DEVELOP

Development of a Sediment Monitoring Tool for Prioritizing Salt Pond Restoration

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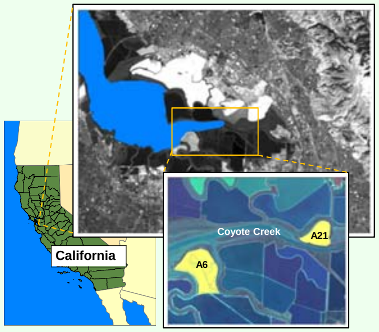
BACKGROUND

Development of the San Francisco Bay Estuary has transformed nearly 90% of ancient wetland habitats into industrial salt production ponds, resulting in an overall loss in biodiversity. The goal of the South Bay Salt Pond Restoration Project (SBSPRP), the largest wetland restoration effort on the west coast of the United States, is to convert these salt production ponds to their former wetland habitats. Breaching the island pond levees in March, 2006 began the restoration process by reintroducing tidal inundation cycles.

2006 Pre-Breach

2009 Post-Breach

STUDY AREA



ABSTRACT

The South Bay Salt Pond Restoration Project (SBSPRP) is the largest tidal wetland restoration project on the west coast of the United States. The purpose of this project was to use in-situ and remote sensing measurements to create a GIS model capable of predicting sediment deposition in restored ponds in the Alviso complex. A sediment transport model, suspended sediment concentration maps, as well as laboratory analyses of in-situ sediment data were used to predict sediment deposition. Suspended sediment concentrations from our in-situ samples as well as the USGS's continuous monitoring sites were correlated with Landsat TM 5 and ASTER reflectance values using three statistical techniques—an Artificial Neural Network (ANN), a linear regression, and a multivariable regression to map suspended sediment concentrations. Grain size data were collected from Pond A21 to calculate particle settling velocities, grain size distribution, particle densities, and rates of deposition. These data coupled with tidal frequencies were used in the MARSED model for predicting deposition rates for three years. Data from MODIS were used to track sediment transport pathways in the South Bay for further assessing future marsh development. Results from this project were applied to the Regional Ocean Modeling System (ROMS) sediment transport module for understanding sediment dynamics in the South Bay.

METHODOLOGY

Taking Water Samples in the SF Bay

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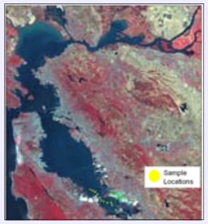
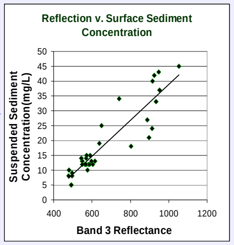
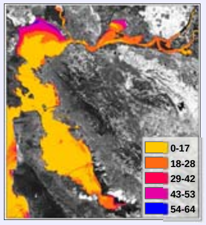


08/22/07 Landsat Image (Bands 2-4)





Suspended Sediment Concentrations in mg/L

CONCLUSIONS

- The Sacramento-San Joaquin River Delta and Coyote Creek are the primary sources of sediment
- Remote sensing can successfully detect SSCs
- Multivariate regression is the most accurate statistical method
- The MARSED model successfully predicts sedimentation
- We predict that Pond A6 will reach equilibrium after 60 months

NASA PARTNERS

US Fish and Wildlife Service

California Department of Fish and Game

US Geological Survey

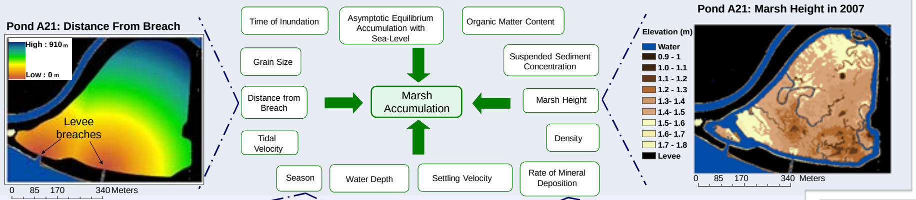
Coastal Conservancy

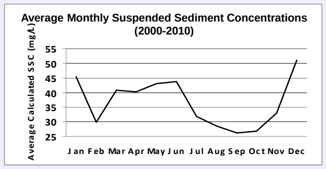
THE TEAM

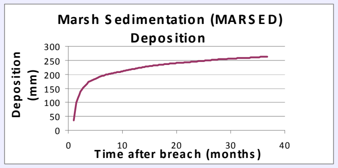
At Pond A21: Mud-Sampling Field Day

RESULTS

MARSH SEDIMENTATION (MARSED) CONCEPTUAL MODEL







MODIS IMAGERY

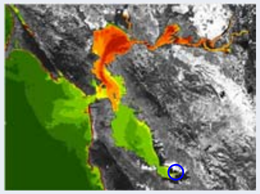
Sediment Transport
January 2006

Suspended Sediment Concentration (mg/L)

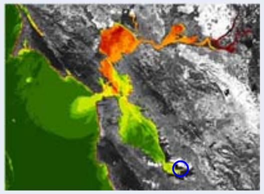
250

10

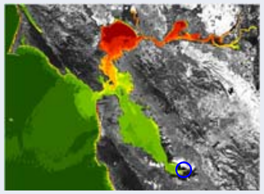
○ Study Area



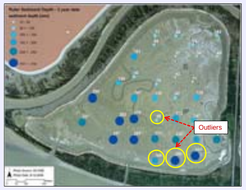
2 Days After Storm (01/04/06)



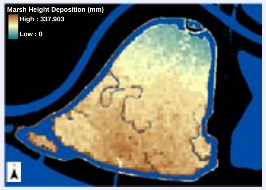
4 Days After Storm (01/06/06)



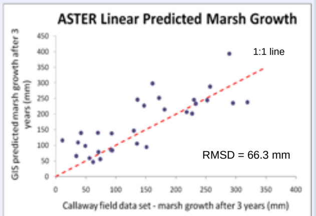
7 Days After Storm (01/09/06)



Sediment deposition 3 years post-breach (Callaway et al., 2007)



MARSED modeled deposition 3 years post-breach



REMOTE SENSING

Sensor	Bands Used	Spectra (µm)	Resolution	R^2 Values From Regression		
				Linear	Multiple	ANN
Landsat 5	1-3	0.50–0.80	30 m	0.64	0.84	0.69
ASTER (Terra)	1-3	0.52–0.86	15 m	0.66	0.88	0.87
MODIS (Terra)	1-2	0.62–0.88	250 m	0.84	0.84	0.84
EO-1 Hyperion	20	0.548	30 m	--	--	--
	52	0.874				
	104	1.184				