highway passage, have reduced the size and changed the shape of wetlands, giving them a lower Physical Structure score.

CRAM index and attribute scores showed a general decrease from north to south. This difference was the biggest for Hydrology and Physical Structure attributes (a 25 to 30 point difference from North to South Coast) and least for Landscape Context (less than a 10 point difference North to South). This trend is related to a southward increase in urbanization along the coastline, with related increases in diking and changes in water and sediment supplies of estuarine wetlands.

The CRAM index and attribute scores for restoration projects tended to be 5 to 20 percent lower than ambient

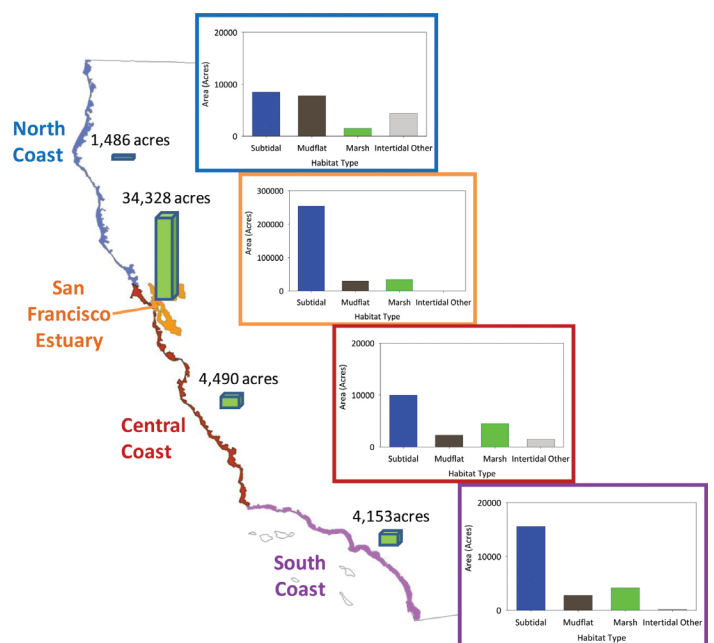
scores for the region in which the projects are located. Differences may involve factors such as project age (that is, how much time the restoration processes have been operating) and landscape context (the degree to which the project is embedded in urban land use).

To understand the causes of low project scores relative to ambient condition, projects should be assessed with CRAM prior to impact or restoration, then re-assessed as the project matures. Data of this kind are essential to enabling wetland managers to track net change in wetland acreage and condition and to evaluate the effect of the large and ongoing public investment in wetland restoration.

Stressors Identified

Dikes and levees were among the most frequent and most severe stressors identified statewide. They reduce the exchange with the ocean, which causes an infilling of the nooks and crannies that give native wetlands higher levels of function for fish and wildlife habitat, water filtration, flood control, and other valuable services. Other important stressors included:

- Invasive plants
- Non-point source discharges
- Pollutants, including pathogens, heavy metals, nutrients, pesticides, or trace organics
- Excessive runoff from watershed
- Flow obstructions (culverts, paved stream crossings)
- Trash or refuse



Suggestions for Management Actions

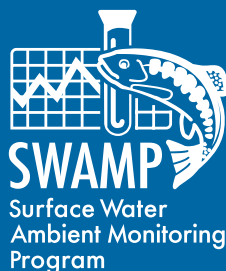
CRAM scores and the accompanying information on stressors provide possible management actions to increase wetland health within each coastal region. These stressors affecting the wetlands originate in their watersheds or adjoining uplands. At the landscape scale, improving the overall condition of estuaries and their wetlands will ultimately require changes in watershed management. The goals are to assure adequate supplies of clean water and sediment, to improve tidal circulation between the wetlands and their estuaries, and to provide adequate lands to accommodate estuarine upland relocation due to sea level rise. Specific management actions include:

- The conversion of estuaries to human land use has greatly decreased the extent of salt marshes and associated habitat. Undertake protection of remaining habitat and restoration to increase the size of estuarine wetlands to reduce the effects of terrestrial predators and other stressors.
- In all regions, converting floodplains to developed land use has reduced their ability to filter runoff. That runoff carries both sediment and contaminants from urban and agriculture land use alike. Necessary steps to protect these systems include:
 - Managing sediment loads, and reducing contaminants concurrently delivered with that sediment
 - Balancing reduced pollutant inputs to these systems while providing enough sediment to sustain estuarine wetlands from expected sea level rise
 - Restoring inflowing creeks and upland areas to increase filtration before discharging to estuaries

- Additionally, management actions should be taken to remediate problems where estuarine wetlands are already impacted by sediment and contaminants

The study provides a model for how to employ California's wetland monitoring tools to answer key management questions in a cost-effective way.

- Invasive plants and animals compete with natives for food and refuge. Remove invasive plant and animal species from salt marshes and surrounding lands and reestablish or reintroduce native species.
- Levees, dikes, and structures related to railroads and roads have changed hydrology and created poor physical structure. Careful removal, realignment, or re-engineering of transportation infrastructure is required to improve tidal flushing. A statewide forecast of sea level rise across the coast would help preview estuarine wetland restoration opportunities, and help predict whether levee realignment to reduce this stressor is possible.
- Mosquito ditches in salt marshes reduce the amount of standing water available to mosquitoes for breeding. Although this is one effective way to reduce potential for disease, this practice alters natural patterns of hydrology and sedimentation on the marsh. Wetland managers and vector control agencies need to work together to develop mosquito management approaches that mitigate hydrological impacts to wetlands.



For more information, please contact:

SWAMP Program Coordinator
State Water Resources Control Board
Office of Information Management and Analysis
1001 I Street, 15th Floor
Sacramento, CA 95814
(916) 341-5566