California's Statewide Survey Of Tidal Wetland Condition

Collins, J.[1], Sutula, M.[2], Williams, M. [1], Clark, R. [5], Roberts, C.[4], Stein, E. 2, Grosso, G. [1], Wiskind, A., Solek C. [2], May, M. [1], O'Connor, K.[3], Fetscher, E. [2], Grenier, L. [1], Pearce, S. [1], Robinson, A.[1], Clark, C. 3, Rey, K. Morrissette, S.[4], Eicher, A. [5], Pasquinelli, R.6, Ritter, K. [2], Ross, J.[1]

[1]San Francisco Estuary Institute, Oakland, CA
[2]Southern California Coastal Water Research Project, Costa Mesa, CA
[3]San Jose State University Foundation, Moss Landing, CA
[4]Humboldt Bay Harbor Recreation and Conservation District, Eureka, CA
[5]California Coastal Commission, Santa Cruz, CA
[6]California State Parks

Wetland Demonstration Program Project Description

The USEPA funded regional teams to assess the condition of California's tidal wetlands and demonstrate a statewide wetland monitoring program. The results help answer four fundamental management questions and are featured in the forthcoming State of the State's Wetlands Report:

1) What are the distribution and abundance of tidal wetlands?
2) What is the ambient condition of the tidal wetlands statewide and regionally?
3) What major stressors are likely to affect condition and how do they vary regionally?
4) What is the condition of tidal marsh restoration projects relative to ambient condition?

The project also included assessments of stream restoration projects relative to ambient condition of wadeable stream systems in three coastal watersheds: Ventura River, Morrow Bay, and Napa River.

1-2-3 framework

The assessment tools used were developed within USEPA's three level monitoring and assessment framework.

Landscape Assessment

Uses map-based inventories and analysis of landscape features

Example Output:

Land use maps — Lanscape analysis
Habitat maps — Historical Ecology
Watershed profiles

Rapid Assessment

Provides standardized, rapid assessments at a moderate cost

- Site-specific rapid assessment of overall health using California Rapid Assessment Method (CRAM).
- CRAM is based on Level 2 methods used in Ohio, Delaware, Washington and other states.

Intensive Assessment

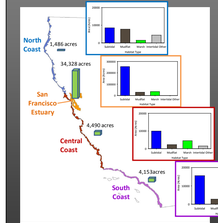
Provides quantitative measurements of conditions and processes

Site-specific quantification of ecological processes and functions like

- Wildlife support
- Flood risk
- Water quality
- Habitat evolution
- Accumulation of contaminants in food webs

Level 1 - Where are the wetlands? Mapping California's wetlands

Standard methods were developed for regional work centers to provide accurate, detailed maps of streams and wetlands to local interests and track net change in wetland and stream habitat distribution and abundance.



Distribution of the total acreage of estuarine habitats and wetlands among the four coastal regions

Map products provide sample frame for Level 2 and Level 3 assessments

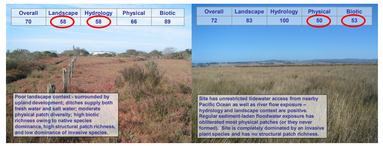
Level 2 –Assessing wetlands health California Rapid Assessment Method (CRAM)

CRAM Tenets

- Wetlands are valued for their services (e.g., habitat, and flood control)
- Overall wetland value depends on the diversity of services
- For any wetland type, service increases with wetland complexity and size

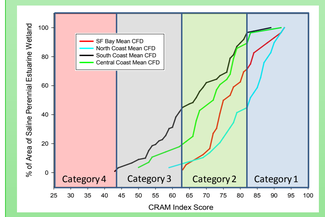
Two people in one day can assess at least one site relative to the best achievable conditions statewide, considering climatic regime and buffer and landscape. There are CRAM modules for seven wetland types (Statewide CRAM information and results www.cramwetlands.org).

ATTRIBUTE	METRIC	SUBMETRICS
BUFFER AND LANDSCAPE CONTEXT describes the area around a wetland	Landscape Connectivity	
	Buffer	
	Percent of AA with Buffer	Average Buffer Width Buffer Condition
HYDROLOGY • The most important direct determinant of wetland function • Influencing physical structure, nutrient cycling, sediment entrapment, and pollution filtration	Water Source	
	Hydroperiod	
	Hydrologic Connectivity	
PHYSICAL STRUCTURE and the diversity and spatial organization of a wetland relates to its capacity for supporting a diverse biological community	Structural Patch Richness	
	Topographic Complexity	
	Plant Community	Number of Plant Layers Number of Co-dominants
BIOLOGICAL STRUCTURE includes all of its plants and algae. Wildlife is not assessed.	Percent Invasion	
	Horizontal Interspersion & Zonation	
	Vertical Biotic Structure	



STRESSORS A CRAM assessment is accompanied by a stressor checklist to help explore what stressors might account for low scores.

How are the State's wetlands doing? Statewide CRAM results



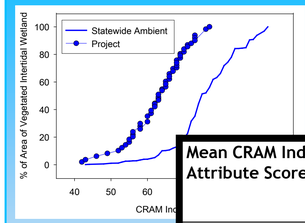
A statewide assessment of estuarine wetlands was conducted in 2007. Assessment Areas were selected from a probabilistic sample draw using the Level 1 wetlands inventory. Wetland condition showed a general decrease from north to south which reflects California's southward increase in coastal urbanization, and resultant fragmentation of estuarine wetlands.

Category 1 100 to 82
Category 2 82 to 63
Category 3 63 to 44
Category 4 44 to 25

CRAM Attribute	North Coast Mean	SF Estuary Mean	Central Coast Mean	South Coast Mean
Index Score	82	78	71	67
Buffer & Landscape	83	90	81	82
Hydrology	89	82	82	61
Physical Structure	84	59	57	59
Biotic Structure	72	78	63	67

At the attribute level of CRAM, differences were most pronounced for Hydrology and Physical Structure (25 - 30 point difference from North to South Coast) and least for Buffer and Landscape(<10 point difference North to South). Differences of ≥10 points can be considered meaningful between regions.

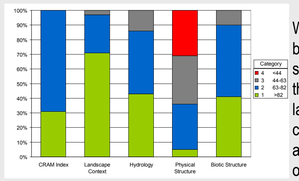
Statewide survey results: ambient vs. project condition



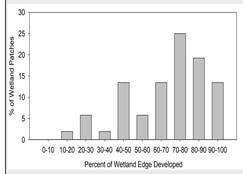
Mean CRAM Index and Attribute Scores	SF Estuary		Central Coast		South Coast	
	Ambient	Project	Ambient	Project	Ambient	Project
Overall Index Score	78	67	71	63	67	59
Buffer and landscape	90	72	81	64	82	65
Hydrology	82	65	82	67	61	55
Physical Structure	59	68	57	66	59	56
Biotic Structure	78	65	63	57	67	59

Regional CRAM scores for restoration projects tended to be 5 - 20% lower than ambient scores. Differences can be attributed to project age, project size, and intensity of adjacent land use. CRAM can be used to cost-effectively track project performance from pre-project conditions through project evolution and maturation. CRAM enables managers to track net change in wetland acreage and condition due to projects.

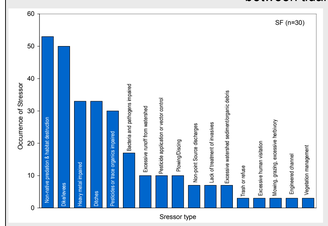
San Francisco Estuary Results

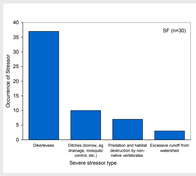


While Bay Area tidal wetlands are faring better than in some other regions of the state, CRAM assessments indicate that the physical structure of our wetlands lacks patch richness and topographic complexity. Pools, channels, pannes, algal mats all contribute to the structure of an estuarine wetland.



Every tidal wetland in SF Estuary is bounded by development to some extent with 60% of the Bay's wetland margins adjacent to developed land. This includes developed fill, salt ponds, developed uplands, and agricultural lands separated from the wetlands by levees, dikes, or other tidal control structures. This highlights the importance of land use decisions that affect important linkages between tidal wetlands and local watersheds.





Marsh age differences.

n	Maximum possible attribute value	Overall score 100	Landscape context 24	Hydrology 36	Physical Structure 24	Biotic Structure 36
13	Old High	82.0	22.0	30.0	18.0	28.0
6	Young High	72.5	24.0	31.5	12.0	22.5
	W	153.0	120.0	134.0	153.0	159.0
	p	0.00481	0.3534	0.7541	0.0432	0.0112
	Significant?	Yes	No	No	Yes	Yes

Differences in attribute scores for old and young marshes were analyzed using the non-parametric Mann-Whitney test. Most old marshes are remnants of ancient marshes that predate Euro-American contact. Younger marshes stem from restoration projects and natural marsh evolution but are all less 100 years old. The better overall condition of older marshes is attributable to the natural evolution of more complex channel systems and topography over time. This is accompanied by more diverse plant communities as plants adapted to the different elevations and inundation levels of a marsh are established.