Wetlands Regional Monitoring Program (WRMP) Updates

Presentation to SFEP Implementation Committee

August 13, 2025

SF ESTUARY
Wetlands Regional Monitoring Program

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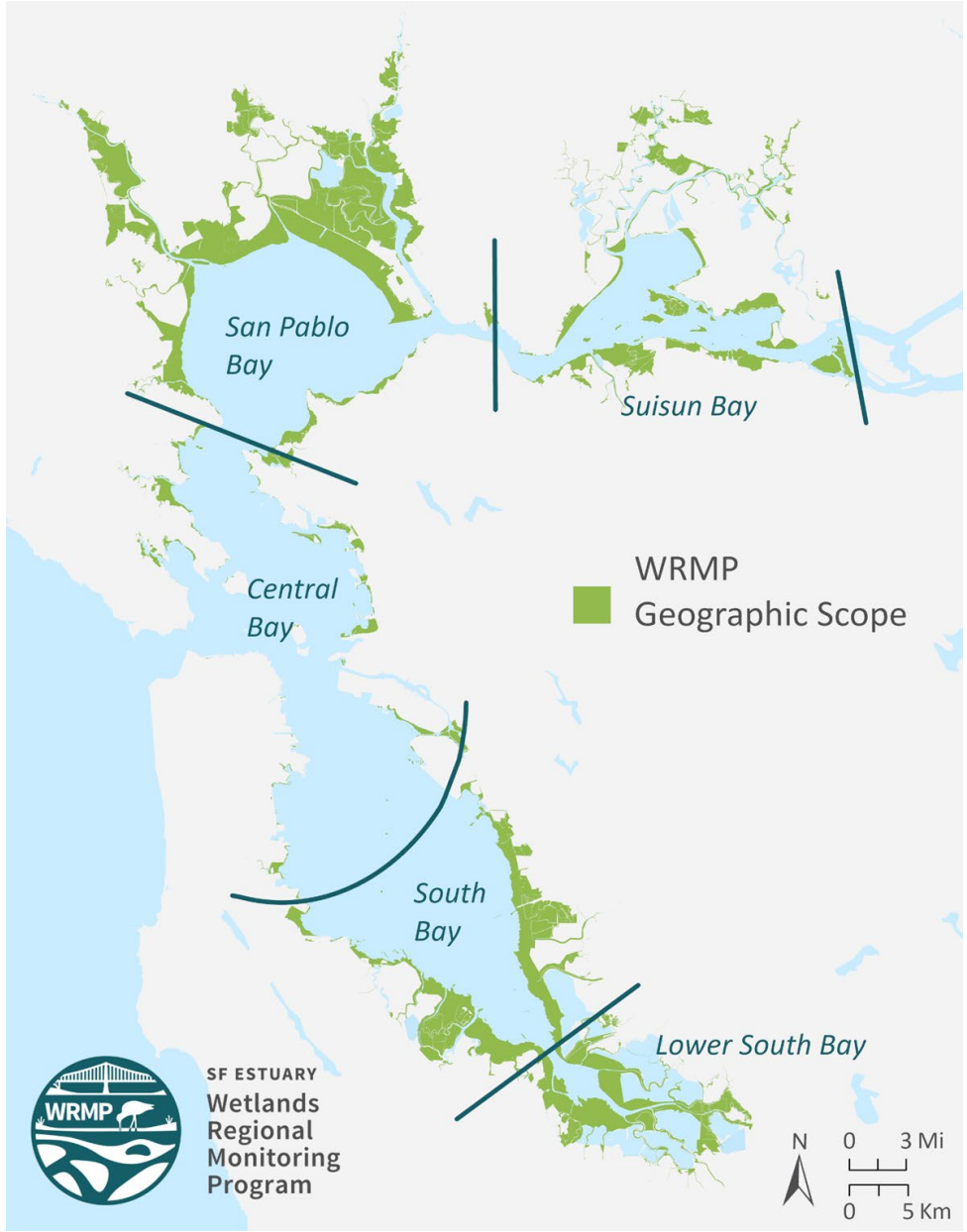
Outline

- WRMP overview
- Key highlights from 2025
  - Regional mapping products
  - Water quality monitoring
  - Fish monitoring
  - Wetland condition monitoring
  - Estuary-wide LiDAR collection
- Questions



WRMP Mission and Scope

Deliver coordinated regional monitoring of the San Francisco Estuary's wetlands to:

1. Inform science-based decision-making for wetland restoration and adaptive management
2. Increase the cost-effectiveness of permit-driven monitoring associated with wetland restoration projects.


Photo: Ben Botkin

Why Regional Monitoring?

- Answers regionally-important, collaboratively developed management questions.
- Produces information to support decision-making.
- Makes permit-driven monitoring for restoration projects more cost-effective.
- Centralizes data management to enable regional analyses for informing adaptive management.

WRMP Phases

Phase 1

2016-2021

Program Planning and Development

- Program Governance
- Science Framework
- Pilot Data Collection
- Data Management
- Outreach

Funding: USEPA and in-kind

Phase 2

2022-Present

Program Implementation and Continued Development

- Program Administration
- Operationalize Monitoring Site Network
- Regulatory Coordination
- Outreach and Workforce Development

Funding: USEPA, State Revolving Fund, SF Bay Restoration Authority, Delta Stewardship Council, in-kind

WRMP Science Framework: Tiers

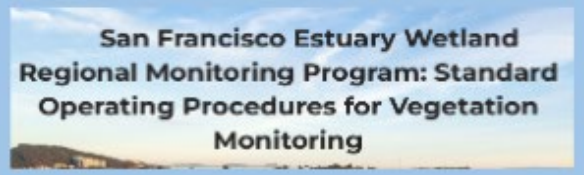
- Guiding Questions
- Management Questions
- Monitoring Questions/Priority Actions
- Metrics
- Protocols

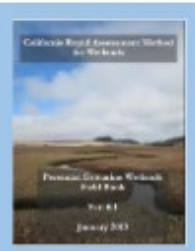
How do policies, programs, & projects to protect & restore tidal marshes affect the distribution, abundance, & health of plants & animals?

How are fish & wildlife **habitats** changing?

What is the distribution & abundance of tidal wetlands?

- Maps of bayland habitats
- Special-status species habitats



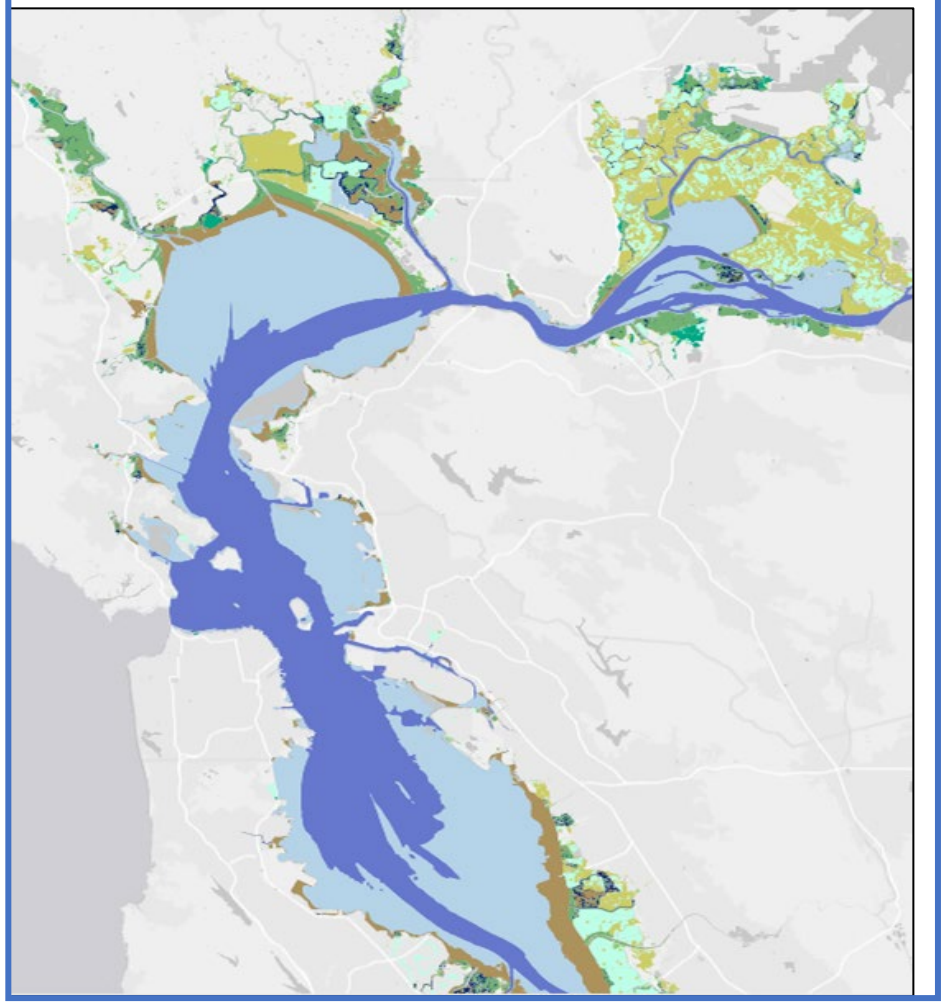


2025 WRMP HIGHLIGHTS

Implementation

SF ESTUARY Wetlands Regional Monitoring Program

LEVEL 1 LANDSCAPE ASSESSMENT



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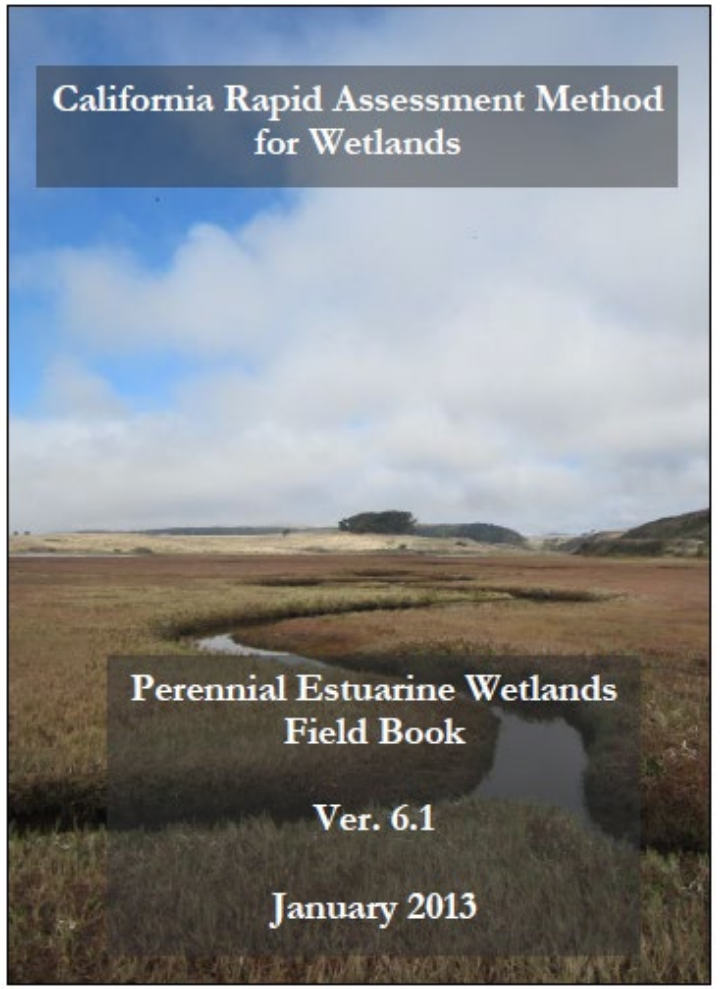
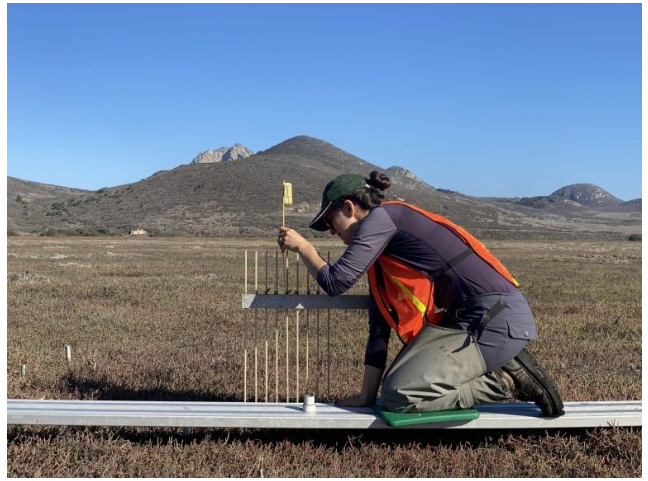
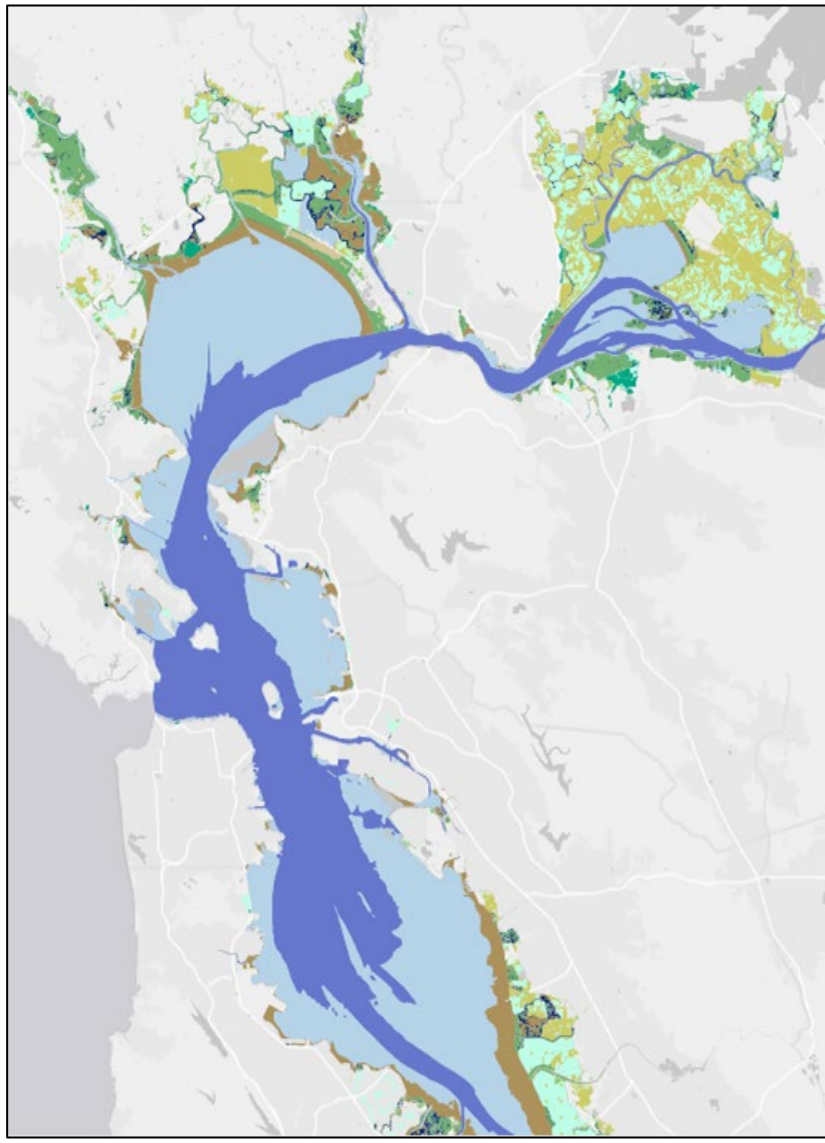


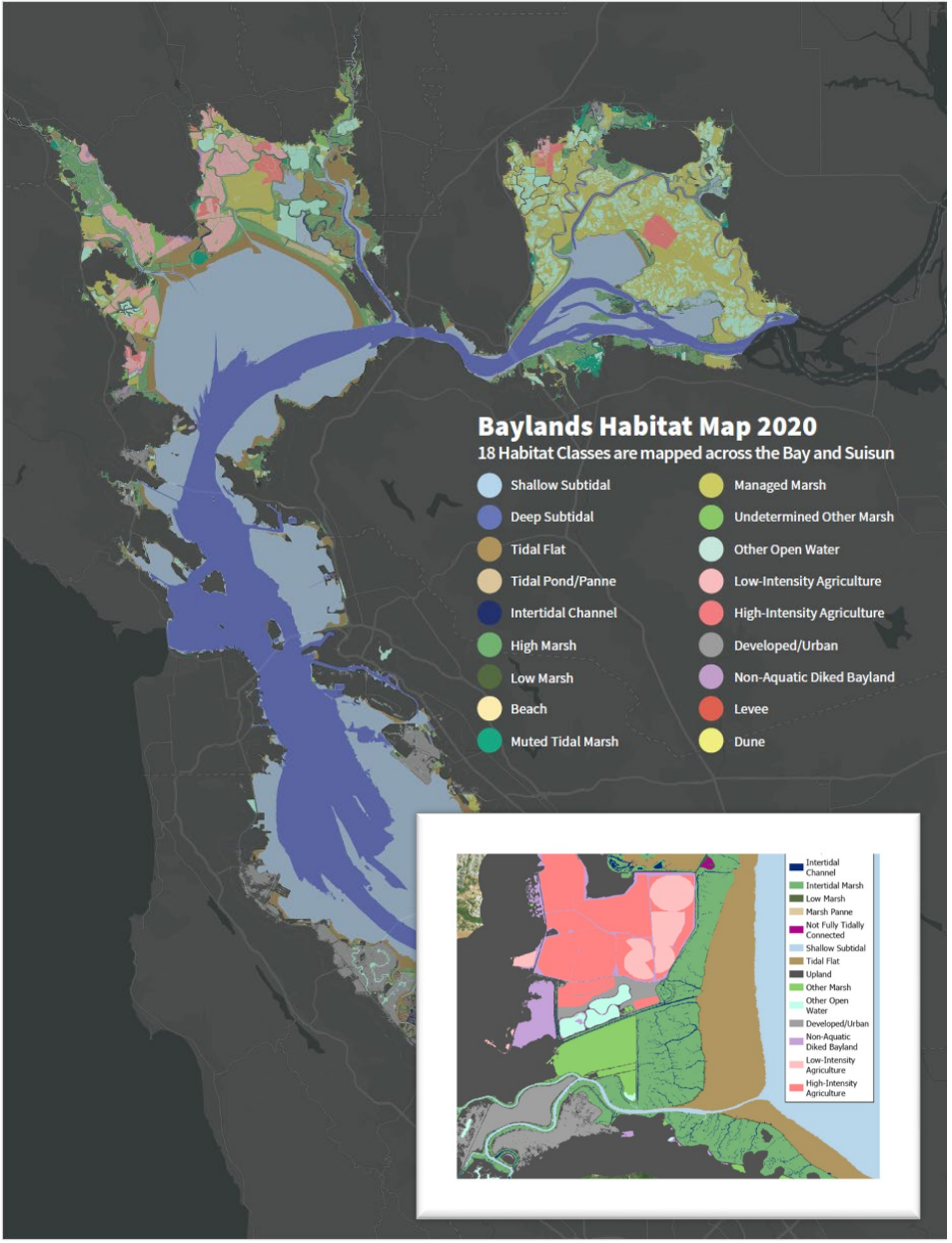
LEVEL 3 INTENSIVE ASSESSMENT



Landscape level WRMP products

- Baylands Habitat Map 2020 & analyses
- Project Tracker Tidal Wetland Restoration Map 2020 & 2024 layers
- Tidal Wetland Extent Report
- WRMP EcoAtlas Profile Tool
- LiDAR – Estuary-wide (Bay and Delta)

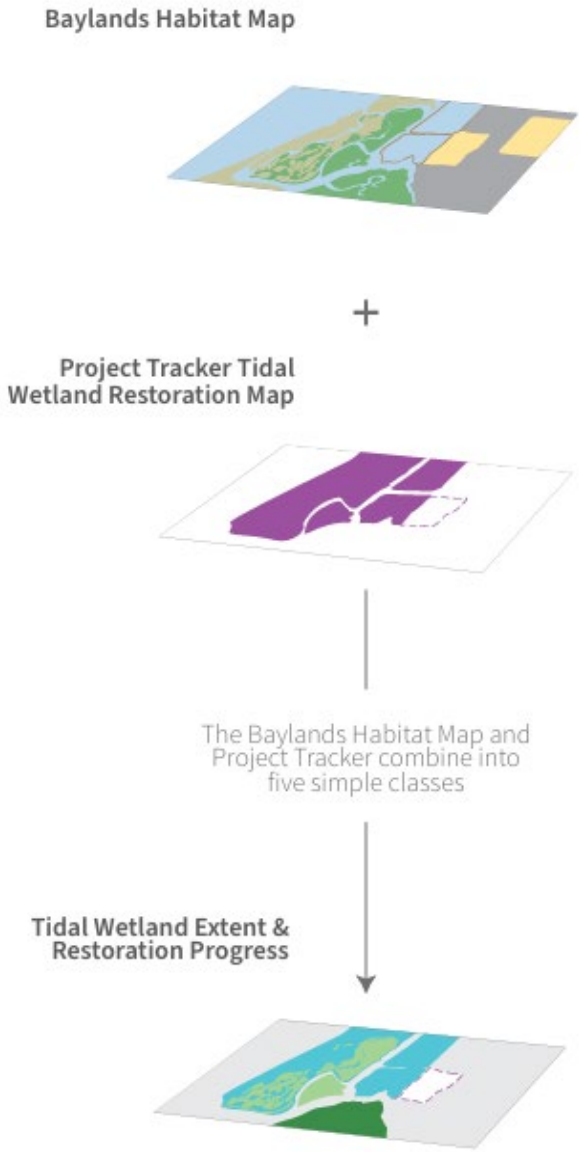




WRMP Baylands Habitat Map

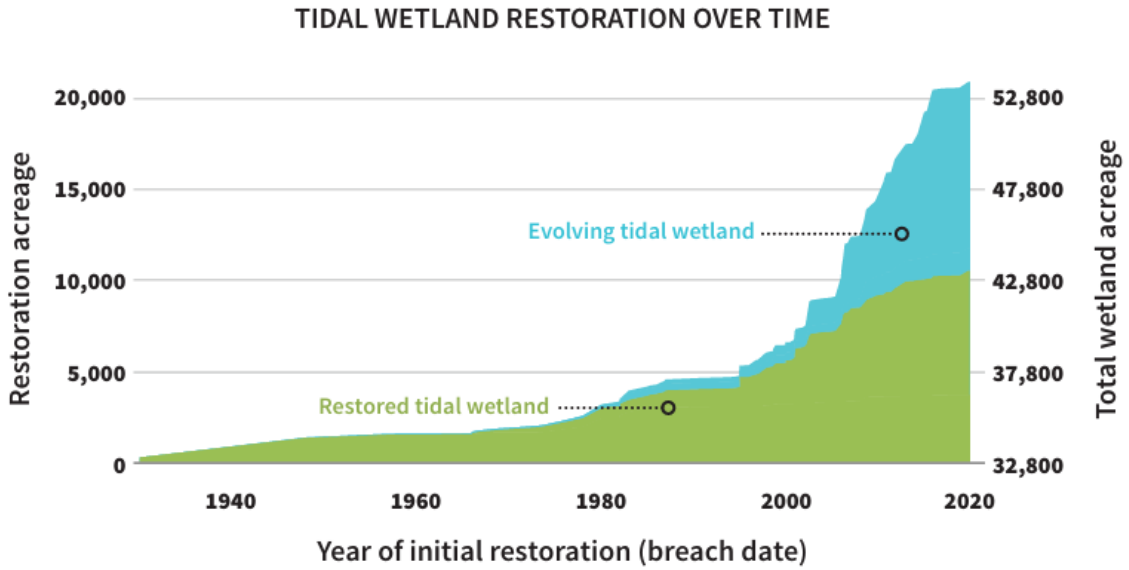
LEVEL 1 LANDSCAPE ASSESSMENT

- First high resolution Baylands habitat map since 2009
- Created by the WRMP using automated, consistent & repeatable methods
- Uses Object Based Image Analysis, high resolution aerial imagery, LiDAR elevation data, tidal data, & other metrics to classify habitats
- Employs a standardized habitat classification scheme
- Map will be updated every 4-5 years



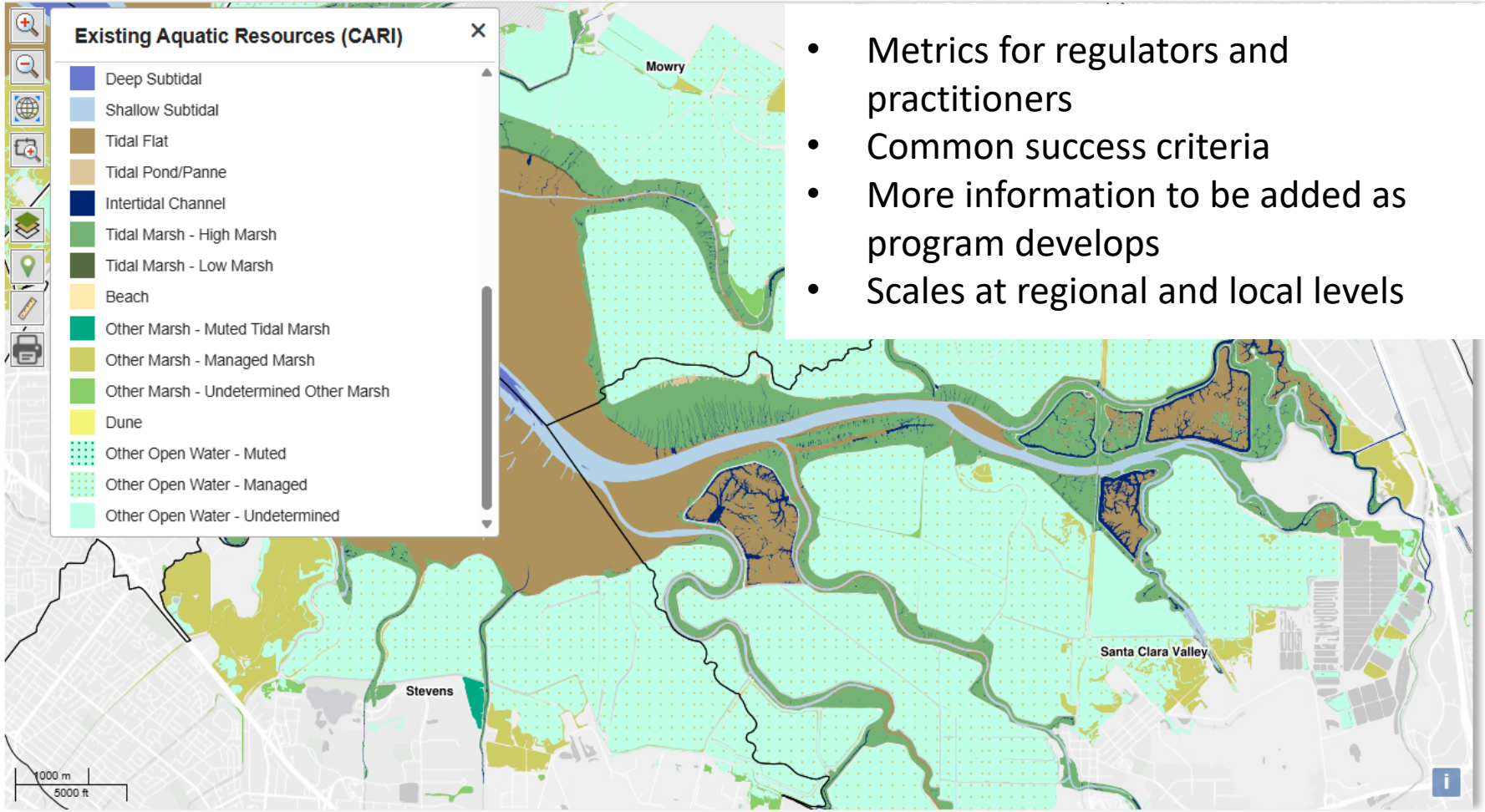
Tidal Wetland Extent

- Track progress against goals at a regional scale
- Improved understanding of how wetlands are restoring
- Adaptive management



WRMP EcoAtlas Profile Tool

Layers ▾ Legends ▾ Basemap ▾ Overlays ▾



- Metrics for regulators and practitioners
- Common success criteria
- More information to be added as program develops
- Scales at regional and local levels

Landscape Profile

WRMP Operational Landscape Unit (OLU): Santa Clara Valley

Total Profile Area: 31,804 acres or 49.7 miles^2

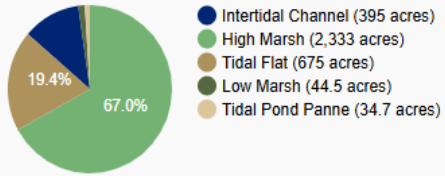
Print Report

The SF Estuary Wetlands Profile summarizes key metrics on indicators for tidal wetlands tracked by the SF Wetlands Regional Monitoring Program.

Tidal Wetland Extent

Tidal wetland extent in the San Francisco Bay based on the Baylands Habitat Map 2020. For more information, refer to this report.

Tidal Wetland Extent: 3,482 acres / 5.4 mi^2

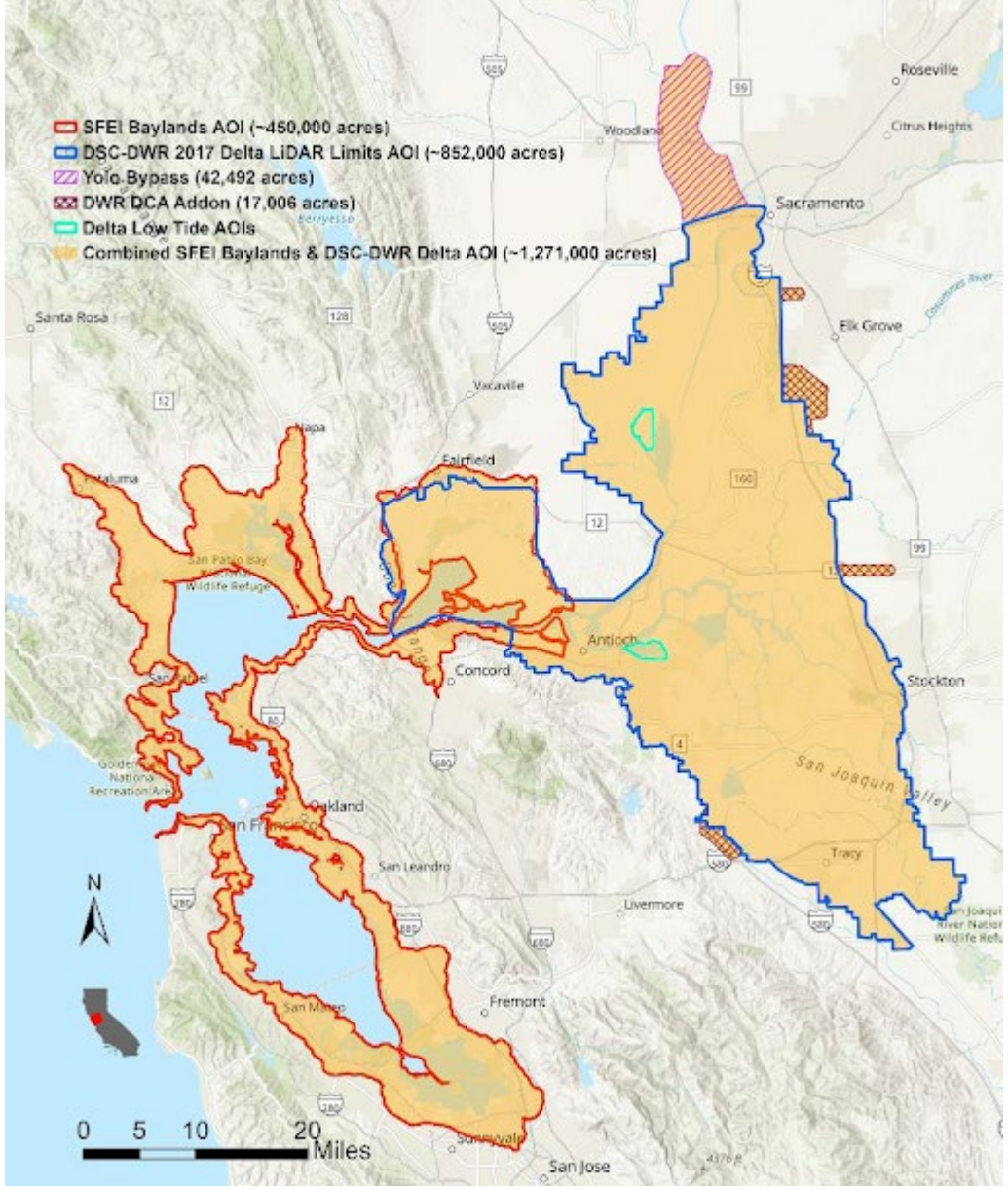


Restoration Status

Restoration status includes completed and future tidal wetland. *Existing* represents ancient or centennial tidal wetland occurring outside of restoration projects. *Restored* indicates tidal wetland that has been restored to tidal flow and now supports wetland vegetation and well-defined channels. *Evolving* is tidal wetland that has resulted from recent or ongoing restoration activities, but has not yet developed wetland vegetation and well-defined channels.

Estuary-wide LiDAR

- Regional efficiencies
- Collective cost savings
  - Cost-share among organizations
- Improved consistent data
  - Baylands Habitat Map 2025
  - Collected at low tide



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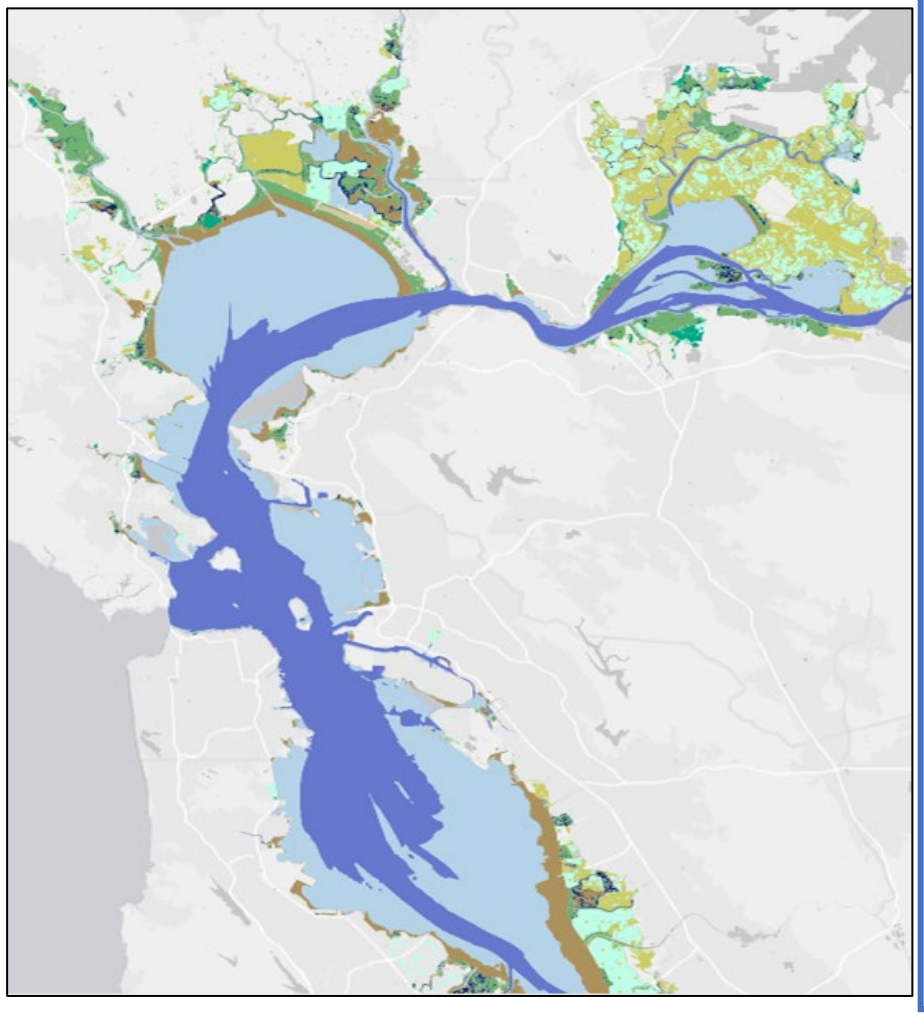

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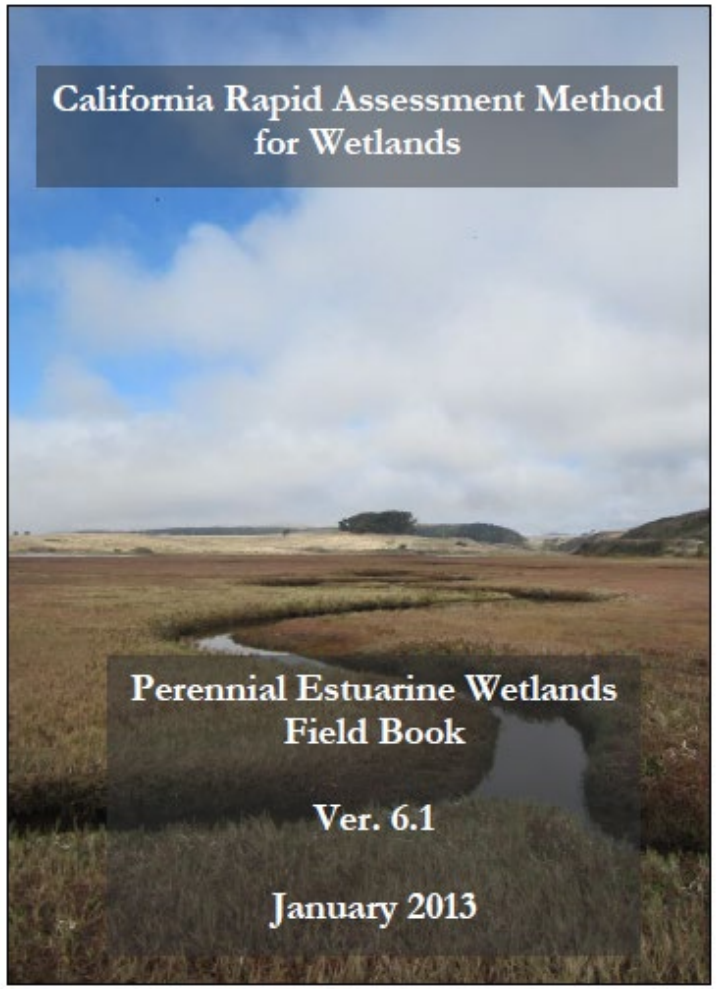

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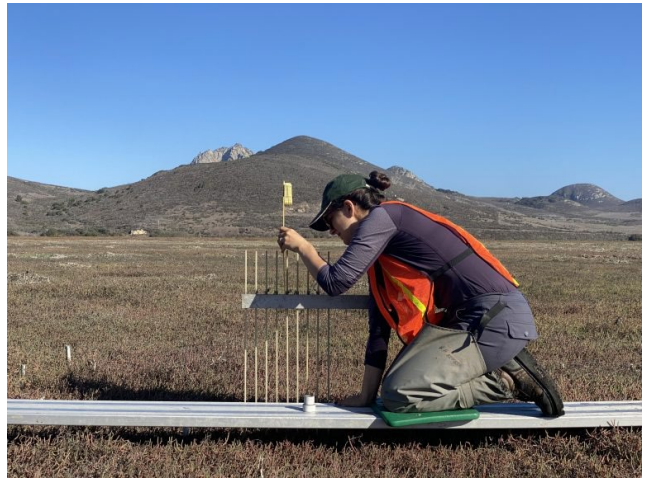
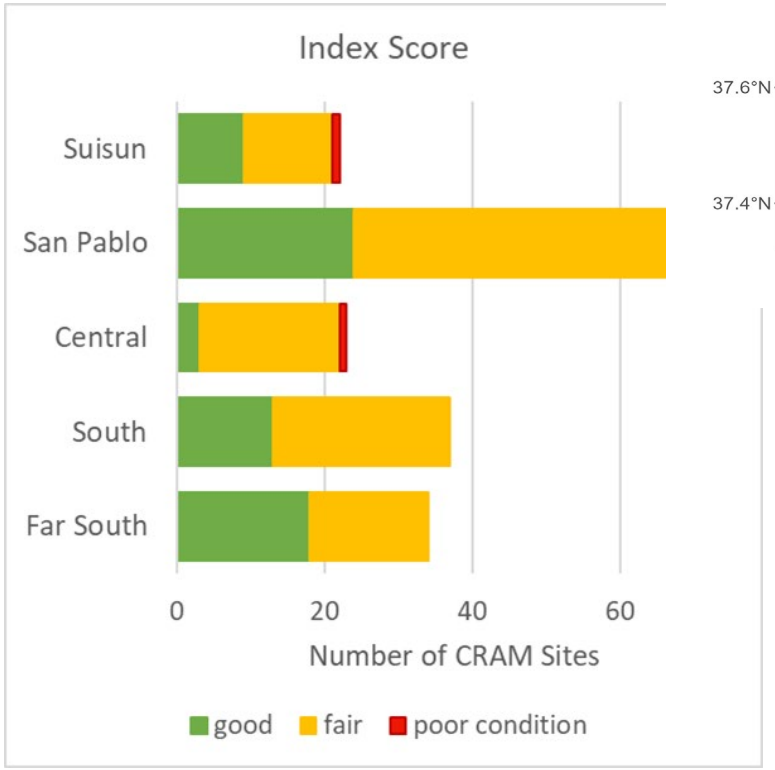
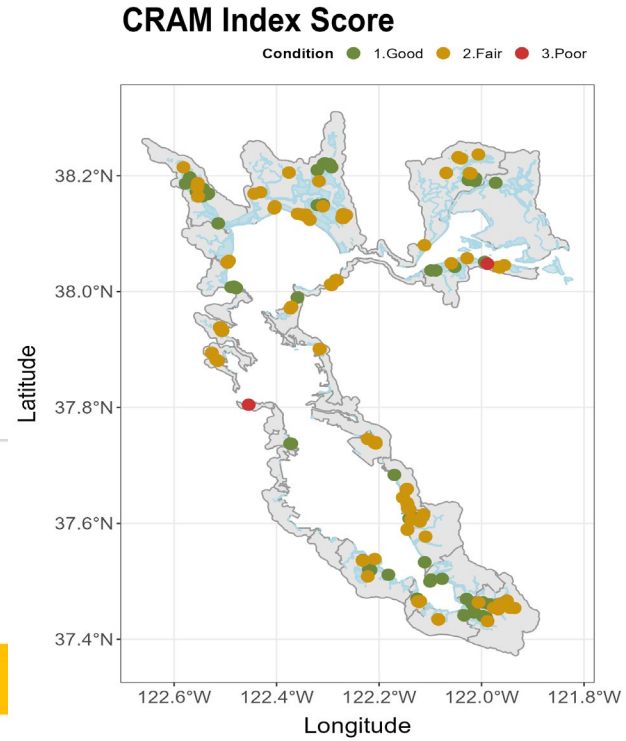


Wetland condition monitoring

- California Rapid Assessment Method (CRAM)
  - Used in the Estuary since 2005
  - Robust online data management system
  - Data viewable on EcoAtlas
- Cost-effective Level 2 monitoring
- Standardized, regional data about wetland condition and restoration site maturation
- Leveraged and built on existing data
- WRMP is creating a robust dataset for future analysis of restoration site development





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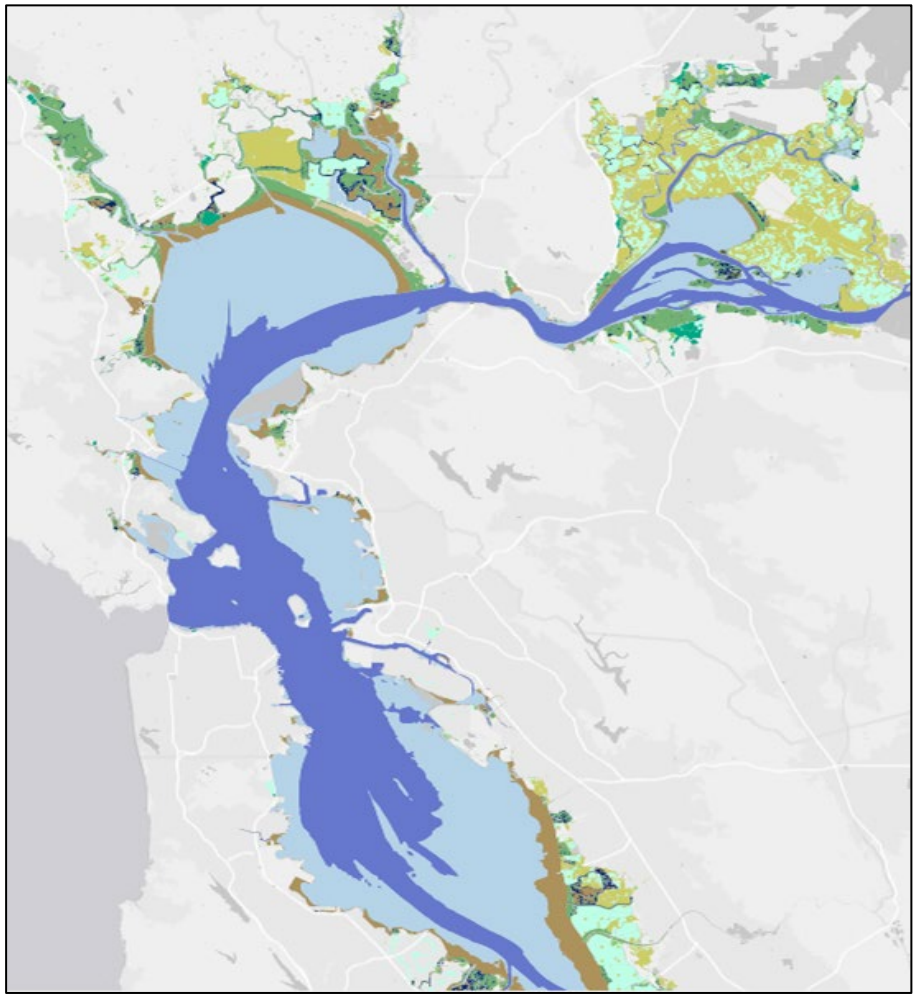

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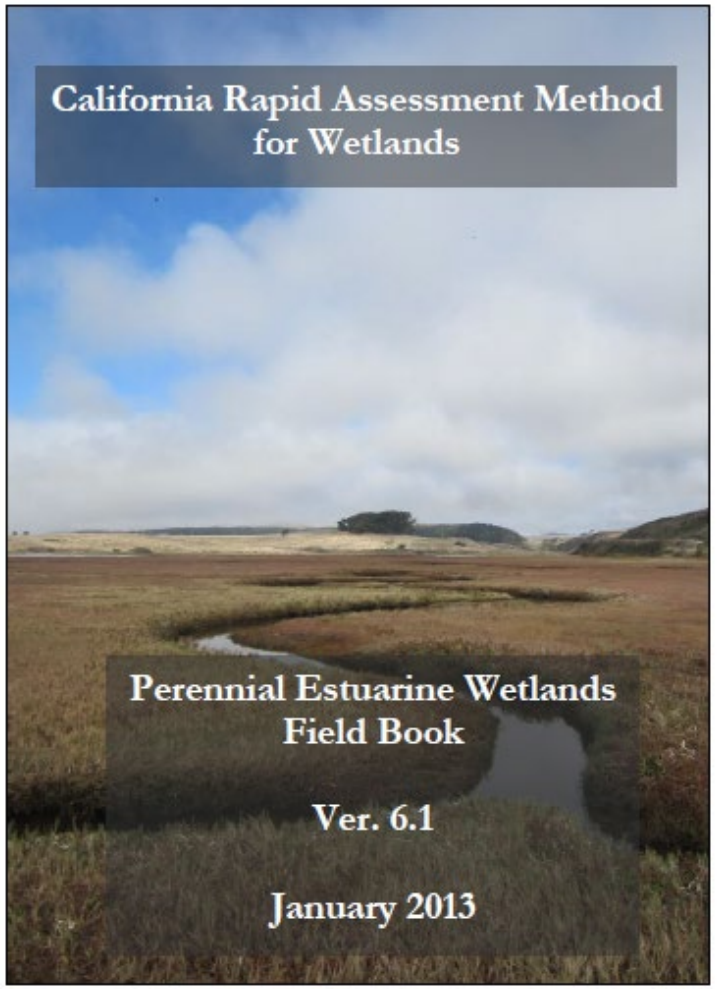

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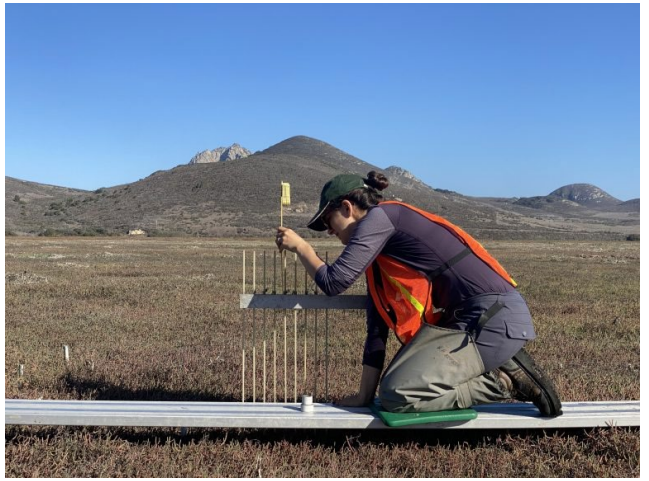
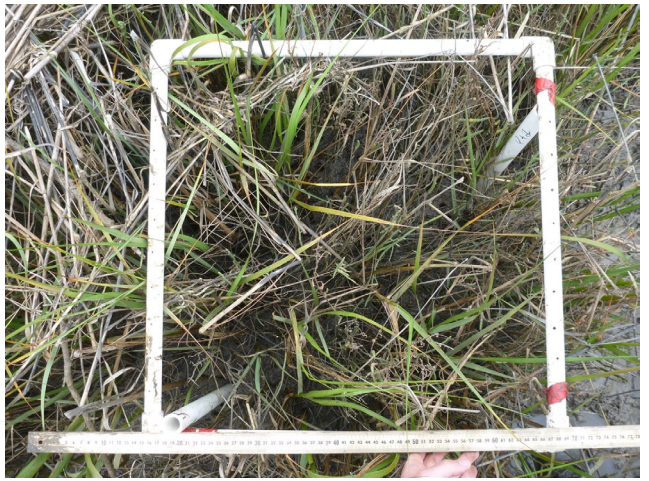
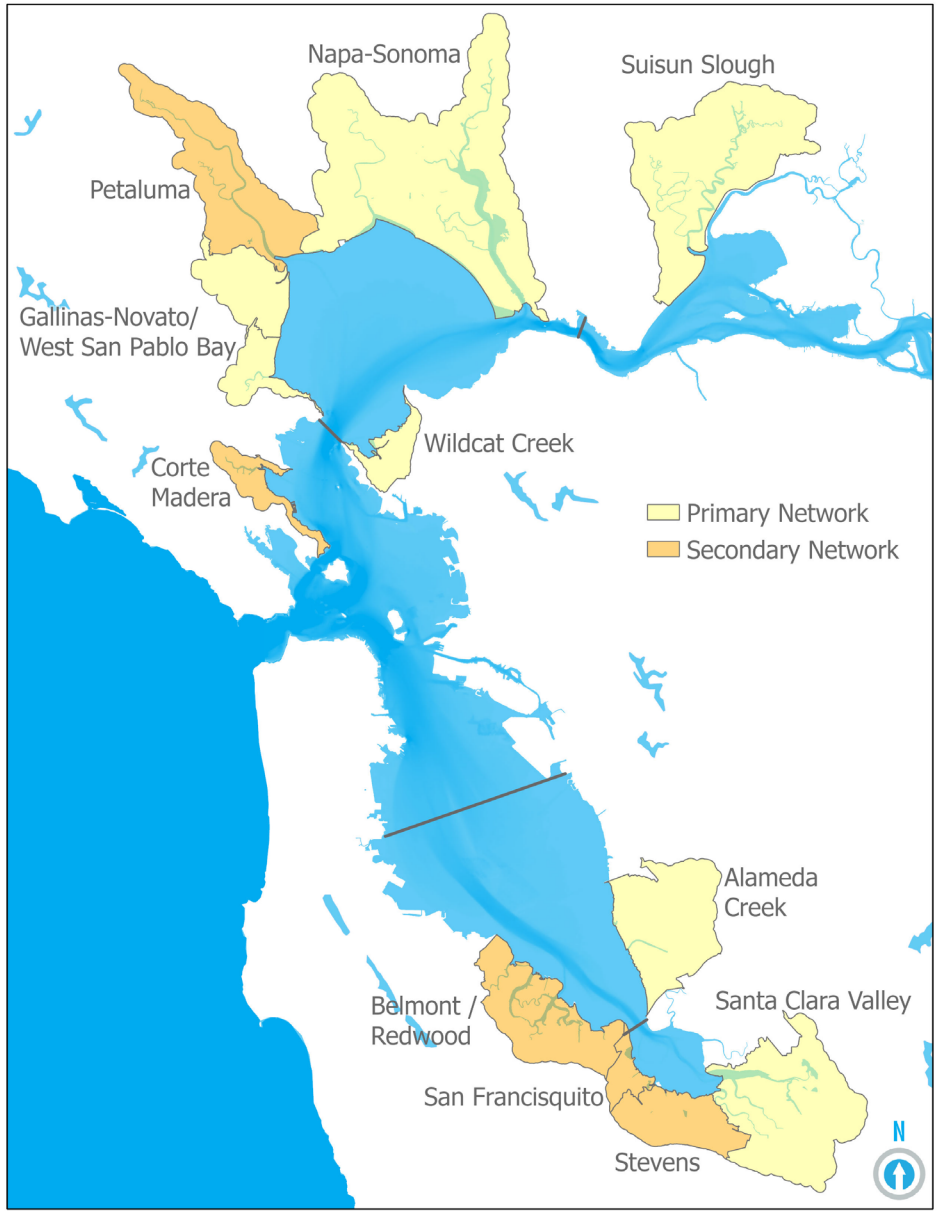
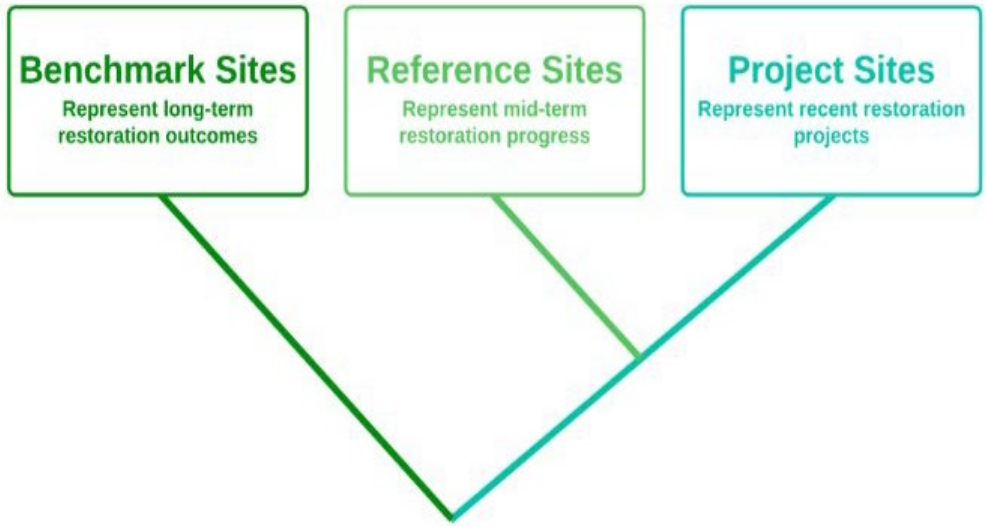






Priority Monitoring Site Networks

- Geographic coverage across the estuary
- Address WRMP Guiding Questions and near-term science priorities
- Ability to build upon and leverage historical and existing wetland monitoring and projects
- Inform existing and planned tidal wetland restoration projects



Supporting Permitting Requirements

- Water
  - Water quality
  - Groundwater patterns
- Sediment
  - Surface Elevation Tables-Marker Horizons (SET-MH)
- Vegetation
  - Wetlands
  - Photo monitoring
- Fish and Fish Habitat

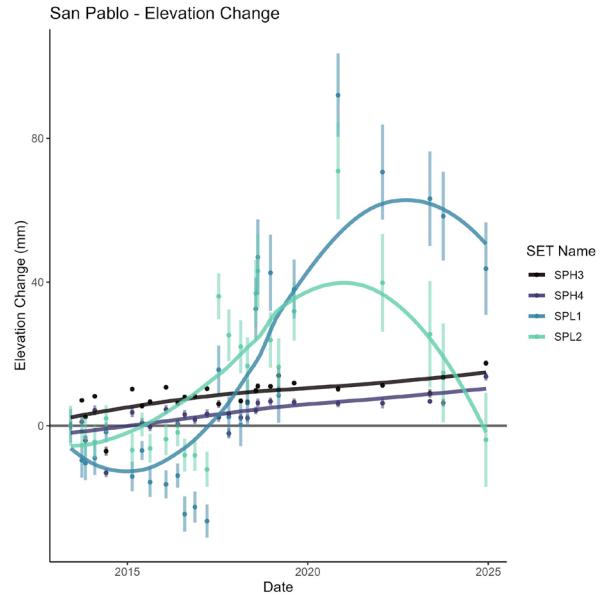
Water Quality Monitoring

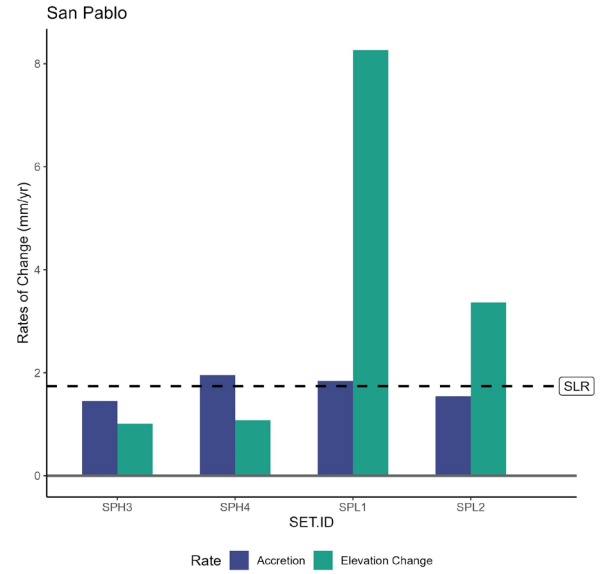
- Water quality sensors
  - New multiparameter gauge at Eden Landing (Mt. Eden Creek)
  - Fills key data gap for East Bay marshes and the SBSPRP
  - Water level, salinity, temp, DO, pH, turbidity
- Additional data collected as part of sediment, vegetation, and fish monitoring

Photos: Chris Janousek

Sediment Monitoring

- Surface Elevation Tables-Marker Horizon (SET-MH)
  - Measures sediment deposition & wetland surface elevation change over time
  - Critical part of wetland success
- Leveraging existing site network & adding new to cover key spatial and project type gaps

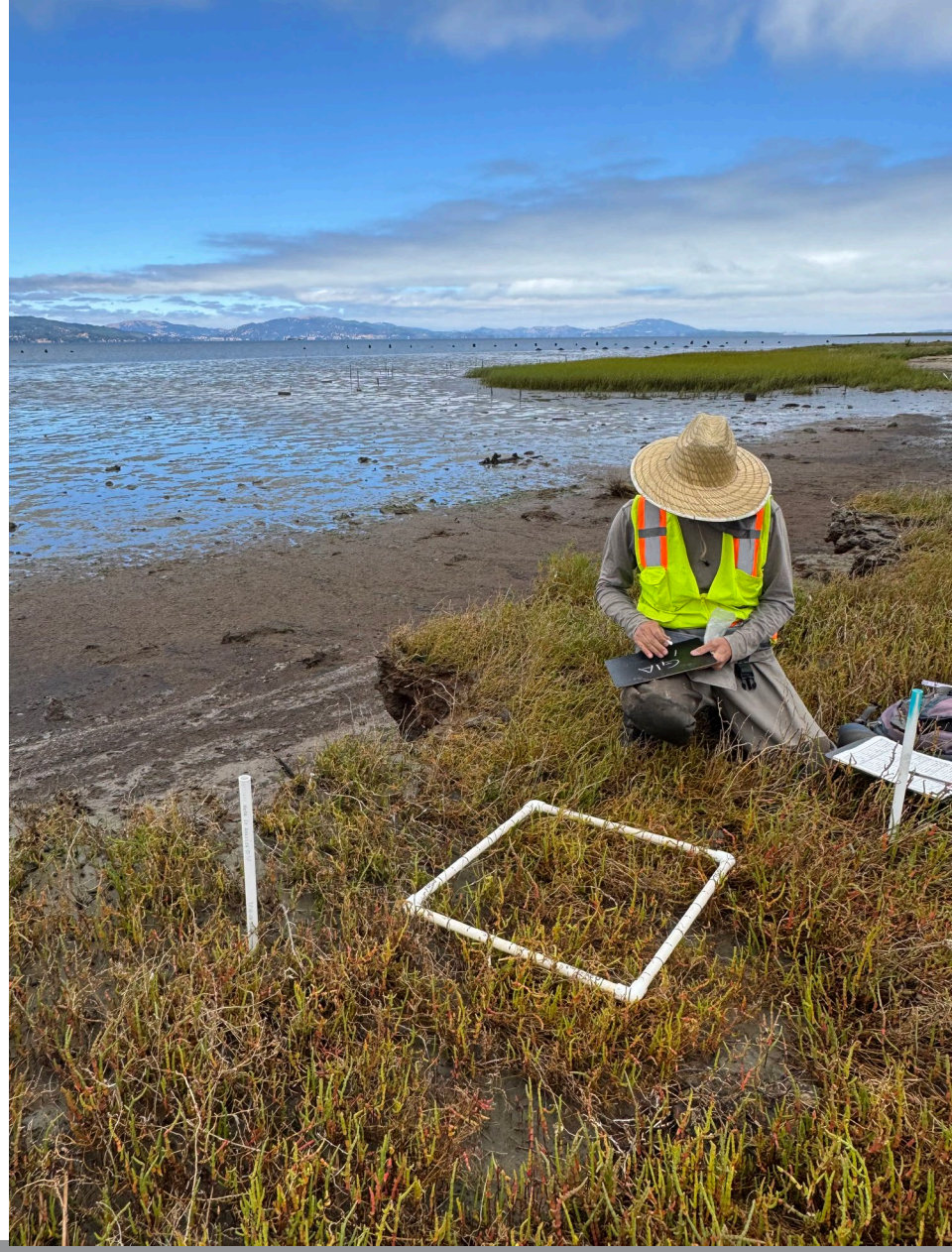




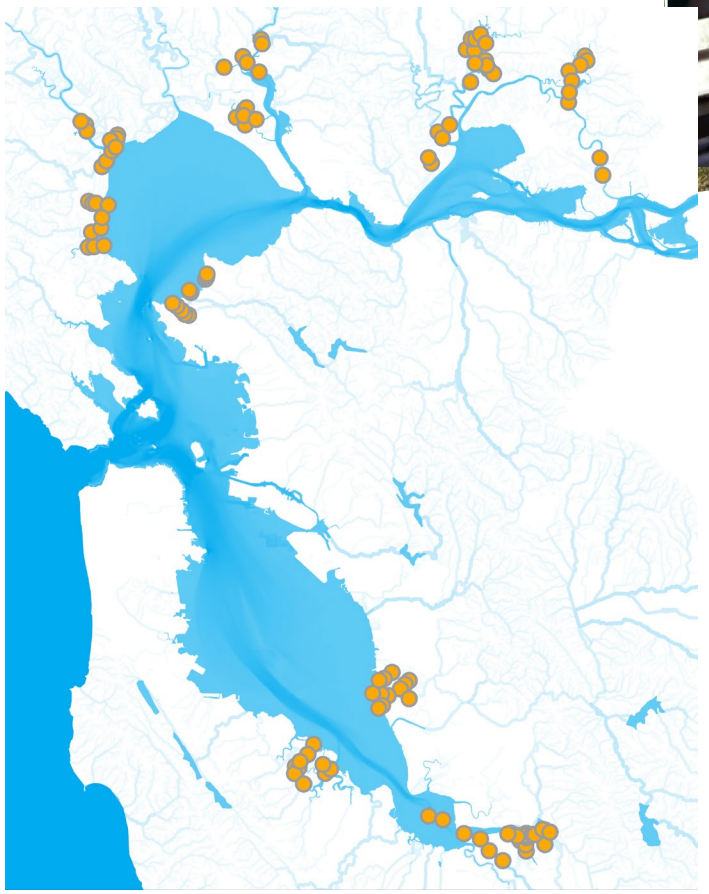
Photos: Chris Janousek

Vegetation Monitoring

- Monitoring common success criteria
- Across benchmark, reference, and project sites
- 18 sites have vegetation and marker horizon transects established
- Vegetation sampling began this summer
- 18 groundwater loggers recording data

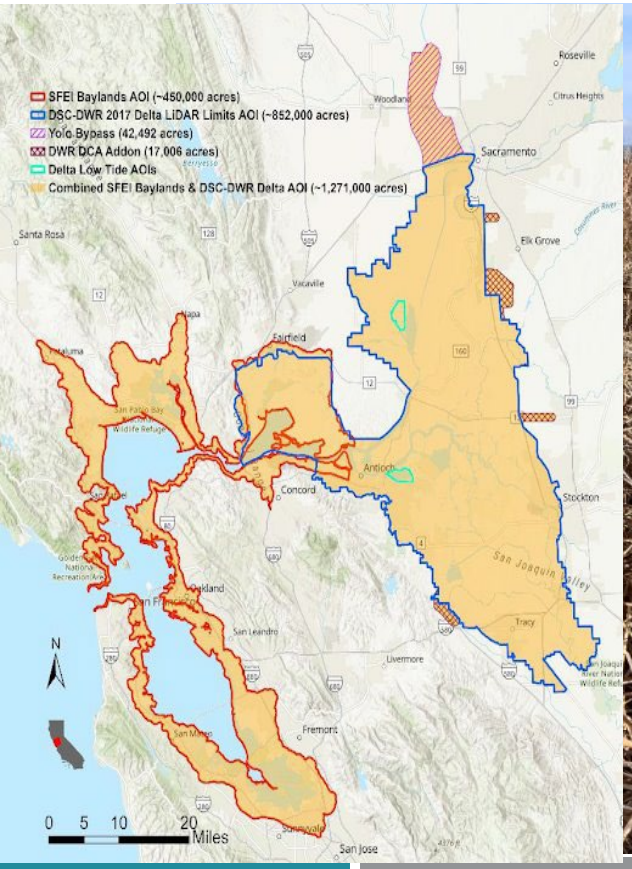


Fish and Fish Habitat

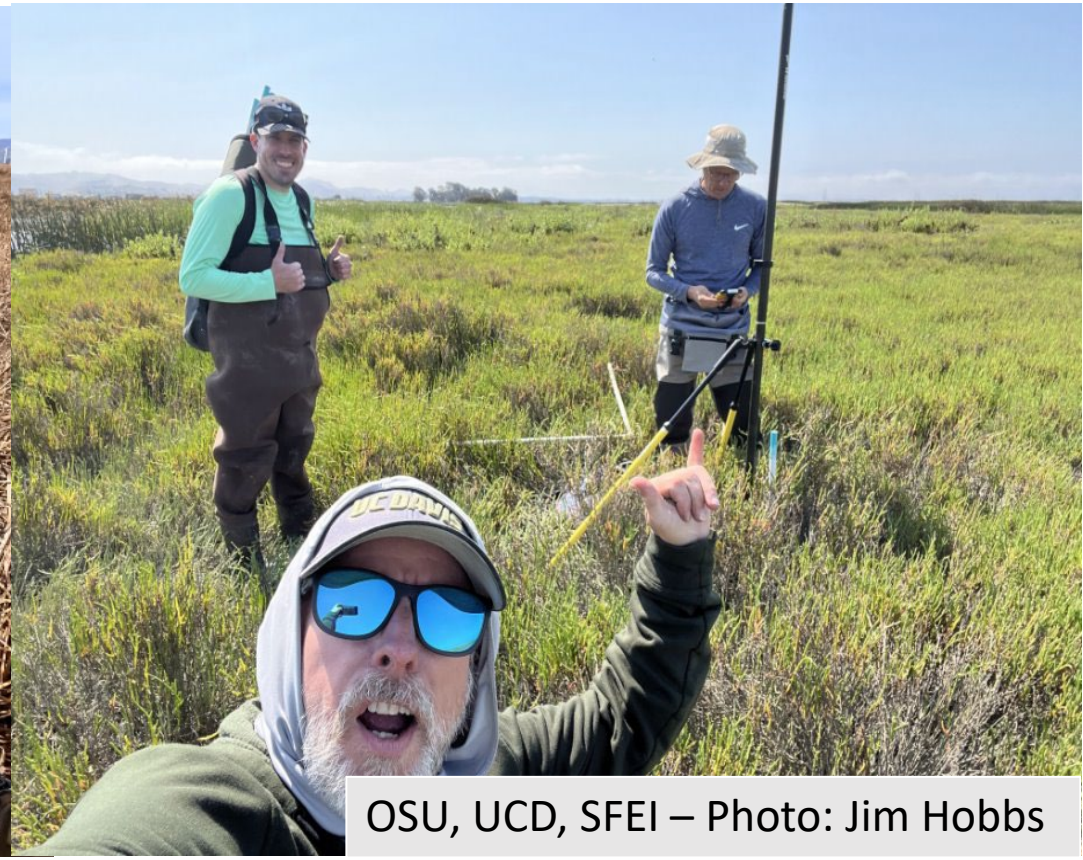


- How wetland management influence abundance and distribution of fish, and commercial/recreational fishery
- Started Spring 2025, ongoing quarterly
- 7 Operational Landscape Units monitored (6 Priority and 1 Secondary Network Site)
- Data on fish and invertebrate communities (abundance, structure) and water quality metrics (temp., salinity, oxygen)
- Findings Highlight: importance of wetlands as fish nurseries

Efficiency Through Collaboration



NERR Staff with OSU – Photo: Chris Janousek



OSU, UCD, SFEI – Photo: Jim Hobbs

Planned monitoring and analysis 2025 - 2029

FUNDERS AND PARTNERS

San Francisco
ESTUARY
PARTNERSHIP

SAN FRANCISCO BAY
RESTORATION AUTHORITY

US Army Corps
of Engineers ®

Delta
Stewardship
Council
A CALIFORNIA STATE AGENCY

UNIVERSITY OF
SAN FRANCISCO

NOAA
FISHERIES

Thank you!

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QUESTIONS?

EXTRA SLIDES

WRMP Guiding Questions

- *Guiding Question 1:* **Where are the region's tidal wetlands and wetland projects**, and what net landscape changes in area and condition are occurring?
- *Guiding Question 2:* How are external drivers **impacting tidal wetlands**?
- *Guiding Question 3:* How do policies, programs, and projects to protect and restore tidal marshes affect the distribution, abundance, and health of **plants and animals**?
- *Guiding Question 4:* **What new information do we need** to better understand regional lessons from tidal wetland restoration projects in the future?
- *Guiding Question 5:* How do policies, programs, and projects to protect and restore tidal wetlands **benefit and/or impact public health, safety, and recreation**?

WRMP Management Questions (summarized)

GQ 1: Where are the tidal wetlands and how are they changing?

MQ 1A: How are **marshes** changing over time?

MQ 1B: Are changes impacting **water quality**?

GQ 2: How are external factors impacting tidal wetlands?

MQ 2A: How are **elevations** changing over time?

MQ 2B: Is there enough **sediment** to support marshes?

GQ 3: How are plants and animals affected?

MQ 3A: How are **fish & wildlife habitats** changing?

MQ 3B: How are **fish & wildlife populations** changing?

GQ 4: What new information do we need?

MQ 4A: How can **interventions** help sustain or increase marsh ecosystem quantity & quality?

GQ 5: How are public health, safety, and recreation affected?

MQ 5A: What strategies influence how restoration affects **mosquito & disease vector populations**?

MQ 5B: What **data will help optimize** marsh restoration, mosquito & vector control, and fish & wildlife support?

WRMP Monitoring Questions & Indicators

(summarized by topic)

Flood risk reduction

Dominant vegetation communities

Overall wetland condition/health

Non-native, invasive plants

Maps of bayland habitats

Salinity, dissolved oxygen

Special-status species habitats

Wetland benefits to communities

Mercury in food webs

Bird, fish, and mammal "indicator" species

Channels and other unvegetated areas (e.g. ponds within marshes)

Sediment supply

Wetland elevations and elevation change

Tidal inundation of marshes

Mosquitoes and potential breeding areas

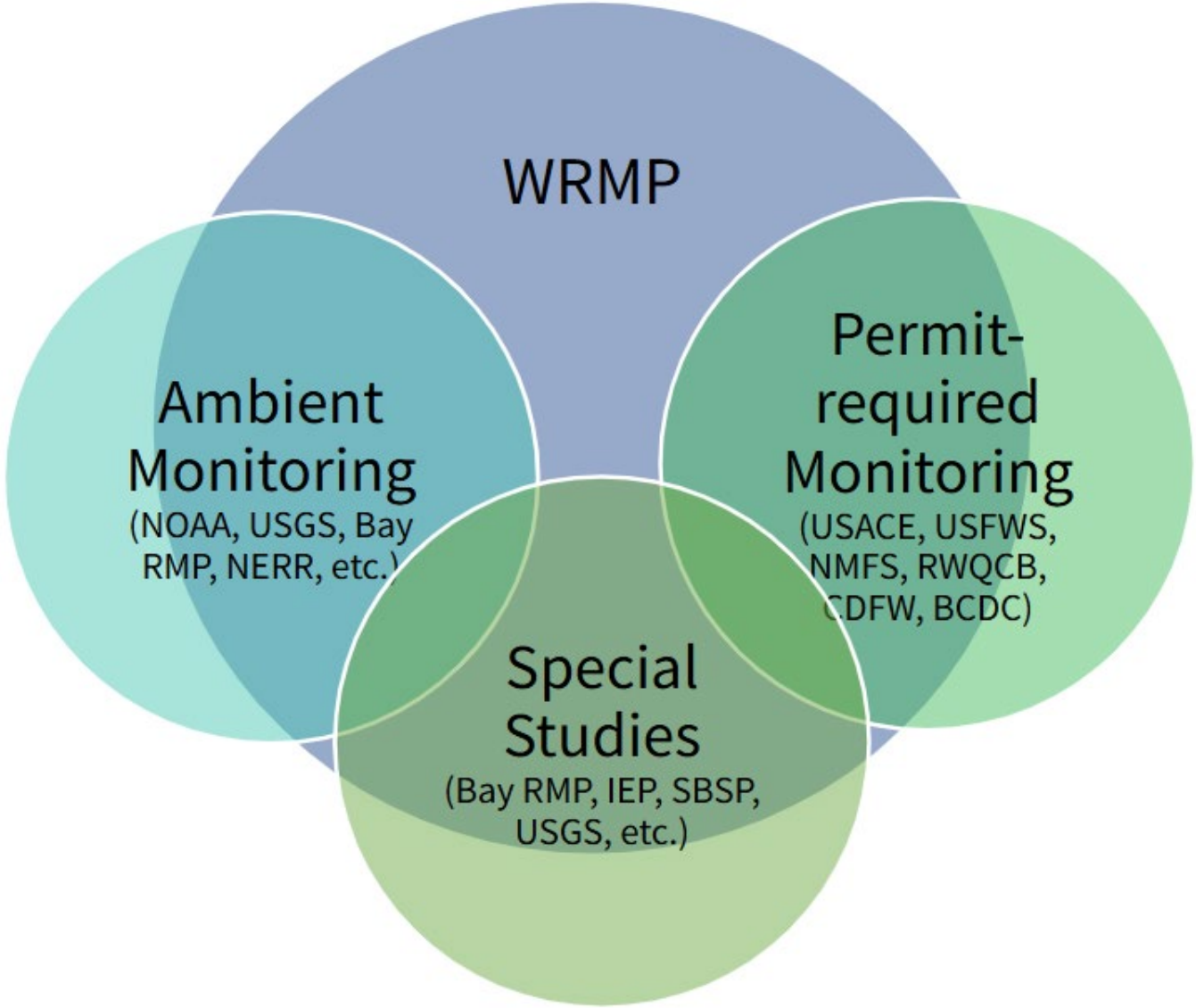
Anticipated WRMP Outcomes

- Build a regional picture of status and trends in tidal wetland distribution, abundance, and condition
- Help identify leading indicators of change to inform decision-making
- Support restoration projects through cost-effective monitoring
- Transform data into information for a broad audience

WRMP Program Plan: Science Priorities

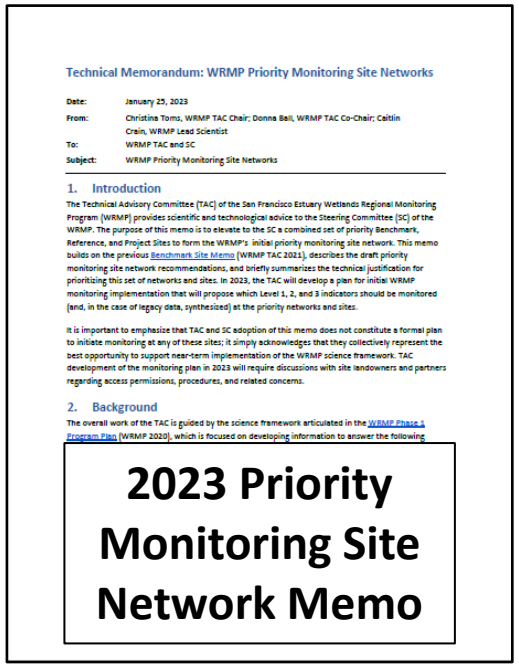
1. Regional baseline and subsequent routine surveys and inventories of the distribution, abundance, and condition of tidal wetlands
2. Repeated surveys of living organisms and their habitats (detect change)
3. Assess the relative roles of estuarine- and watershed-derived sediment to support wetland longevity
4. Assess the broad range of interactions between people and wetlands

WRMP Vision


WRMP
Ambient Monitoring
(NOAA, USGS, Bay RMP, NERR, etc.)
Permit-required Monitoring
(USACE, USFWS, NMFS, RWQCB, CDFW, BCDC)
Special Studies
(Bay RMP, IEP, SBSP, USGS, etc.)

Timeline

2020 Program Plan



Technical Memorandum: WRMP Priority Monitoring Site Networks

Date: January 25, 2023

From: Christina Toms, WRMP TAC Chair; Donna Ball, WRMP TAC Co-Chair; Caitlin Crain, WRMP Lead Scientist

To: WRMP TAC and SC

Subject: WRMP Priority Monitoring Site Networks

1. Introduction

The Technical Advisory Committee (TAC) of the San Francisco Estuary Wetlands Regional Monitoring Program (WRMP) provides scientific and technological advice to the Steering Committee (SC) of the WRMP. The purpose of this memo is to elevate to the SC a combined set of priority Benchmark, Reference, and Project Sites to form the WRMP's initial priority monitoring site network. This memo builds on the previous Benchmark Site Memo (WRMP TAC 2021), describes the draft priority monitoring site network recommendations, and briefly summarizes the technical justification for prioritizing this set of networks and sites. In 2023, the TAC will develop a plan for initial WRMP monitoring implementation that will propose which Level 1, 2, and 3 indicators should be monitored (and, in the case of legacy data, synthesized) at the priority networks and sites.

It is important to emphasize that TAC and SC adoption of this memo does not constitute a formal plan to initiate monitoring at any of these sites; it simply acknowledges that they collectively represent the best opportunity to support near-term implementation of the WRMP science framework. TAC development of the monitoring plan in 2023 will require discussions with site landowners and partners regarding access permissions, procedures, and related concerns.

2. Background

The overall work of the TAC is guided by the science framework articulated in the WRMP Phase 1 Program Plan (WRMP 2020), which is focused on developing information to answer the following

2023 Priority Monitoring Site Network Memo

WRMP SF ESTUARY Wetlands Regional Monitoring Program

2023 Monitoring Plan + SOPs

WRMP SF ESTUARY Wetlands Regional Monitoring Program

2024 Implementation Work Plan

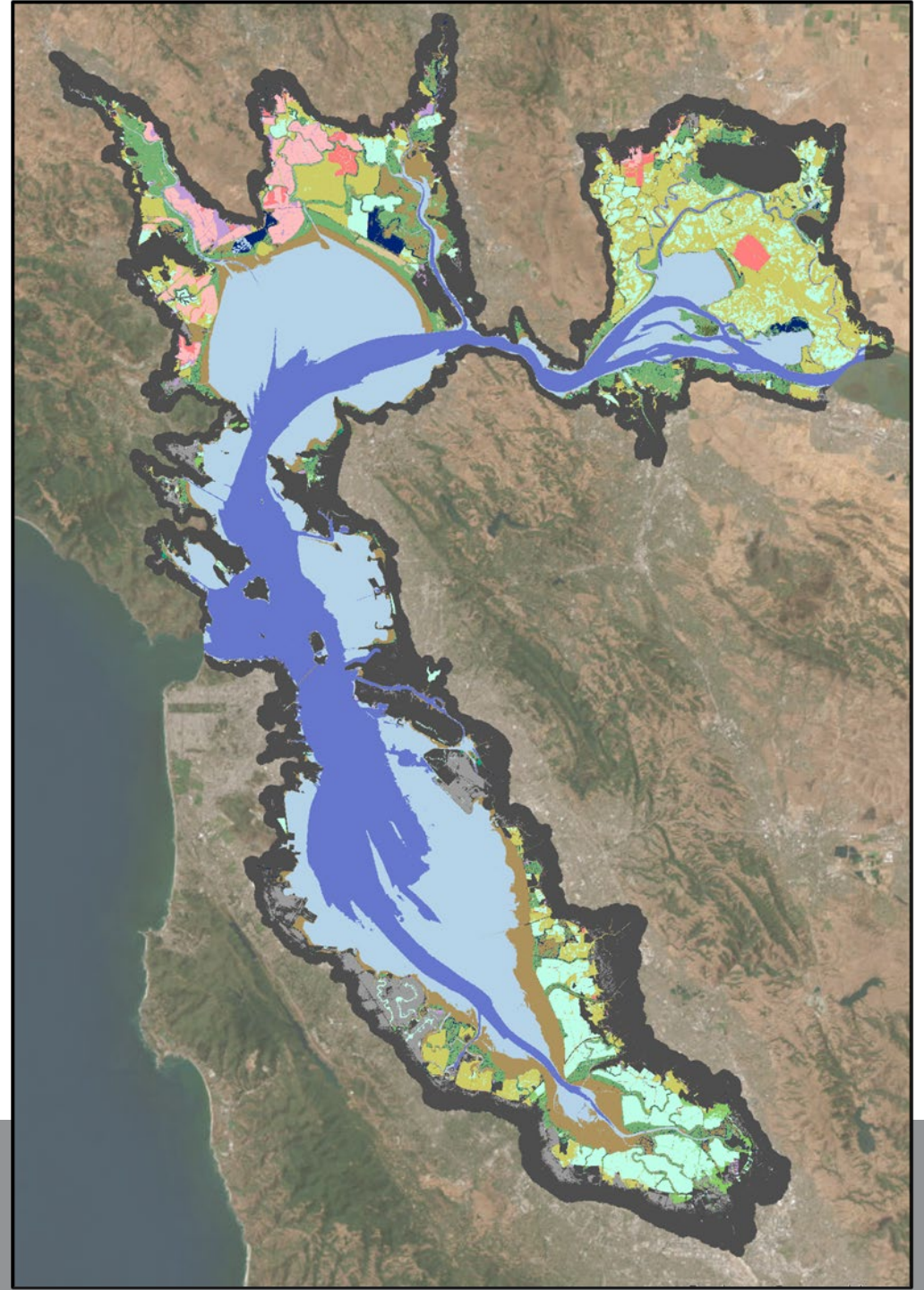
Monitoring Across Scales

- Level 1: Landscape Remote Sensing and Mapping
  - Baylands Habitat Map (BHM)
  - Project Tracker Tidal Wetland Restoration Map
  - Baylands Resilience Metrics
- Level 2: Rapid Field Assessment
  - California Rapid Assessment Method (CRAM)
- Level 3: Detailed Field Assessment
  - Status and trends in hydrology, water quality, elevations, morphology, vegetation, fish communities

Where are our tidal wetlands?

Baylands Habitat Map 2020 can be used to:

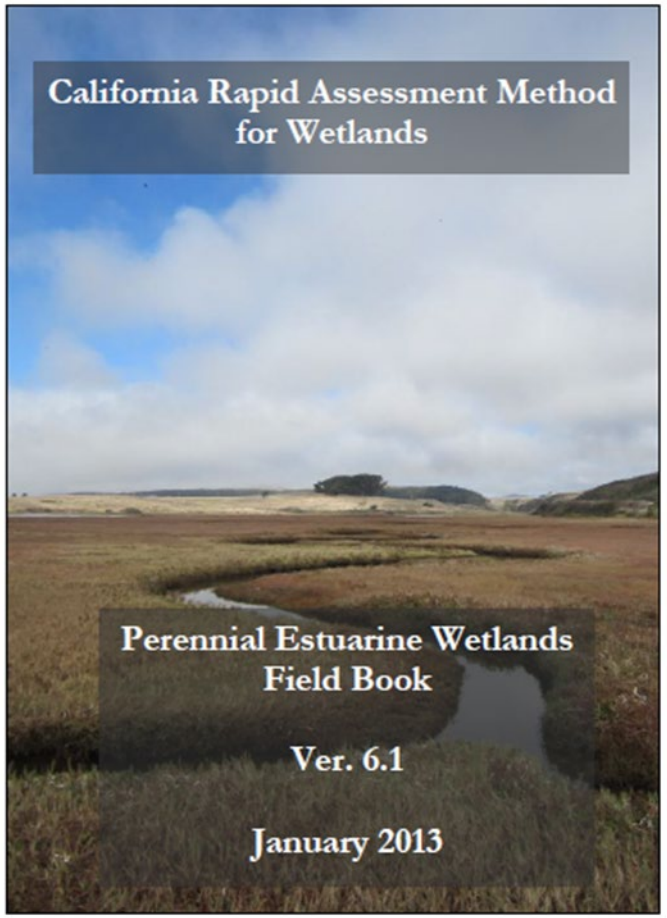
- quantify area of different habitat types and transition zones
- determine marsh patch size and connectivity
- determine percent vegetated cover
- quantify channel width and density



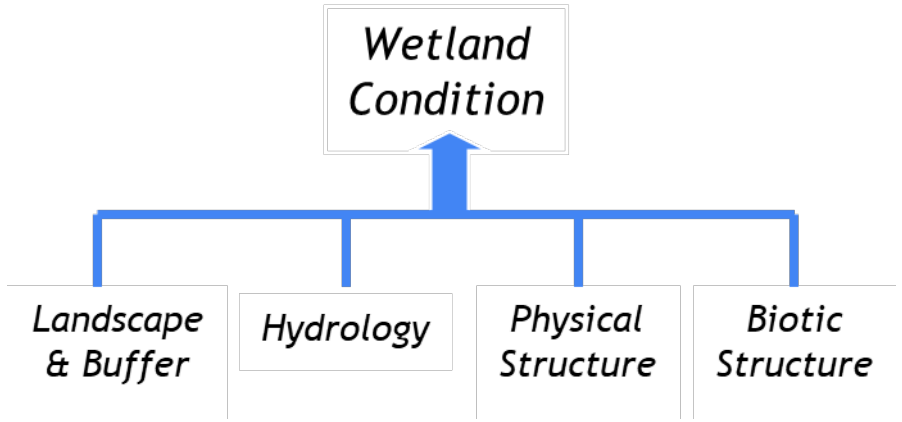
SF ESTUARY Wetlands Regional Monitoring Program

Network Name	Network Type	Site Name	Site Type	SET-MH	Vegetation/MH Transects	Photo-point monitoring	Piezometers	Transition Zone
Suisun	Primary	Hill Slough (Project)	Project		X	X		
Suisun	Primary	Hill Slough (Existing)	Reference		X	X	X	
Suisun	Primary	Rush Ranch	Benchmark	X	X		X	X
Suisun	Primary	Lower Joice Island	Reference candidate	X				
Montezuma	Secondary	Brown's Island	Benchmark	X				
Wildcat	Primary	Dotson Family Marsh, Restoration	Project	X	X	X		
Wildcat	Primary	Dotson Family Marsh, Existing (Giant marsh)	Reference	X	X	X	X	
Pinole	Secondary	Point Pinole (Whittell Marsh)	Benchmark		X		X	
Napa-Sonoma	Primary	Pond 2A	Project		X	X		
Napa-Sonoma	Primary	Bull Island	Reference		X	X	X	
Napa-Sonoma	Primary	Raccoon Island, centennial	Reference	X	X	X	X	
Napa-Sonoma	Primary	Raccoon Island, ancient	Benchmark	X	X		X	
Petaluma	Secondary	Sonoma Baylands	Project		X	X		
Novato-Gallinas	Primary	Outer McInnis	Reference		X	X	X	
Novato-Gallinas	Primary	China Camp	Benchmark	X	X		X	X
Petaluma	Secondary	Petaluma Marsh	Benchmark	X				
Petaluma	Secondary	San Pablo NWR strip marsh	N/A	X				
Alameda Creek	Primary	Mt. Eden Creek Marsh	Project		X	X		
Alameda Creek	Primary	Cargill Marsh	Reference		X	X	X	
Alameda Creek	Primary	Whale's Tail South	Benchmark		X		X	
Santa Clara Valley	Secondary	Pond R4	Project	X	X	X		
Santa Clara Valley	Primary	Coyote Triangle Marsh	Reference	X	X	X	X	
Santa Clara Valley	Primary	Laumeister	Benchmark	X	X		X	
Santa Clara Valley	Primary	Calaveras Point	Reference	X				
Santa Clara Valley	Primary	Pond A6 strip marsh	N/A	X				
Santa Clara Valley	Primary	Pond A5 strip marsh	N/A	X				
Mowry	N/A	Mowry Marsh	N/A	X				

How are our wetlands doing?

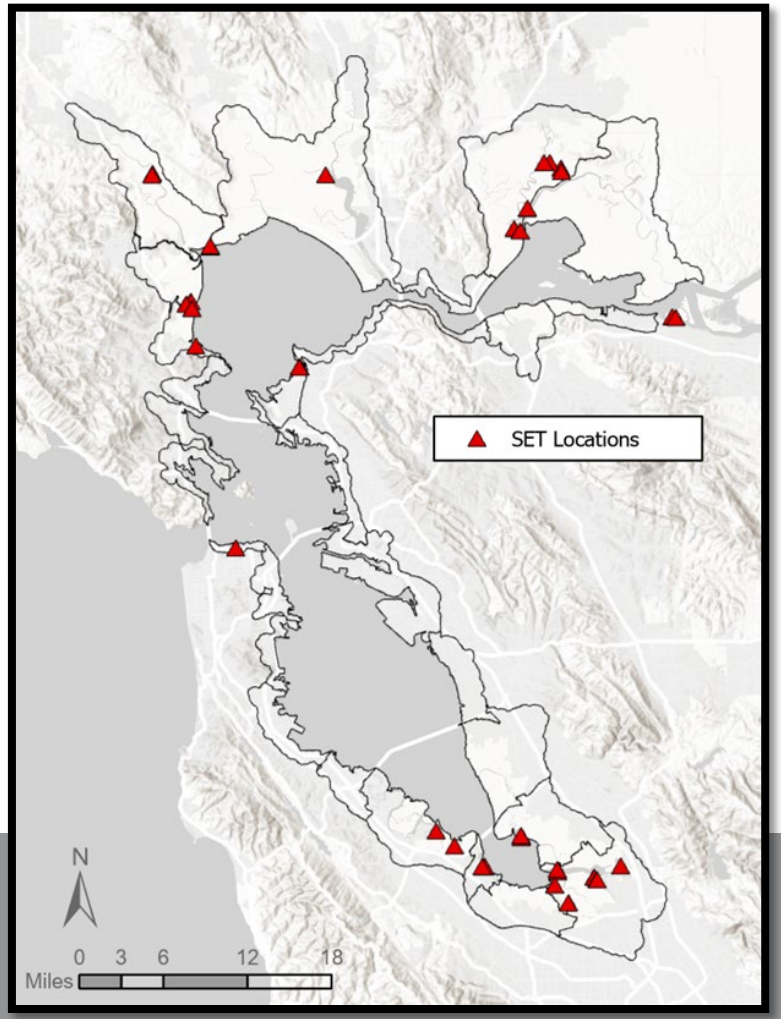


California Rapid Assessment Method (CRAM) - condition assessment



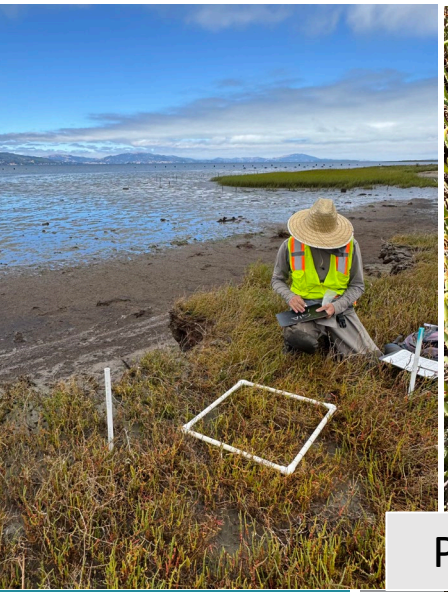
Are wetlands gaining elevation over time?

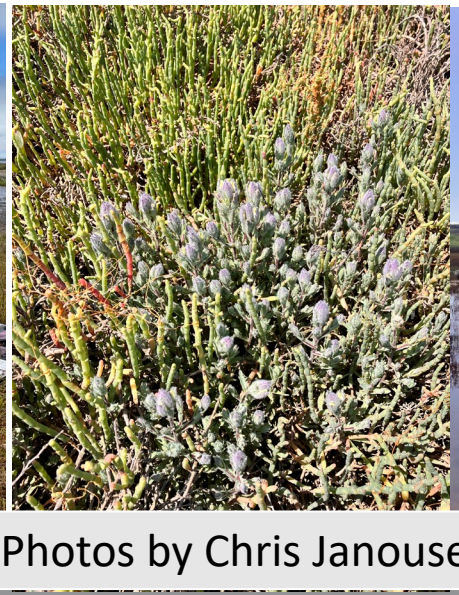
Regional network of Sediment Elevation Table- Marker Horizons (SETs)

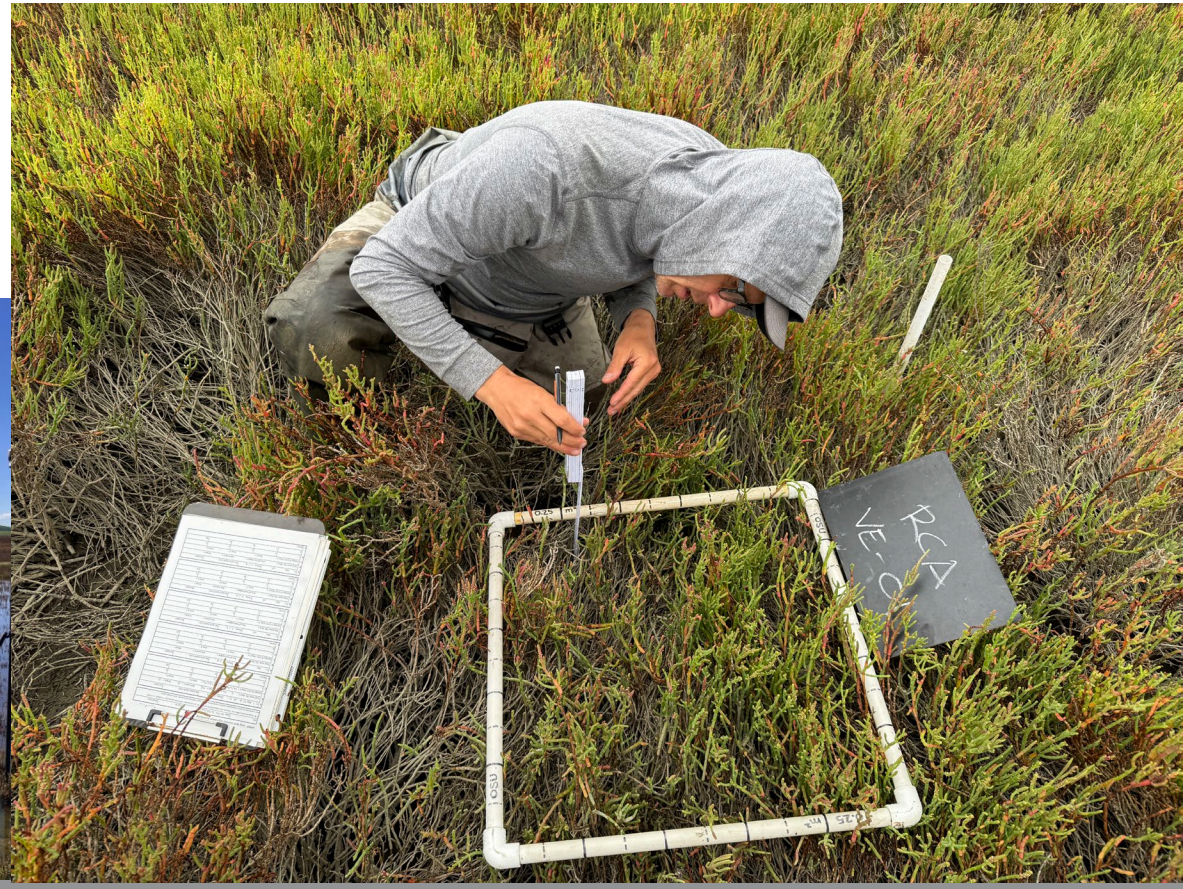


Vegetation Monitoring

- 18 sites have vegetation, elevation and marker horizon transects established
- 30 long term monitoring plots per site







Photos by Chris Janousek