

Integrating Remote Sensing Into Regional Tidal Wetland Monitoring

Environmental Law Institute

05/15/2023

SF ESTUARY
Wetlands
Regional
Monitoring
Program



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WRMP Technical Advisory Committee Chair
San Francisco Bay Regional Water Quality Control Board

Today's Presentation

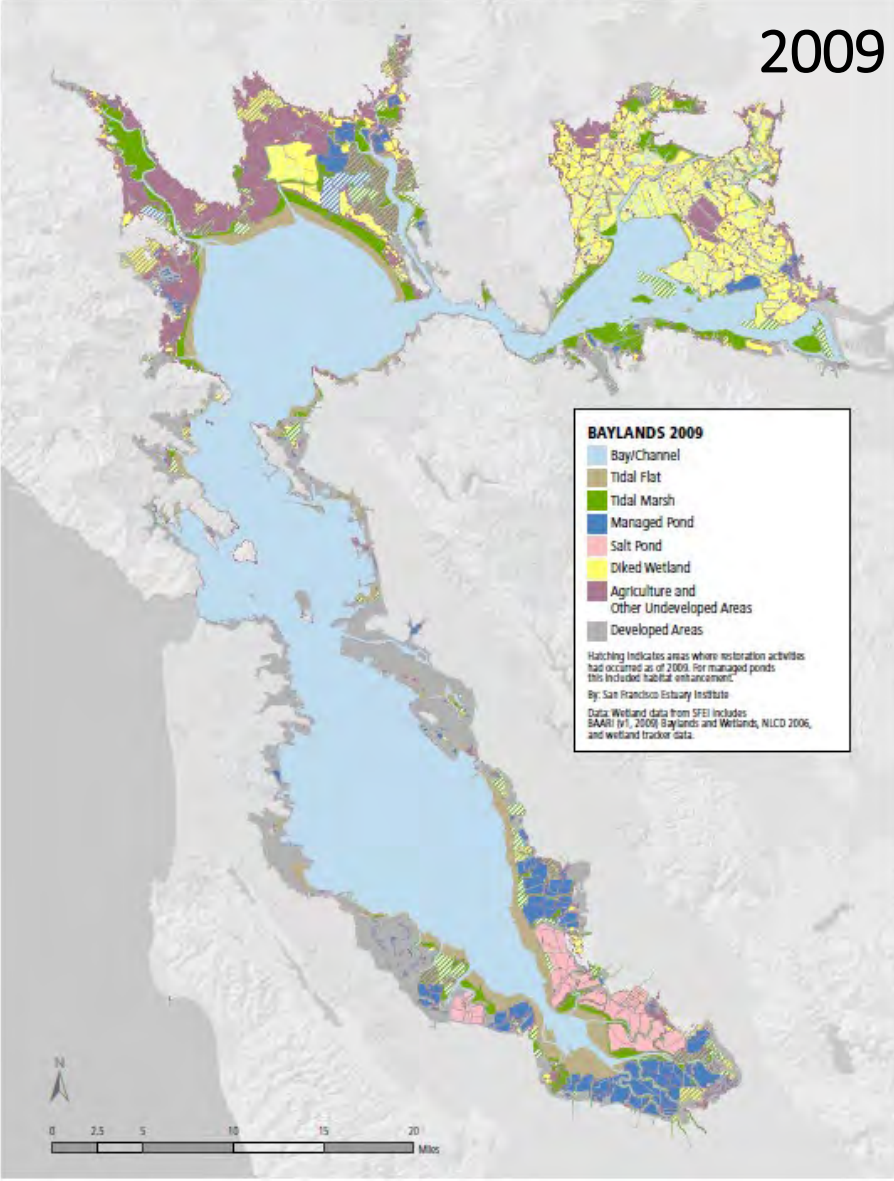
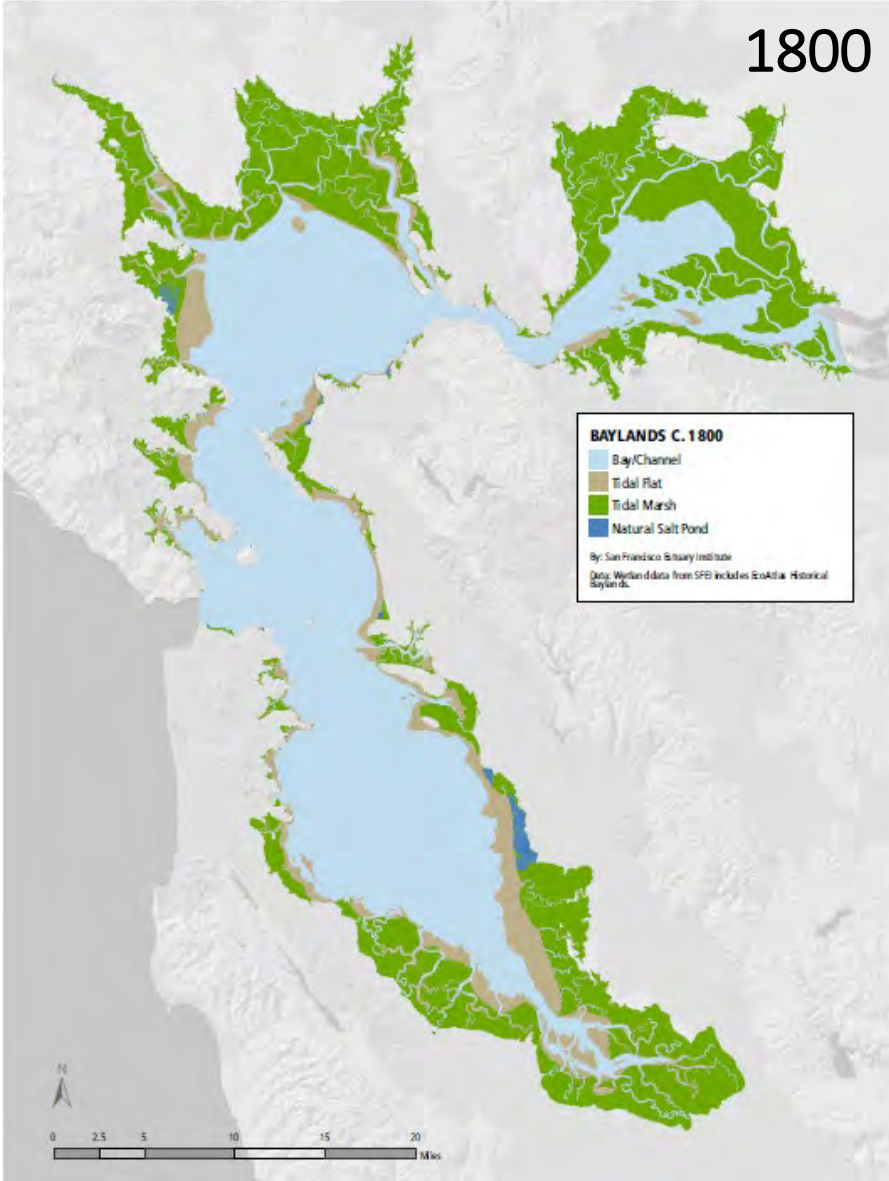
- Introduction to the WRMP
- Science framework and priorities
- How remote sensing helps answer key management questions

Photo: Mike Vasey

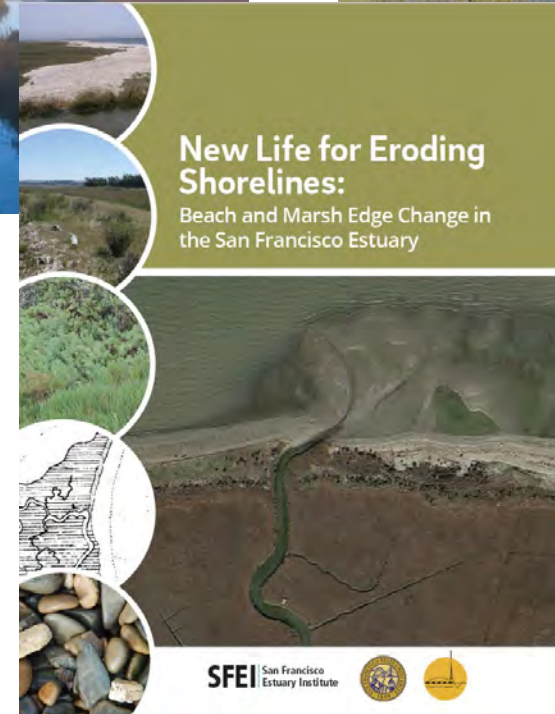
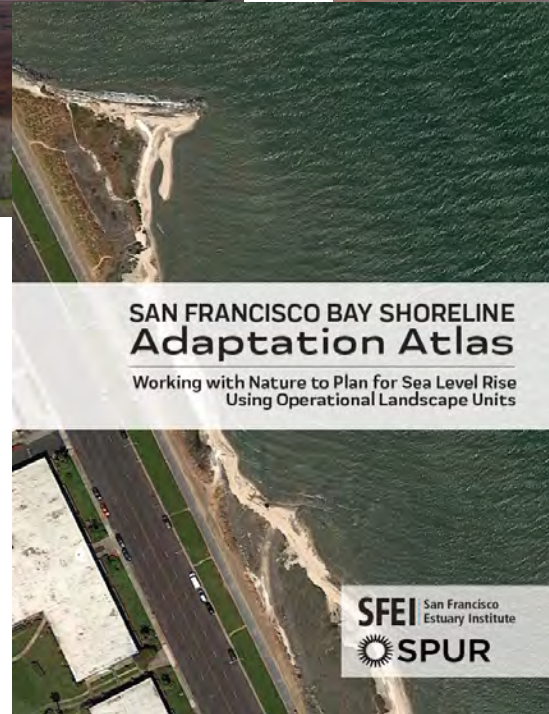
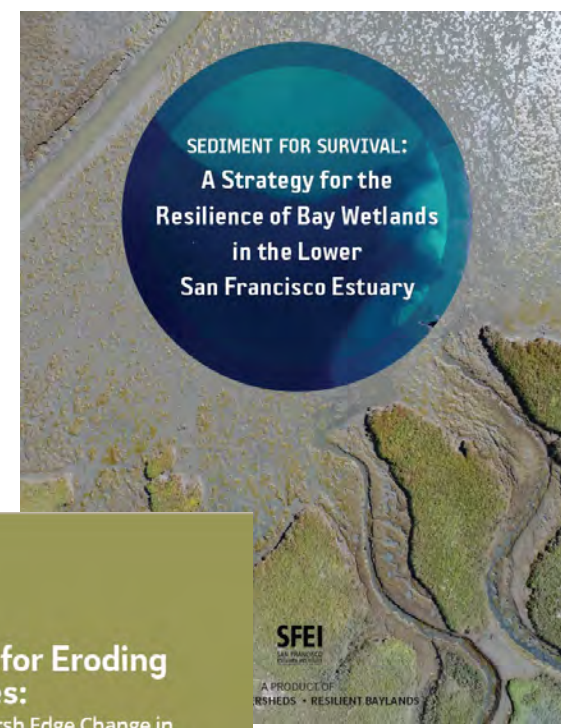
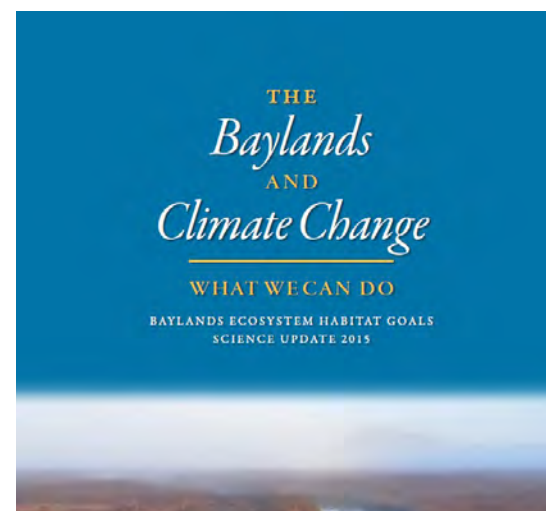
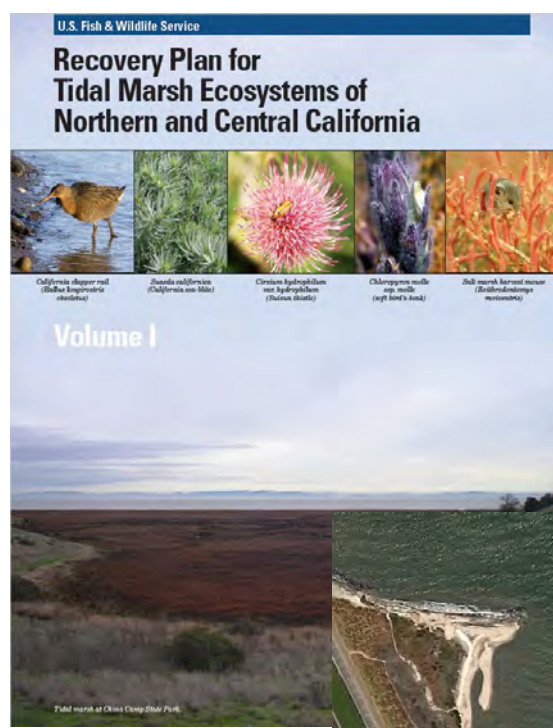
Introduction to the WRMP



Habitat Loss in Lower SF Estuary



Regional Habitat Recovery Strategies



Regional Investment in Habitat Restoration



Featured Restoration Projects



Montezuma Tidal and Seasonal Wetlands Restoration Project

Montezuma Wetlands LLC



Deer Island Basin Phase I Tidal Wetlands Restoration Project

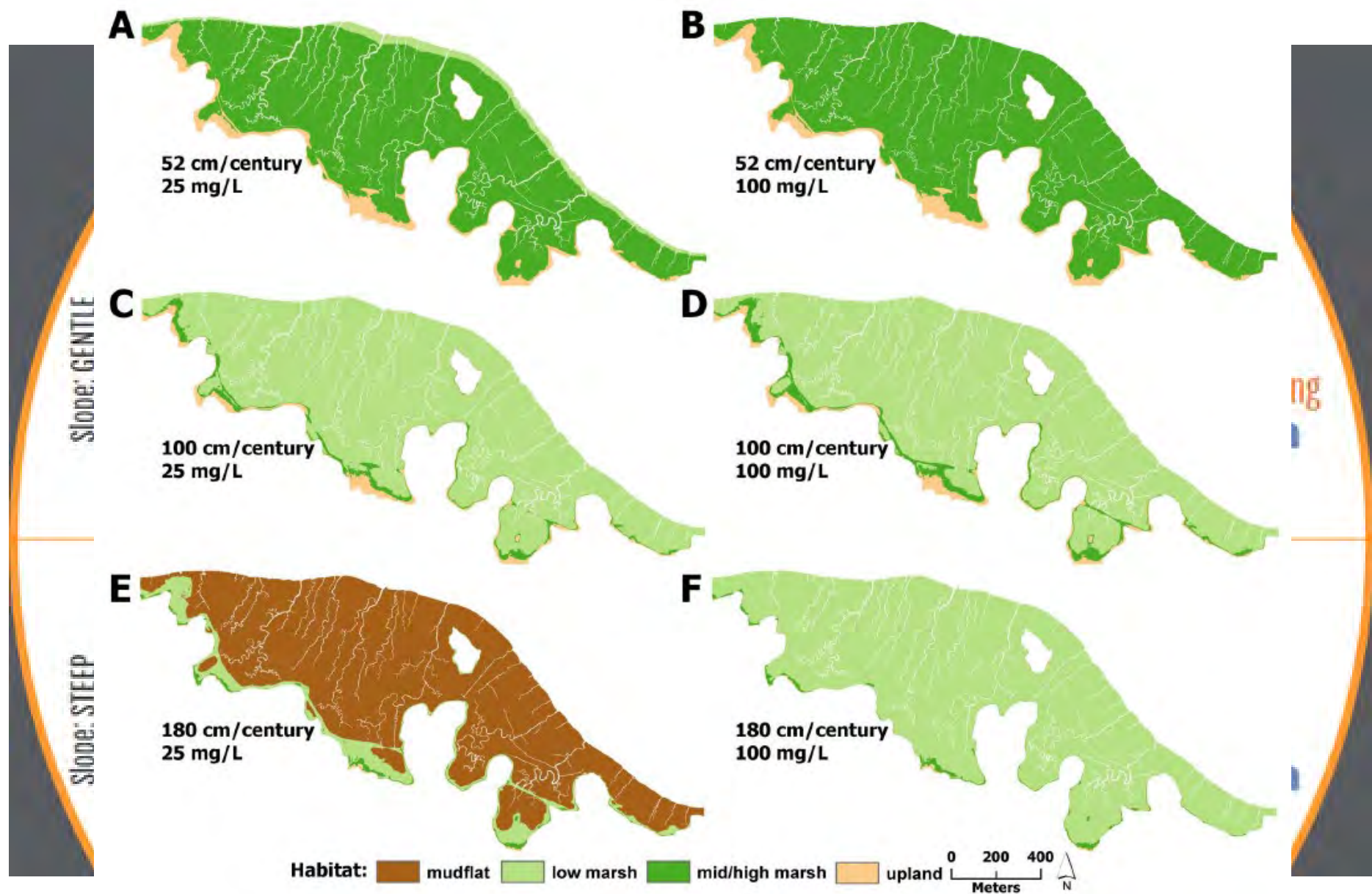
Marin County Flood Control District



South Bay Salt Ponds Restoration Project

Ducks Unlimited, Inc. & California Wildlife Foundation

Regional Need to Address Climate Change



Regional Tidal Wetland Monitoring



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Steering Committee

Logos for Steering Committee members: Ducks Unlimited, USGS, Coastal Conservancy, Save Bay, East Bay Regional Park District, National Marine Fisheries Service, and bcdc.



Technical Advisory Committee

Logos for Technical Advisory Committee members: UC Davis, Valley Water, SFSU, bcdc, Berkeley, SFEI, National Marine Fisheries Service, and USGS.

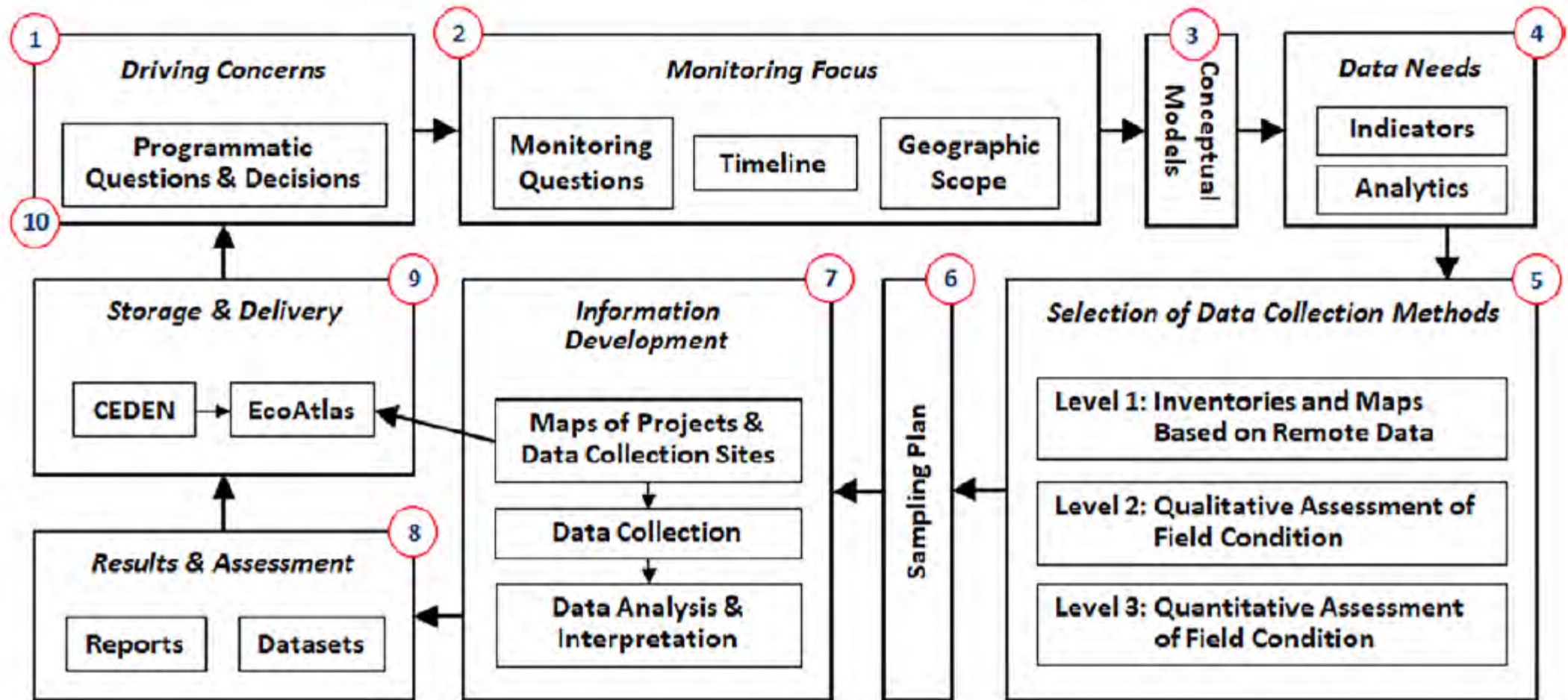
Overall WRMP Goals

- Assess the influence of landscape-scale drivers such as climate change and watershed management on tidal wetlands across multiple spatial and temporal scales
- Develop a consistent approach for implementing and contextualizing the monitoring for tidal wetland restoration projects that is typically required by regulatory agencies
- Develop information to support decision making by tidal wetland conservation and restoration stakeholders – land managers, project funders, designers, regulators, etc.

WRMP Science Framework

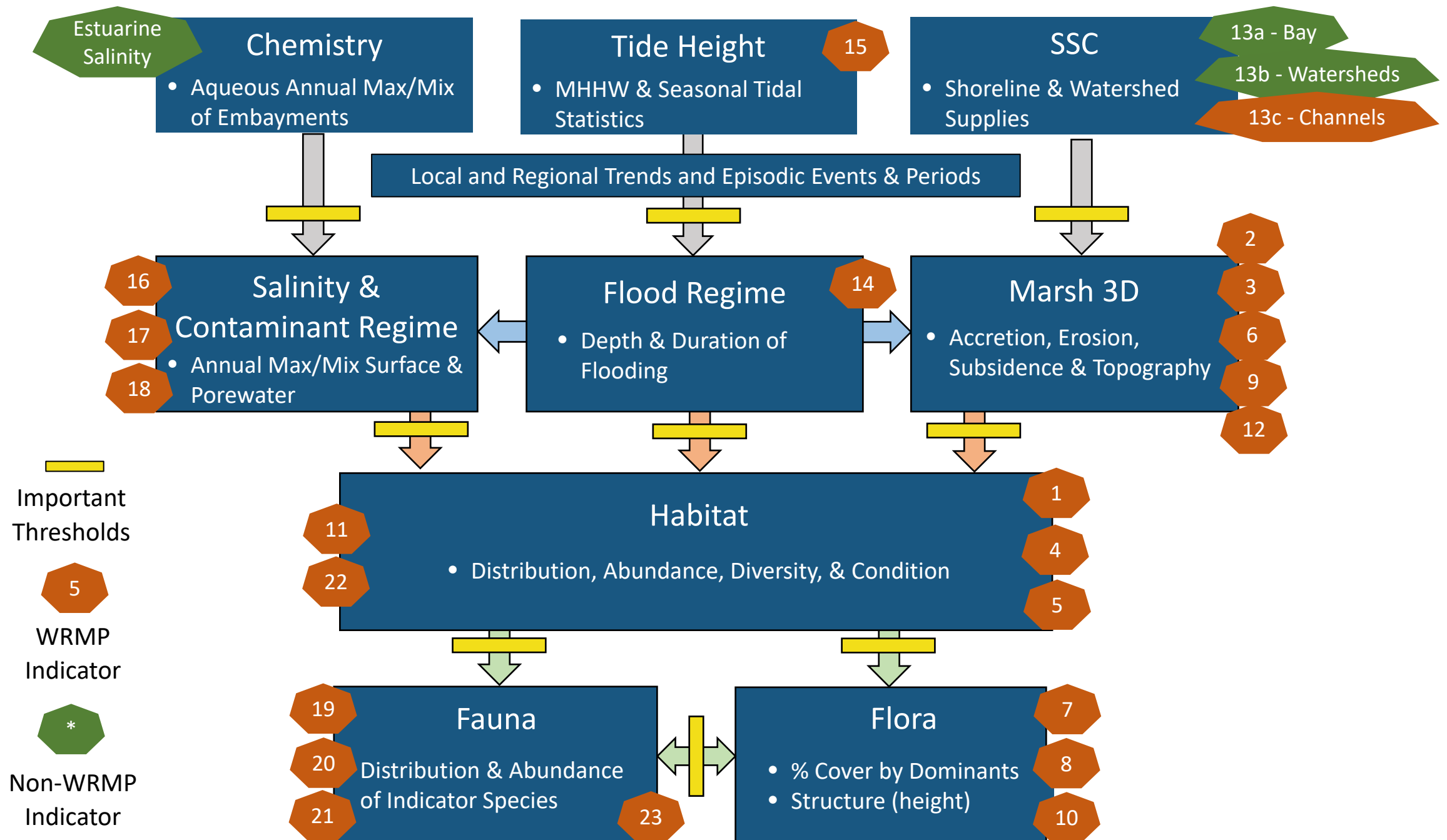


WRAMP Framework



WRMP Guiding Questions

1. Where are the region's tidal wetlands and wetland projects, and what net landscape changes in area and condition are occurring?
2. How are external drivers, such as accelerated sea level rise, development pressure, and changes in runoff and sediment supply, impacting tidal wetlands?
3. How do policies, programs, and projects to protect and restore tidal marshes affect the distribution, abundance, and health of plants and animals?
4. What new information do we need to better understand regional lessons from tidal wetland restoration projects in the future?
5. How do policies, programs, and projects to protect and restore tidal wetlands benefit and/or impact public health, safety, and recreation?



WRMP Science Priorities





Surveys & inventory of distribution, abundance, diversity, and condition of tidal wetlands

Priority Recommended Action based on Guiding Question 1: *Where are the region's tidal wetlands and wetland projects, and what net landscape changes in area and condition are occurring?*

Photo: Pete Kauhanen, SFEI-ASC

Level 1 Indicators: Maps

Primary mapping indicators

Indicator 1: map of bayland habitats + features

Indicator 2: map of bayland elevations + elevation capital

Indicator 3: map of estuarine-terrestrial transition zones

Indicator 7: map of bayland vegetation alliances



Secondary (derivative) Mapping indicators

Indicator 4: map of "complete tidal marshes" per BEHGU

Indicator 5: map of special-status species habitats

Indicator 6: map of changes in natural foreshore locations

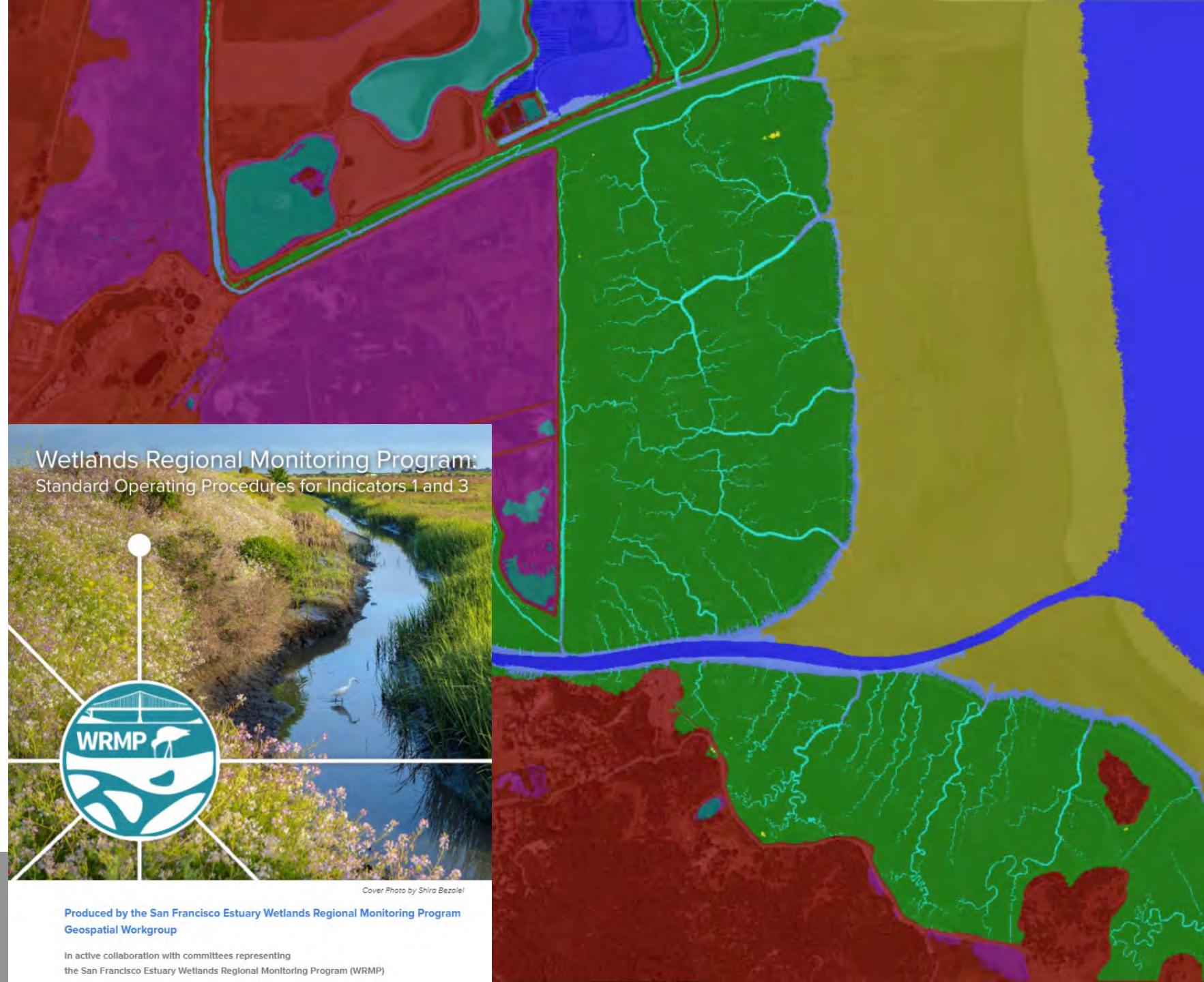
Indicator 8: map of changes in tidal marsh vegetation alliances

Indicator 9: changes in tidal marsh morphology

Indicator 10: map of invasive bayland plant species

Baylands Change Basemap

- Tidal wetland distribution and abundance



Level 2 Indicator: California Rapid Assessment Method (CRAM)

- Tidal wetland diversity and condition





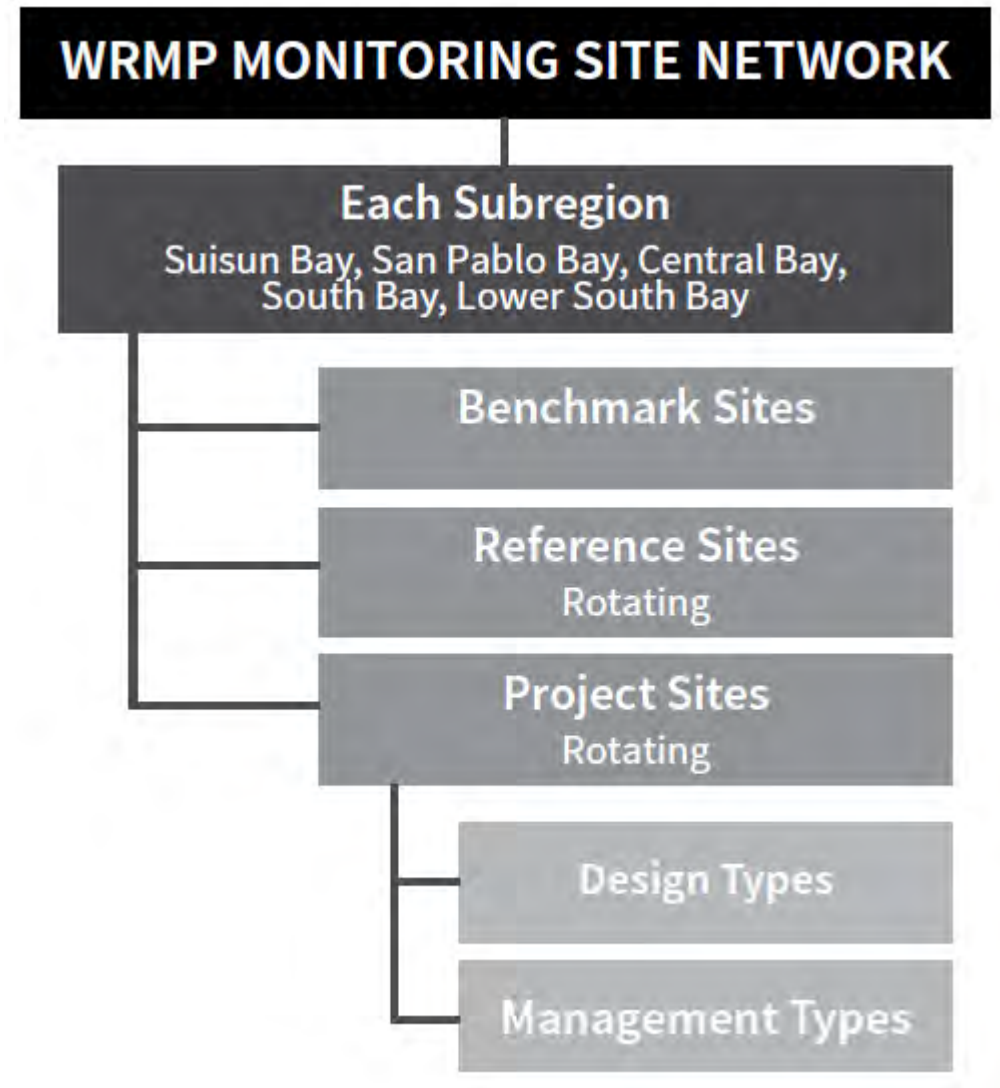
Benchmark Sites & WRMP monitoring site network

Priority Recommended Action based on Guiding Question 2: *How are external drivers, such as accelerated sea level rise, development pressure, and changes in runoff and sediment supply, impacting tidal wetlands?*

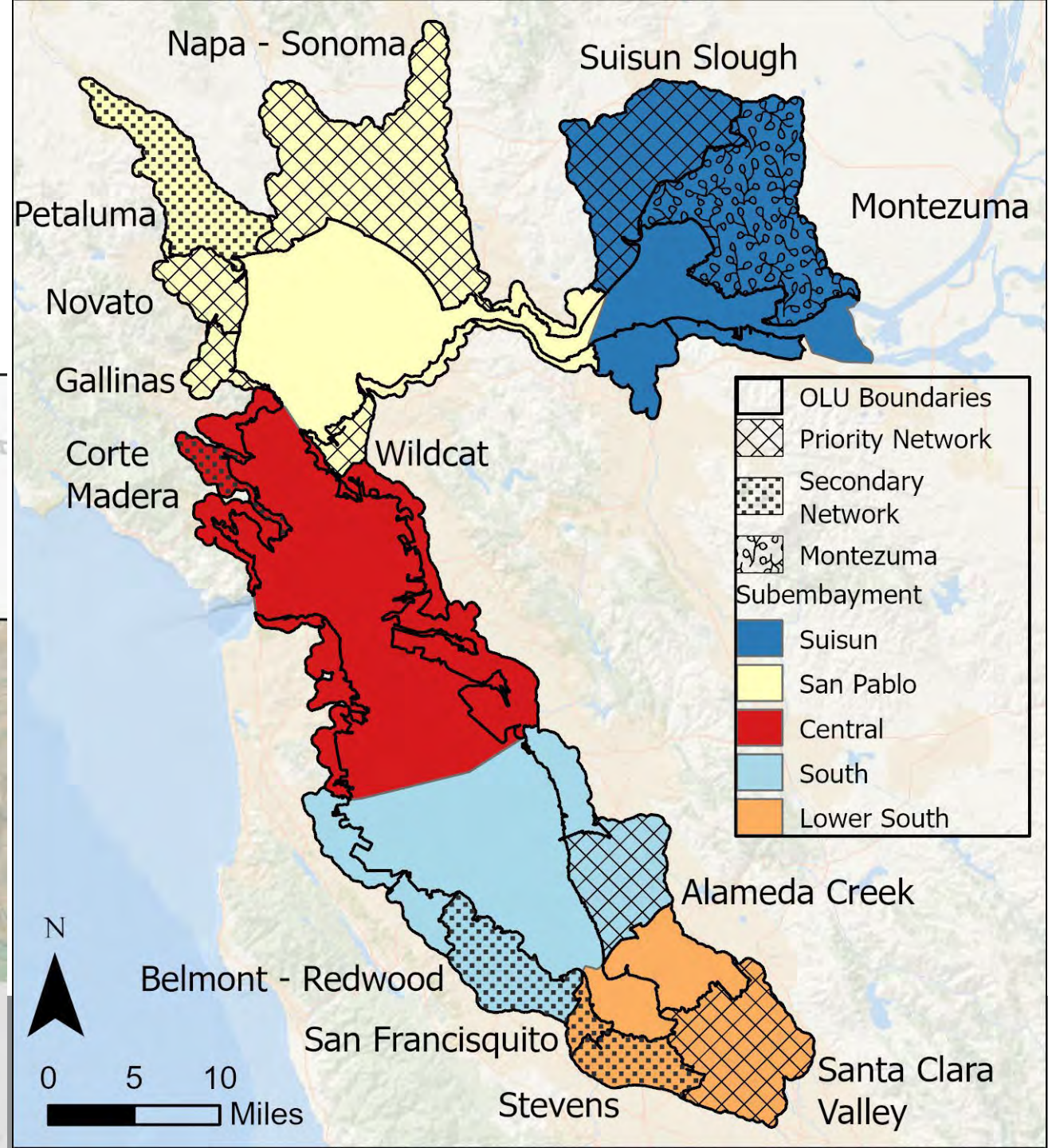
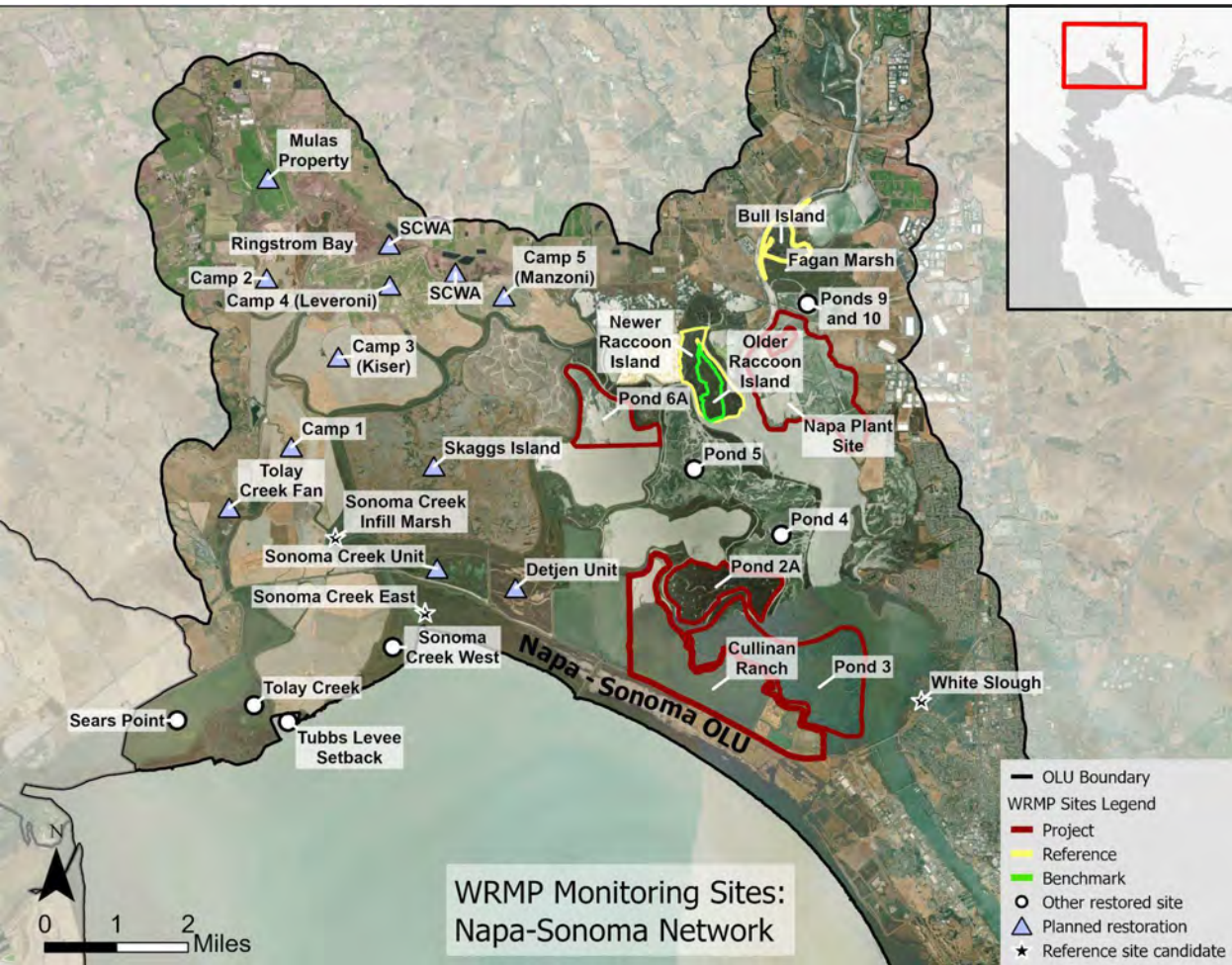
Photo: Mike Vasey

WRMP Site Network

- Benchmark sites: Represent mature, mostly ancient marshes
- Reference sites: Represent target conditions for restoration projects
- Project sites: Reflect a variety of design and management approaches



Monitoring Networks & Sites



Repeat surveys (detect change) of living organisms & habitats (indicators)

Priority Recommended Action based on 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?*

Photo: Anna Deck



Analyze sources of sediment to counter threat of SLR

Priority Recommended Action based on Guiding Question 4: *What new information do we need to better understand regional lessons from tidal wetland restoration projects in the future?*

Photo: Shira Bezalel

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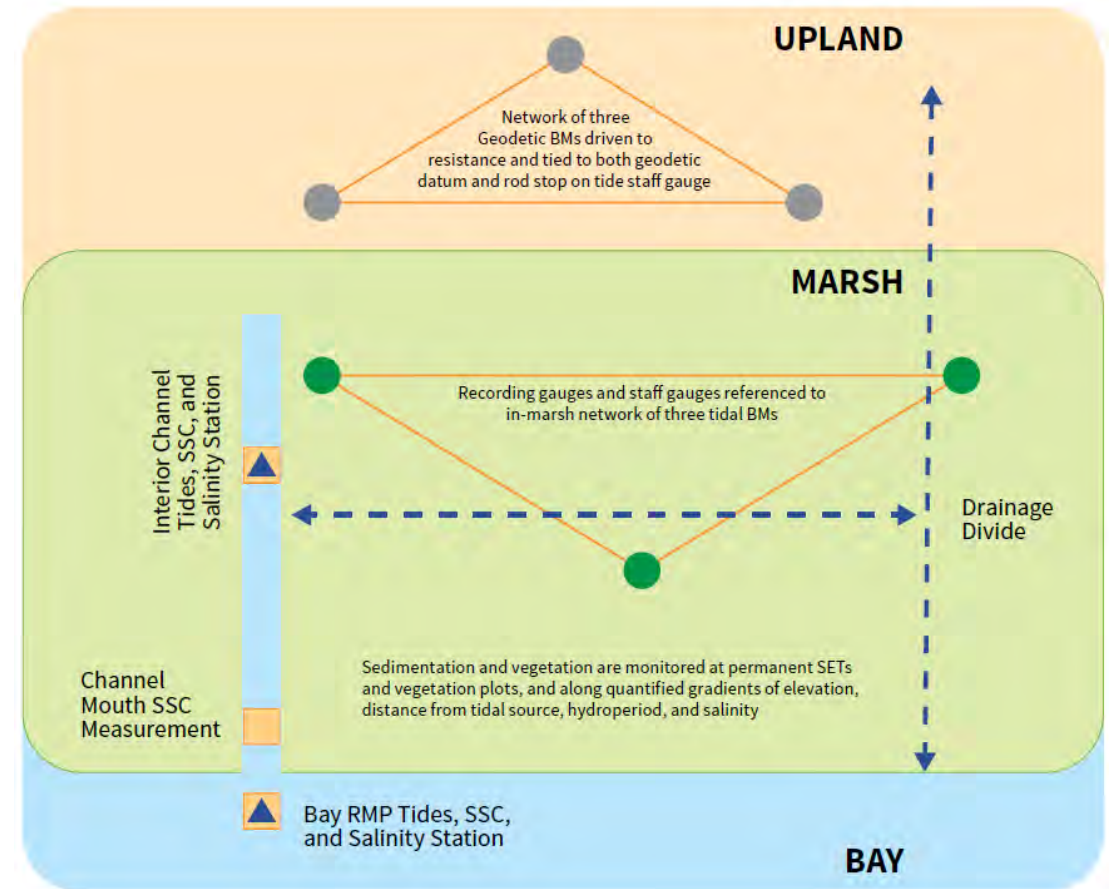
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Level 3 Indicators: Field Sensing

- Topography, bathymetry, and geomorphology
- Inundation and salinity
- Sediment delivery and accretion
- Vegetation percent cover
- Status and trends in abundance/distribution of key indicator tidal wetland organisms (rare plants, birds, fish, mammals, etc.)



Standard Operating Procedures (SOPs)

- Habitat mapping (Level 1): **Complete**
- Habitat condition (Level 2): **Complete**
- Hydrogeomorphology (Levels 1 and 3): **In-progress**
- Vegetation (Levels 1 and 3): **In-progress**
- Fish and fish habitat (Level 3): **Complete**

SOPs can identify triggers for CRAM/field-based monitoring based on remote sensing



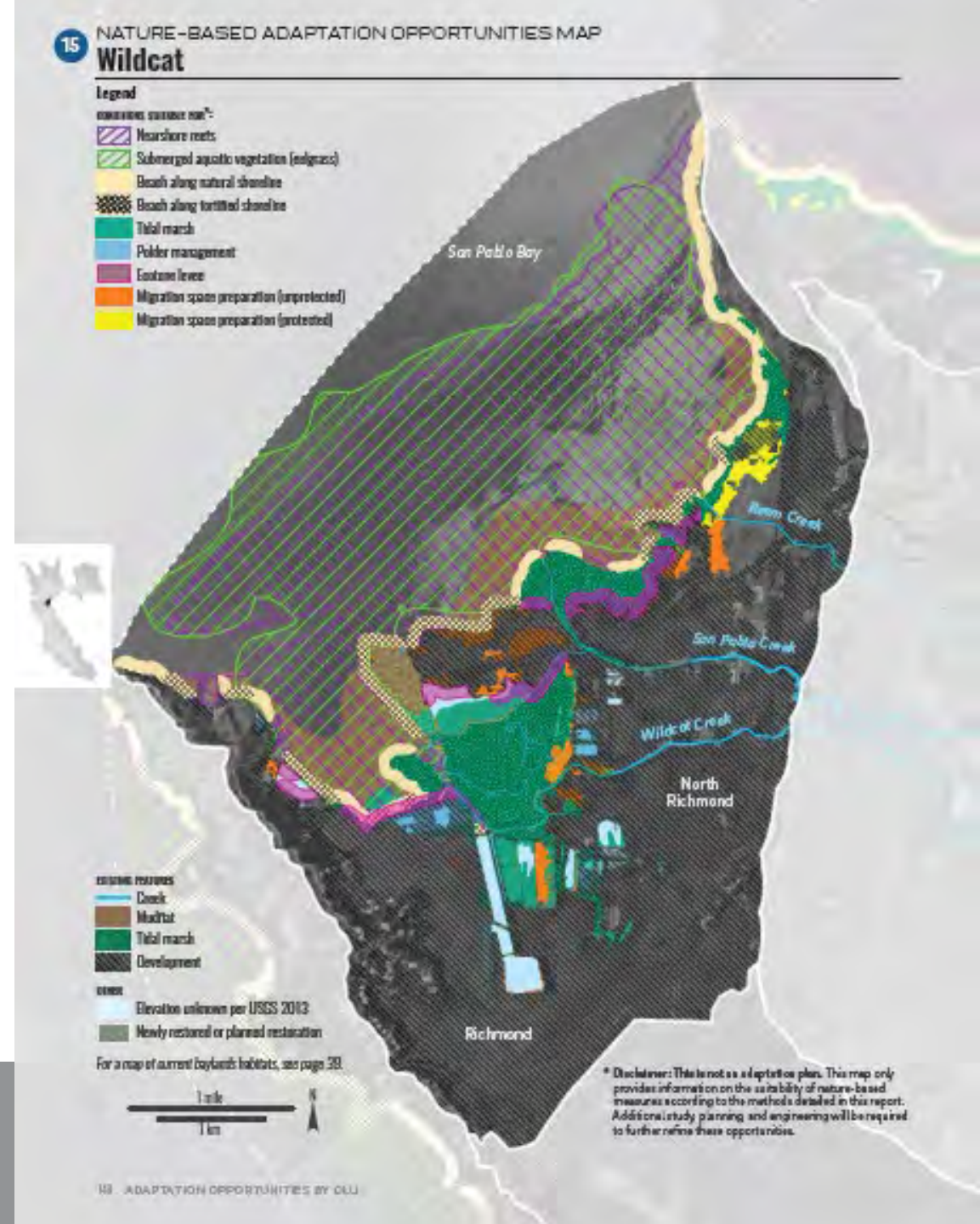
Monitor interactions between people & wetlands

Priority Recommended Action based on Guiding Question 5: *How do policies, programs, and projects to protect and restore tidal wetlands benefit and/or impact public health, safety, and recreation?*

Photo: Shira Bezalel

Potential Mapping Products

- Where tidal wetland conservation and restoration can promote community health and resilience
 - Protecting infrastructure
 - Providing recreation
- Where tidal wetlands produce mosquitoes



Take-Aways



Take-Aways

- WRMP addresses information needs of a broad range of stakeholders
- WRMP is based on the WRAMP framework, which integrates Level 1 (remote sensing), Level 2 (rapid assessment), and Level 3 (field sensing) data collection
- Remote sensing products focus on tidal wetland distribution, abundance, and condition, as well as key physical/ecological drivers
- WRMP SOPs explain how remote sensing, rapid assessment, and field sensing are used together to answer monitoring questions and produce information products for stakeholders



Questions?
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Photo: Mike Vasey