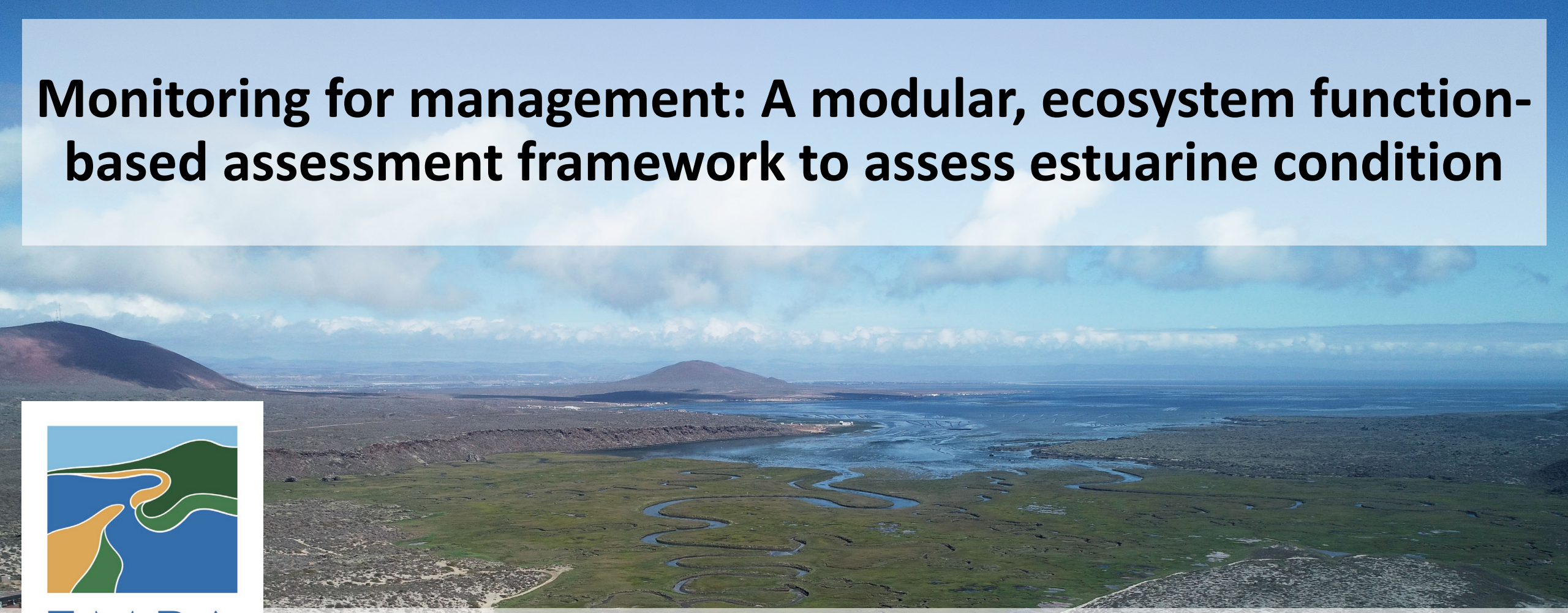
# Monitoring for management: A modular, ecosystem function-based assessment framework to assess estuarine condition



EMPA
Monitoring Program

**PMEP Effective Estuary Restoration Symposium**

May 6th 2025

J. Walker, E. Stein, K. O'Connor, R. Clark, C. Whitcraft, B. Hughes, J. Largier, D. Jacobs, and C. Toms

SCCWRP Established 1969

CCWG Central Coast Wetlands Group

Biological Sciences

Sonoma State University

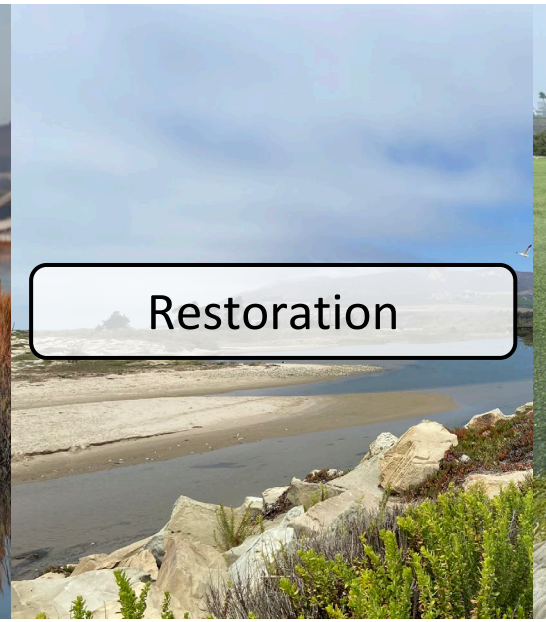
UC Davis Coastal and Marine Sciences Institute

UCLA

California Water Boards San Francisco Bay - R2

# Many Decisions Affect What Happens in Estuaries.





## Effective Management Requires Consistent Monitoring and Assessment

# Challenges to Large Scale Monitoring

- Comparison across heterogeneous environments
- Differing management needs
- Variety of monitoring programs
- Data storage and sharing


Batiquitos Lagoon


Big Sycamore Canyon

San Dieguito Lagoon

# The California Estuary Monitoring Program

EMPA
Monitoring Program

The California Estuarine Marine Protected Area (EMPA) Monitoring Program is an ongoing effort to assess the quality and condition of estuaries statewide.

***The program goals are to monitor California estuaries with a standard, comprehensive function-based assessment framework to determine the health of California's estuaries and the efficacy of MPA designation.***

Monitoring has been occurring since 2021

## Key Questions

How healthy are California's estuaries?

*Is health improving over time?*

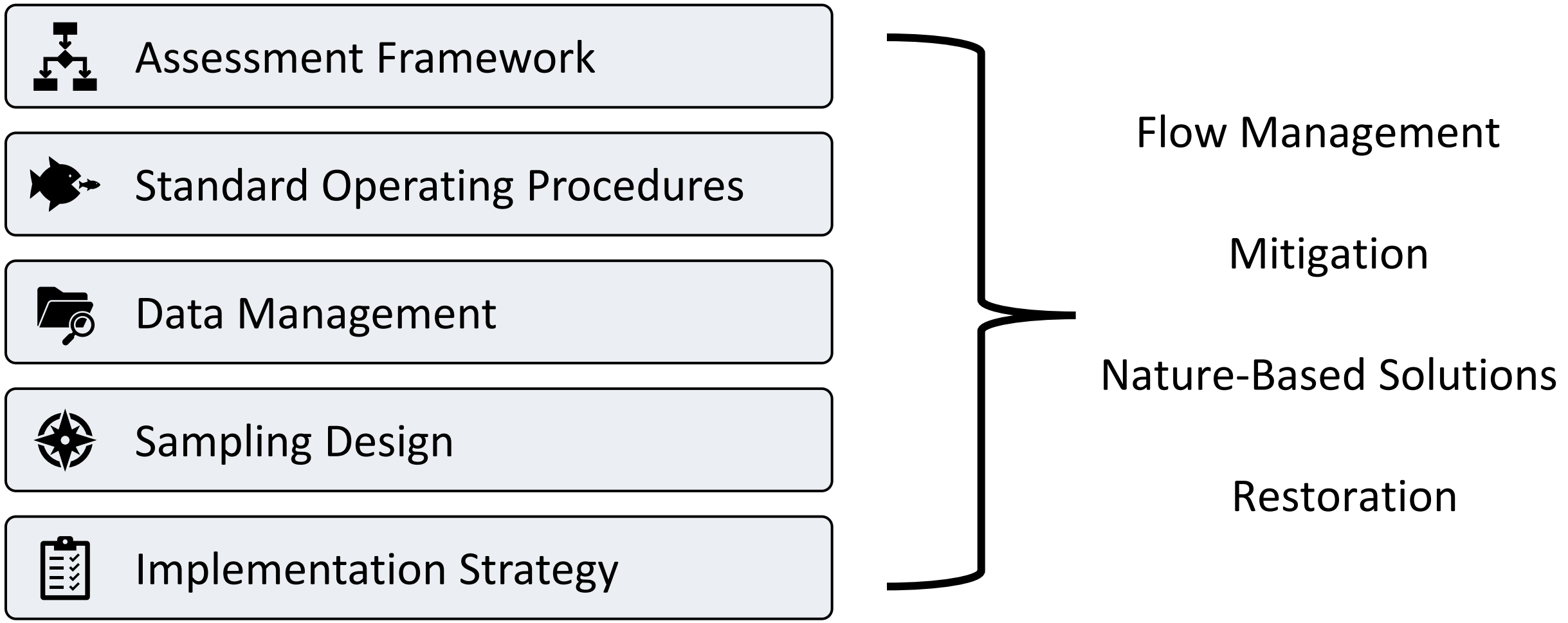
What are the key stressors impacting our estuaries?

*How resilient are estuaries over time?*

How effective are our management actions?

*Restoration, mitigation, regulatory protection?*

# The Estuary Monitoring Program Consists of Several Elements that Together Can Address Key Management Issues.



# Assessment Framework

1. **Function-based assessment** to determine the health of California's estuaries.
2. **Modular, flexible, and adaptable** to accommodate different programmatic needs and heterogenous landscapes.
3. **Comprehensive set of SOPs and QA measures to** bridge the gap between data collection and utility for management
4. **Integrated, user-friendly data management system** to increase transparency, accessibility, and quality control in data collection, upload, and publication.

# Function-based Assessment

***The underlying principle is that all estuaries should provide a variety of ecological functions at some ideal rate in the absence of anthropogenic disturbance and alteration.***

| | |
|---|---|
| Primary Production | Bird Habitat Provision |
| Secondary Production | Shellfish Support |
| Nutrient Cycling | Support of Vascular Plants |
| Nekton Habitat Provision | SLR Amelioration |
| Nursery Habitat Provision | |

# Adaptable to a Variety of System Types and Management Needs

- **Modular**: Programs or agencies can prioritize functions for inclusion based on program needs and estuary type.
- **Flexible:** Multiple indicators can be used to assess a given ecological function.
- **Adaptable:** Functions can be added over time.

| Estuary | | Indicators | | |
|---|---|---|---|---|
| | | Water quality | Sediment nutrient concentration | General community composition (eDNA) |
| Functions | Nekton Habitat | ■ | | ■ |
| | Primary Production | ■ | ■ | |
| | Secondary Production | ■ | ■ | ■ |

Green squares represent the indicators that can be used to evaluate function

| Estuaries | | Indicators | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Water quality (DO, temp, salinity, Chl a, etc.) | Sediment nutrient concentration (TOC/TN) | General community composition (eDNA) | Sediment characteristics (grainsize) | Benthic infauna community (small and large) | SAV distribution | Fish community | Mobile Invertebrate community | Marsh plain vegetation community | Marshplain elevation and inundation | Sediment accretion | Macroalgae distribution | General habitat condition (CRAM) | Level 1 |
| Ecosystem Functions | Primary Production | ■ | ■ | | | | ■ | | | ■ | | | ■ | | |
| | Secondary Production | ■ | ■ | ■ | | ■ | ■ | | | ■ | | | | | ■ |
| | Nutrient Cycling | ■ | ■ | | ■ | ■ | ■ | | | ■ | | ■ | ■ | | |
| | Nekton Habitat Provision | ■ | | ■ | | ■ | ■ | ■ | ■ | | | | ■ | ■ | ■ |
| | Nursery Habitat Provision | ■ | | | | ■ | ■ | ■ | ■ | ■ | ■ | | | | ■ |
| | Bird Habitat Provision | | | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | | ■ | ■ | ■ |
| | Shellfish Support | ■ | | ■ | ■ | ■ | ■ | | | | | | ■ | | |
| | Support Vascular Plants | | | | | | | | | ■ | ■ | ■ | | ■ | ■ |
| | SLR Amelioration | | | | | | | | | ■ | ■ | ■ | | ■ | ■ |

# Standard Operating Procedures

| SOP | Indicator | Collection Method |
|---|---|---|
| 1/2 | Water quality: PH, temperature, DO, salinity<br>Water Elevation | Continuous data sensors<br>YSI |
| 3 | Sediment nutrient concentration | Sediment cores – TOC/TN |
| 4 | General community composition (eDNA) | Water grabs - eDNA<br>Sediment grabs |
| 5 | Sediment characteristics | Sediment cores - grainsize |
| 6 | Benthic infauna community (small and large) | Sediment cores |
| 7 | SAV and Macroalgae surveys | Transects |
| 8/9 | Fish community | BRUVs<br>Fish seines |
| 10 | Mobile invertebrate community | Traps |
| 11 | Marshplain vegetation community | Transects |
| 12 | Topographic complexity | RTK surveys |
| 13 | Sediment accretion | Feldspar plots |
| 14 | General habitat condition | CRAM |

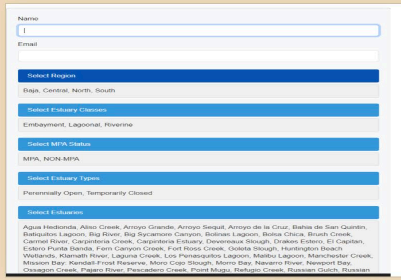
Red = proposed core set of indicators

# Integrated Data Management System


https://empa.sccwrp.org

## Data Download

Use the *Advanced Data Retrieval Tool* to filter and download data

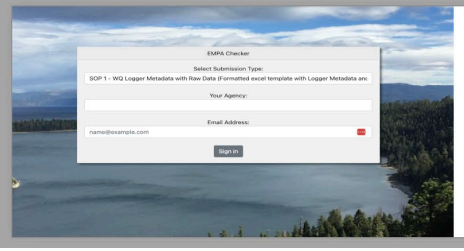


### Advanced Data Retrieval

Filter your data download with the EMPA Advanced Data Retrieval Tool. According to SCCWRP's data protocol, this tool is undergoing a QAQC process and is therefore password-protected. If you need access to this tool, please email Jan Walker at janw@sccwrp.org. When the process is complete, this tool will be released to the public.

View Data Retrieval Tool

## Data Submission



### Data Submission Checker

Check your data with the Data Submission Checker tool to ensure that your filled-out template file matches out database structure.

View Checker Tool

# Example: Vascular Plant Support Function

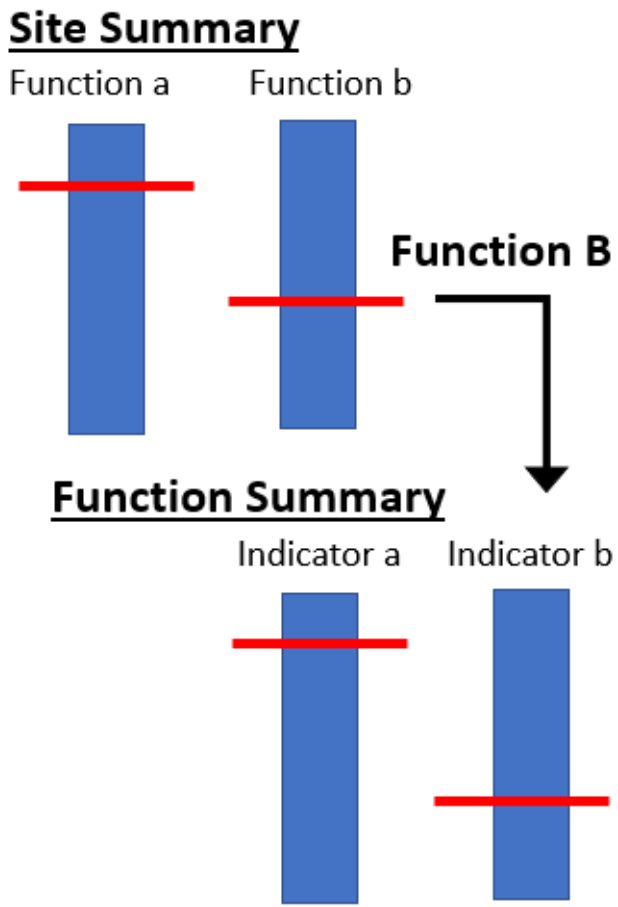
Condition Statement*: Support of a diversity of emergent fresh and salt tolerant plant species distributed throughout the system based on the geographic and temporal variability in water depth, sediment composition, marsh elevation, salinity gradient, and submergent conditions.*

A high performing estuary has…

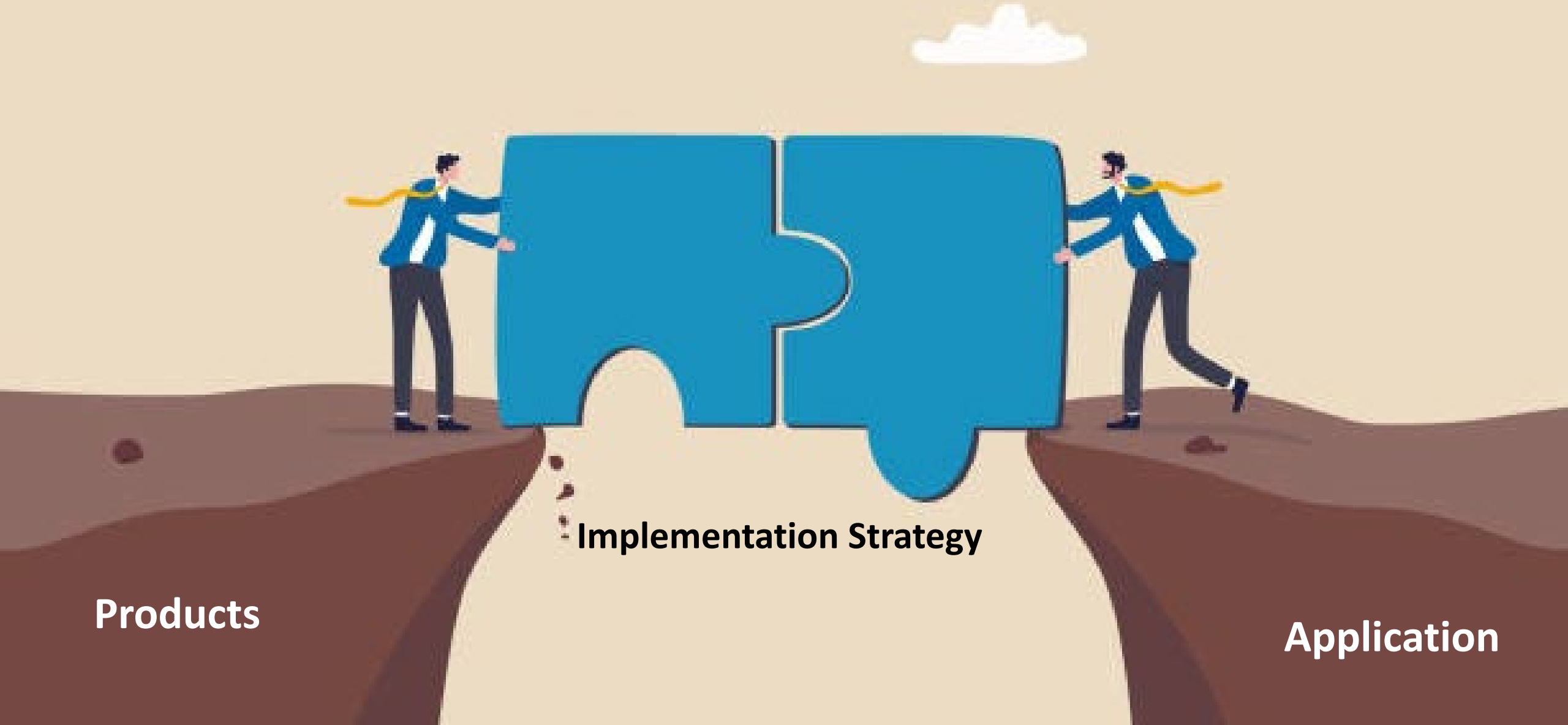
1. High California Rapid Assessment Method (CRAM) scores (Index, Physical, and Biotic attributes)
2. High percentage of native plant species relative to total cover
3. High vegetation cover in upper marsh elevation habitats (mid and high marsh)
4. Large range of elevations within the estuary available on the DEM (landscape-scale rugosity)
5. High correlation between extent of inundation and proportion of different topographic surfaces
6. High number of habitat assemblage types along vegetation transects
7. Sediment supply to the marsh plain supports vascular plants

| Site Name | General habitat condition | Marsh vegetation distribution & diversity | | Marsh plain elevation | | Sediment accretion rates | SAV/ macroalgae distribution | Final Score |
|---|---|---|---|---|---|---|---|---|
| | *High CRAM Index, physical, and biotic attribute scores* | *Native plant cover* | *Vegetation Cover* | *Varied marsh plain topography* | *Appropriate amount of inundation* | *Sediment supply* | *Low presence of floating algae* | |
| Ten Mile River | 3.00 | 3.00 | NA | 3.00 | NA | NA | 3.00 | 3.00 |
| Big River | 3.00 | 3.00 | 1.50 | 3.00 | NA | NA | 3.00 | 2.70 |
| Navarro River | 3.00 | 3.00 | 1.33 | 3.00 | NA | NA | NA | 2.58 |
| Drakes Estero | 3.00 | 3.00 | 1.67 | 3.00 | NA | NA | NA | 2.67 |
| Bolinas Lagoon | 3.00 | 3.00 | 1.67 | 2.00 | NA | NA | 3.00 | 2.53 |
| Pajaro River | 1.33 | 1.67 | 2.00 | 2.00 | NA | NA | 3.00 | 2.00 |
| Moro Cojo Slough | 1.33 | 2.67 | 2.00 | 1.00 | NA | NA | 3.00 | 2.00 |

# Example Output




# How Do We Realize Our Vision?



Implementation Strategy

Products

Application

# Implementation Through Partnerships

Incorporate assessment protocols into regional and local programs (CRMB, Bight)

Use indicators and protocols in mitigation monitoring requirements and performance standards for permit and grant-funded restoration (SCC and CCC)

Develop and implement a sentinel site/reference site monitoring (WRP RMP)

Incorporate data into the estuary data portal (NERR, NEP)

The **Estuary Monitoring Program** was designed and implemented alongside many partners and agencies.

## State

EMPA
Monitoring Program

Coastal Conservancy

OCEAN PROTECTION COUNCIL

## Region

SOUTHERN CALIFORNIA WETLANDS RECOVERY PROJECT

SOUTHERN CALIFORNIA BIGHT REGIONAL MONITORING PROGRAM 2023

CALIFORNIA Water Boards

## Local

los cerritos wetlands

Batiquitos Lagoon Foundation

UCLA

Biological Sciences

# Questions

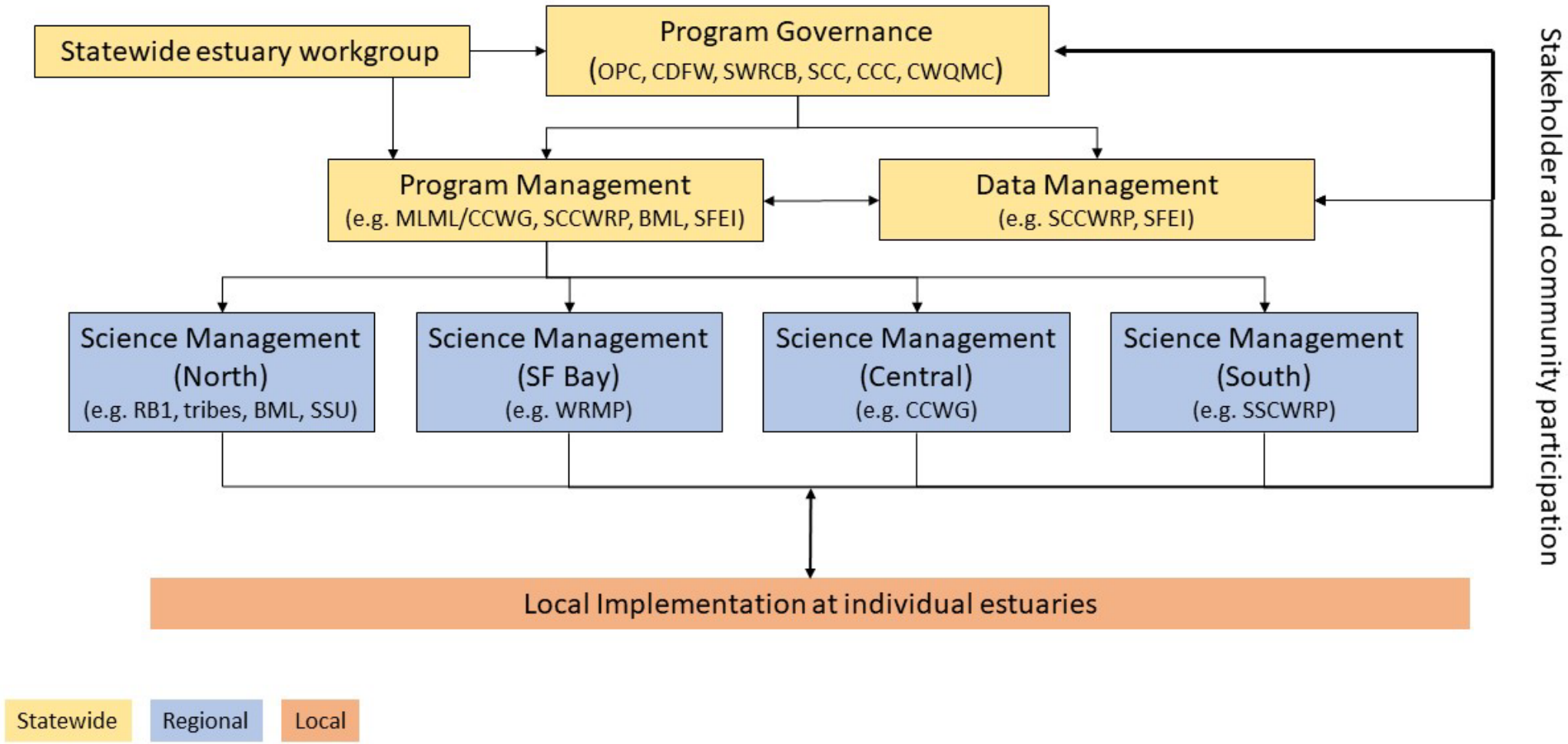
EMPA.SCCWRP.ORG

Kevin O’Connor– kevin.oconnor@sjsu.edu

CCWG
Central Coast Wetlands Group

# EXTRA SLIDES

# Our vision for statewide implementation is via state-regional-local partnerships.



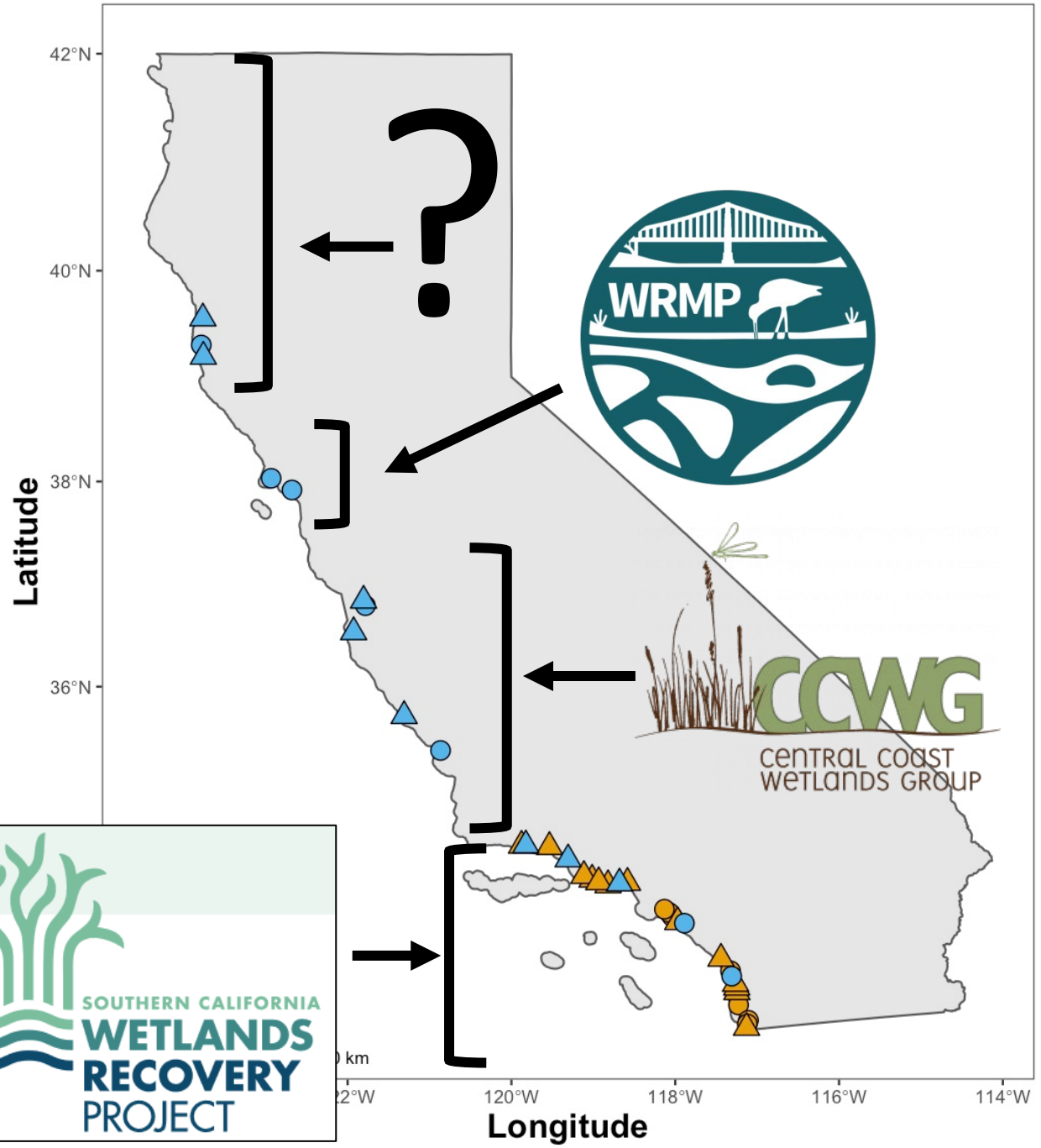
# Our vision for implementation is via state-regional-local partnerships.

1. State coordination via the California Estuary Monitoring Workgroup

2. Program management via a single entity (e.g., SCCWRP, SFEI, CCWG)

3. Regional science management and monitoring

4. Local implementation via project-based monitoring

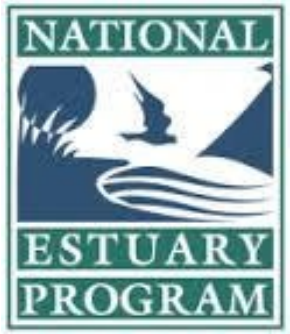


4. **Bridge the gap** between data collection and **utility for management** utilizing strong QA measures and strict adherence to SOP implementation









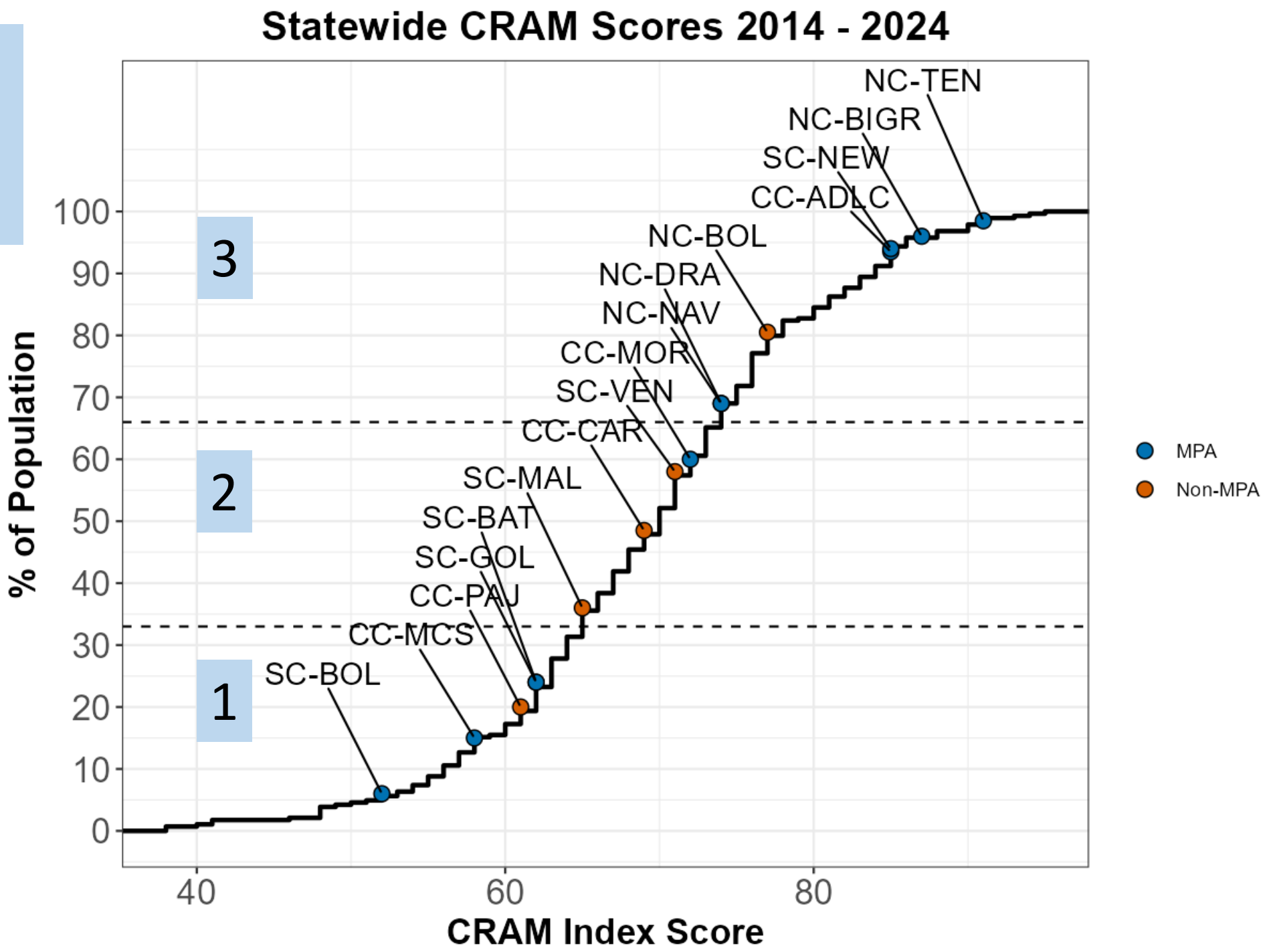






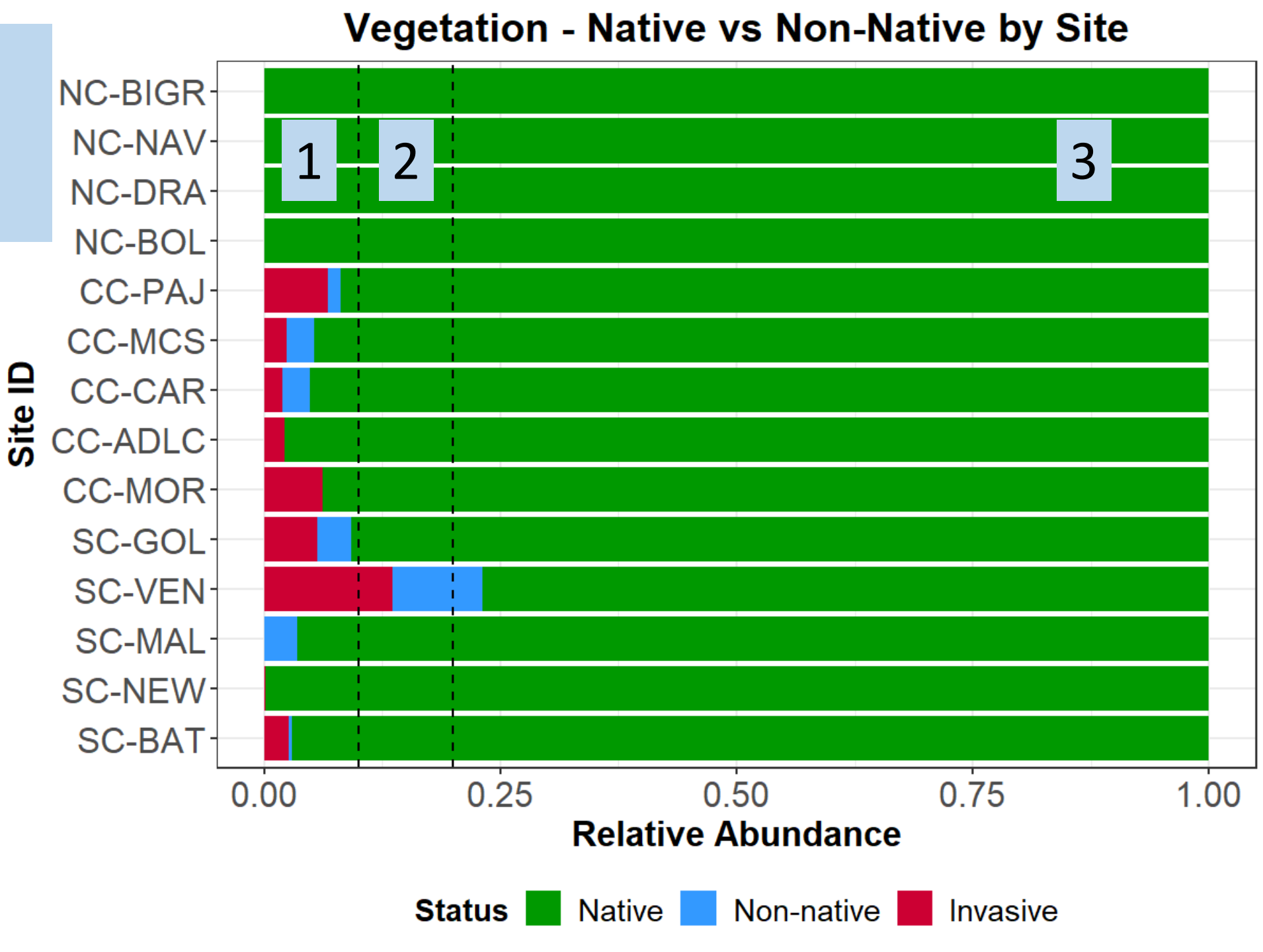

# A high performing estuary has…

1. High California Rapid Assessment Method (CRAM) scores (Index, Physical, and Biotic attributes)



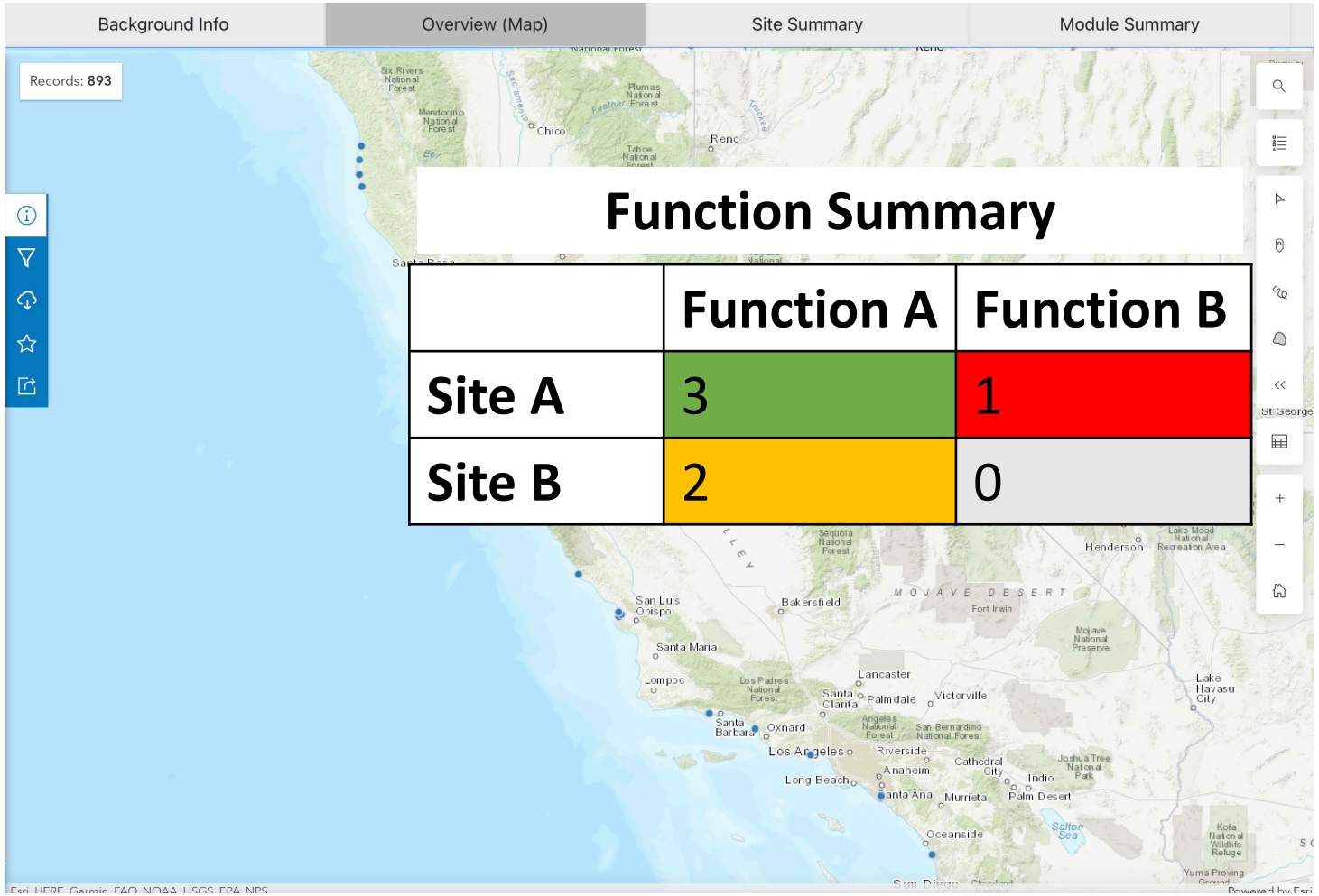
A high performing estuary has…

2. High percentage of native plant species relative to total cover



| Site Name | General habitat condition | Marsh vegetation distribution & diversity | | Marsh plain elevation | | Sediment accretion rates | SAV/ macroalgae distribution | Final Score |
|---|---|---|---|---|---|---|---|---|
| | *High CRAM Index, physical, and biotic attribute scores* | *Native plant cover* | *Vegetation Cover* | *Varied marsh plain topography* | *Appropriate amount of inundation* | *Sediment supply* | *Low presence of floating algae* | |
| Ten Mile River | 3.00 | 3.00 | NA | 3.00 | NA | NA | 3.00 | 3.00 |
| Big River | 3.00 | 3.00 | 1.50 | 3.00 | NA | NA | 3.00 | 2.70 |
| Navarro River | 3.00 | 3.00 | 1.33 | 3.00 | NA | NA | NA | 2.58 |
| Drakes Estero | 3.00 | 3.00 | 1.67 | 3.00 | NA | NA | NA | 2.67 |
| Bolinas Lagoon | 3.00 | 3.00 | 1.67 | 2.00 | NA | NA | 3.00 | 2.53 |
| Pajaro River | 1.33 | 1.67 | 2.00 | 2.00 | NA | NA | 3.00 | 2.00 |
| Moro Cojo Slough | 1.33 | 2.67 | 2.00 | 1.00 | NA | NA | 3.00 | 2.00 |
| Carmel River | 2.67 | 2.67 | 3.00 | 3.00 | NA | NA | 3.00 | 2.87 |
| Arroyo de la Cruz | 2.67 | 2.67 | 2.33 | 2.00 | NA | NA | NA | 2.42 |
| Morro Bay | 2.67 | 2.33 | 2.00 | 2.00 | NA | NA | 3.00 | 2.40 |
| Goleta Slough | 2.00 | 2.00 | 1.67 | 2.00 | NA | NA | 3.00 | 2.13 |
| Ventura River | 2.67 | 1.67 | 2.17 | 2.00 | NA | NA | 3.00 | 2.30 |
| Malibu Lagoon | 2.00 | 3.00 | 2.33 | 2.00 | NA | NA | 2.00 | 2.27 |
| Newport Bay | 3.00 | 2.67 | 2.33 | 3.00 | NA | NA | 3.00 | 2.80 |
| Batiquitos Lagoon | 1.67 | 2.67 | 1.33 | 2.00 | NA | NA | 3.00 | 2.13 |

# **Coming 2025:** Development of a coastal wetland (L3) functional assessment dashboard and toolkit to support project prioritization and evaluation [EPA WPDG]




## Site Summary

Function a

Function b

Function B

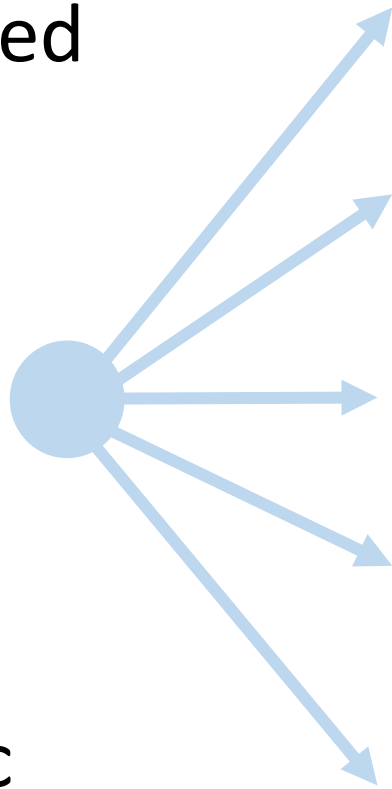
## Function Summary

Indicator a

Indicator b

# An ecosystem function framework will help move us forward in collecting estuary long-term monitoring data.

1. **Flexible:** Modular, function-based approach
2. **Comparable:** Synthesize across geographic areas
3. **Interpretable:** Comprehensive and consistent sampling
4. **Practical:** Feasible sampling campaign, Management centric



- Baseline conditions
- Bioassessment tools
- Trend analysis
- Evaluate restorations
- Answer management questions

- Commitment to long-term monitoring
- Ensuring support for training and enhancement of protocols
- Exploring new partnerships to enhance data collection
- Enhancing outreach and communication