



Bridging the Estuary: The History, Current Status, and Future of Restoration Planning, Policy, and Implementation in The Sacramento-San Joaquin Delta and San Francisco Bay

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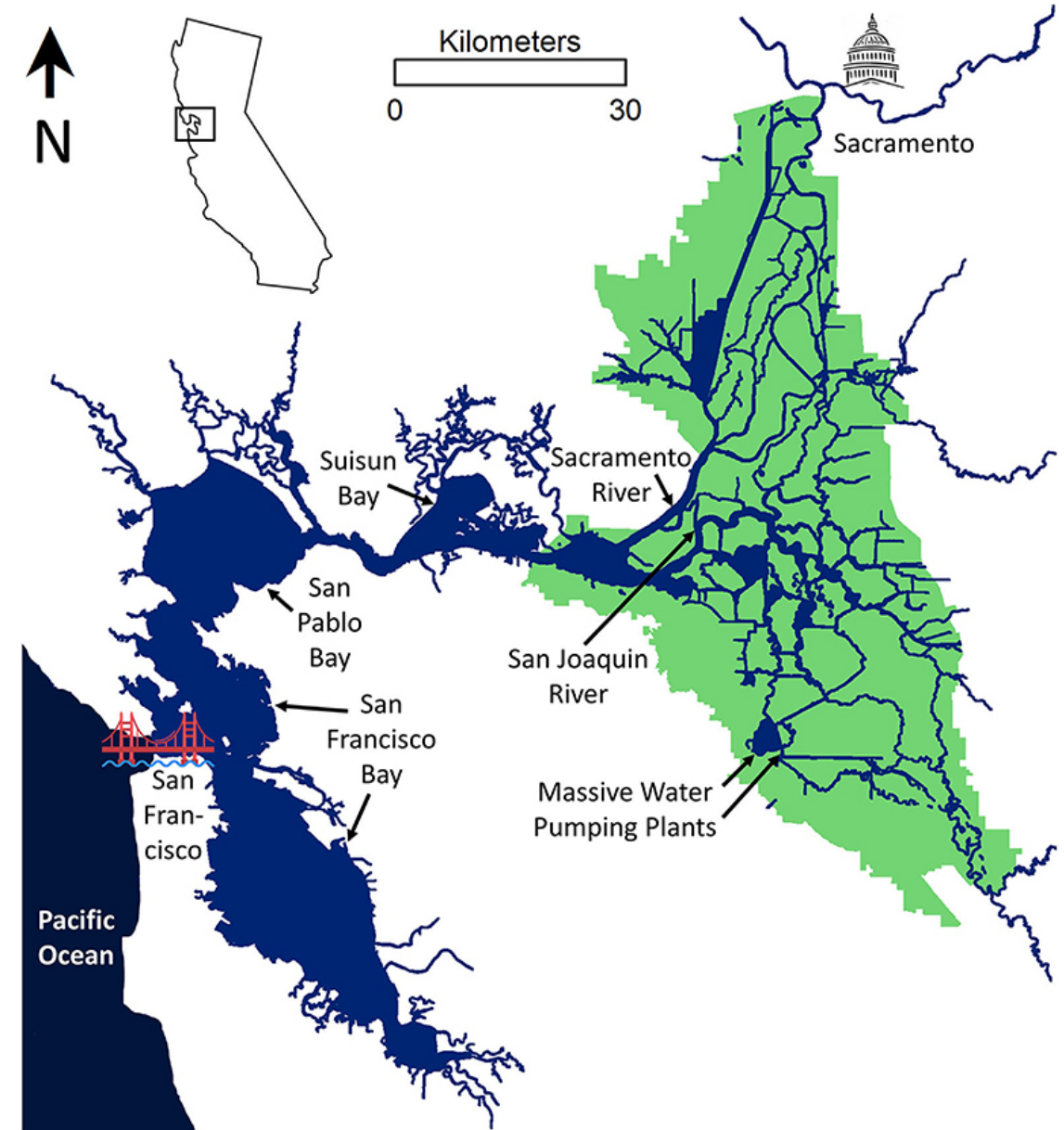


**Delta
Stewardship
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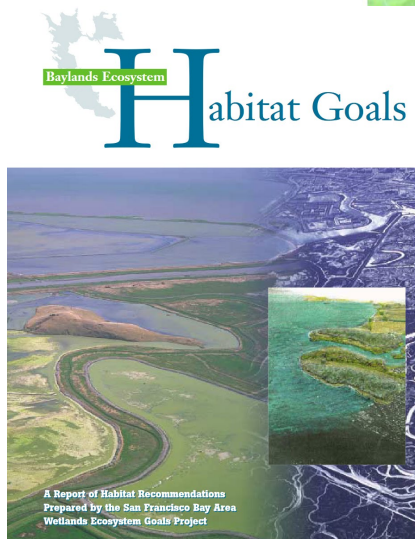
San Francisco Estuary

- San Francisco Bay (Lower Estuary)
- Sacramento-San Joaquin Delta (Upper Estuary)
- High rates of historic wetland loss (79% SF Bay, 98% Delta)
- Same estuary, distinct restoration trajectories



San Francisco Bay Restoration

- First wetland restoration projects: 1970's
- Lessons learned over time documented in literature
- Baylands Goals Report: 1999
 - ~70,000 acres of wetland restoration
 - Updated in 2015 for climate change and current status



Journal of Coastal Research	SI	27	203-211	Royal Palm Beach, Florida	2001
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Salt Marsh Restoration Experience in San Francisco Bay

Philip Williams and Phyllis Faber

Examples of Projects Anticipated to be Eligible for Restoration Authority Grants



San Francisco Bay Restoration

- Restoration Progress:
 - ~4000 acres pre-1998
 - ~3500 acres 1998-2009
 - 28,000 additional acres identified
- Largely “voluntary” restoration not required for mitigation
- Goals don’t include the Delta



POLICY AND PRACTICE REVIEWS
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Voluntary Restoration: Mitigation’s Silent Partner in the Quest to Reverse Coastal Wetland Loss in the USA

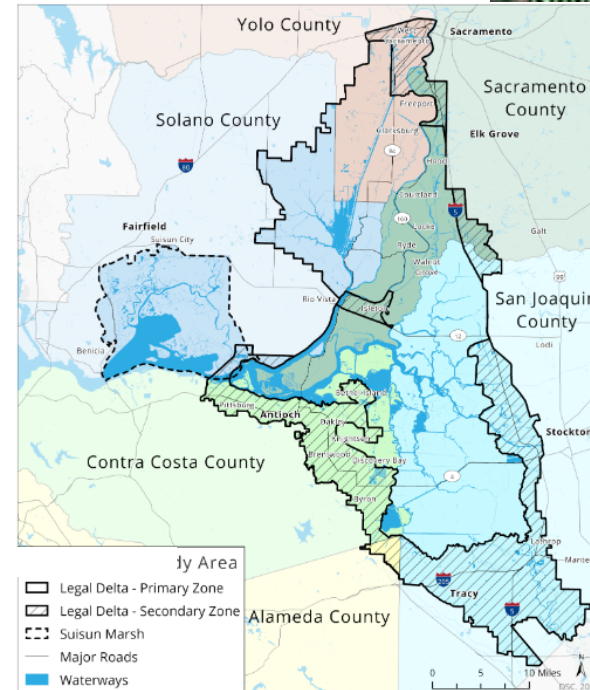
Rachel K. Gittman^{1*}, Christopher J. Baillie¹, Katie K. Arkema^{2,3}, Richard O. Bennett⁴, Jeff Benoit⁵, Seth Blitch⁶, Julien Brun⁷, Anthony Chatwin⁸, Allison Colden⁹, Alyssa Dausman¹⁰, Bryan DeAngelis¹¹, Nathaniel Herold¹², Jessica Henkel¹³, Rachel Houge¹⁴, Ronald Howard¹⁵, A. Randall Hughes¹⁶, Steven B. Scyphers¹⁶, Tisa Shostik¹⁷, Ariana Sutton-Grier¹⁸ and Jonathan H. Grabowski¹⁶



Recent Restoration Sites	Year Opened to Tidal Action	Planned Area of Tidal Wetland Restoration (Acres)
BAY Tidal Wetland Restoration Since 2015 Report		
Corte Madera Marsh Ecological Reserve Restoration – Greenbrae Gas Pipeline Emergency Replacement Project	2015	0.27
Sears Point Wetland and Watershed Restoration Project	2015	970
Bair Island Restoration (Inner)	2015	276
Dotson Family Marsh Restoration	2017	150
Corte Madera Ecological Reserve Expansion and Restoration	2018	5
TOTAL (BAY)		1401
DELTA Tidal Wetland Restoration Since 2015 Report		
Decker Island	2017	140
Yolo Flyway Farms	2018	300
TOTAL (DELTA)		440

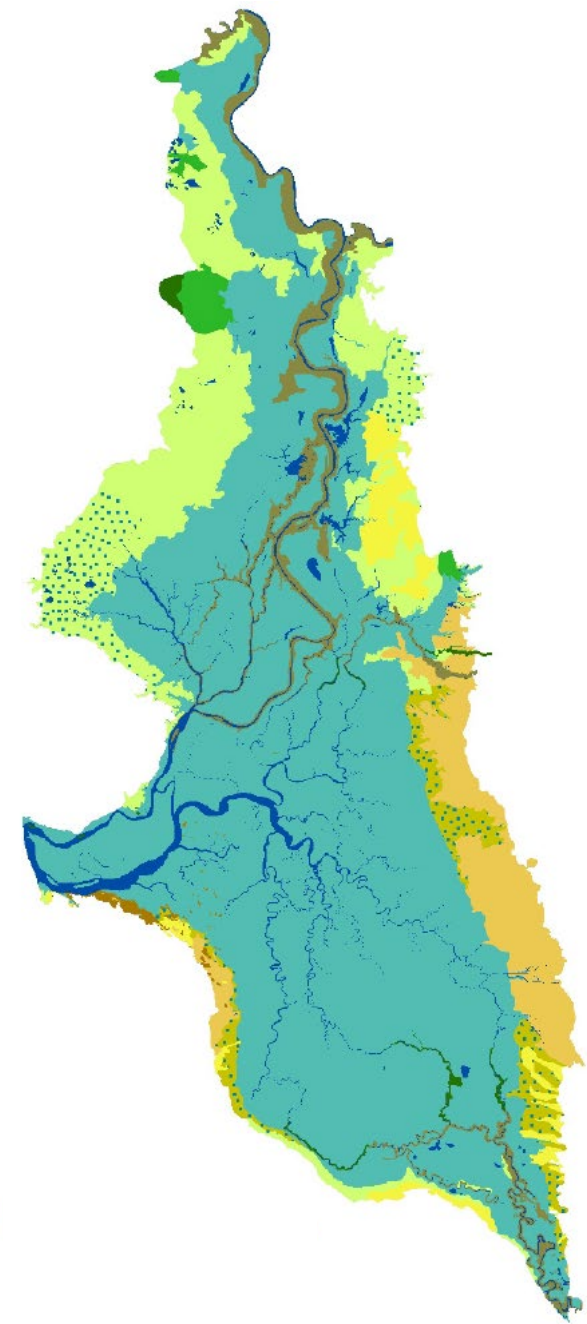
California's Delta and Suisun Marsh

- **"Upper Estuary"**
- **500,000 residents**
- Habitat for over **700 species**
- **Supports 80%** of California's commercial fishery species; recreational fishing area
- Water supply for **26 million people**
- Irrigates over **4 million acres** (45% of US fruits & vegetables)



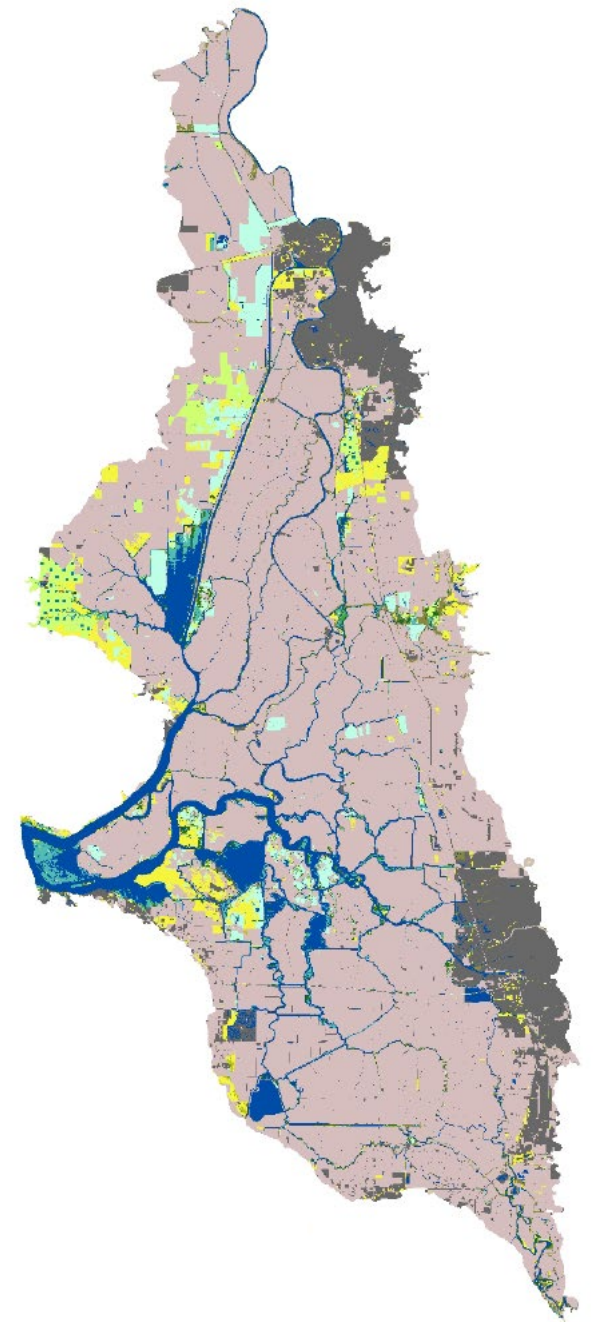
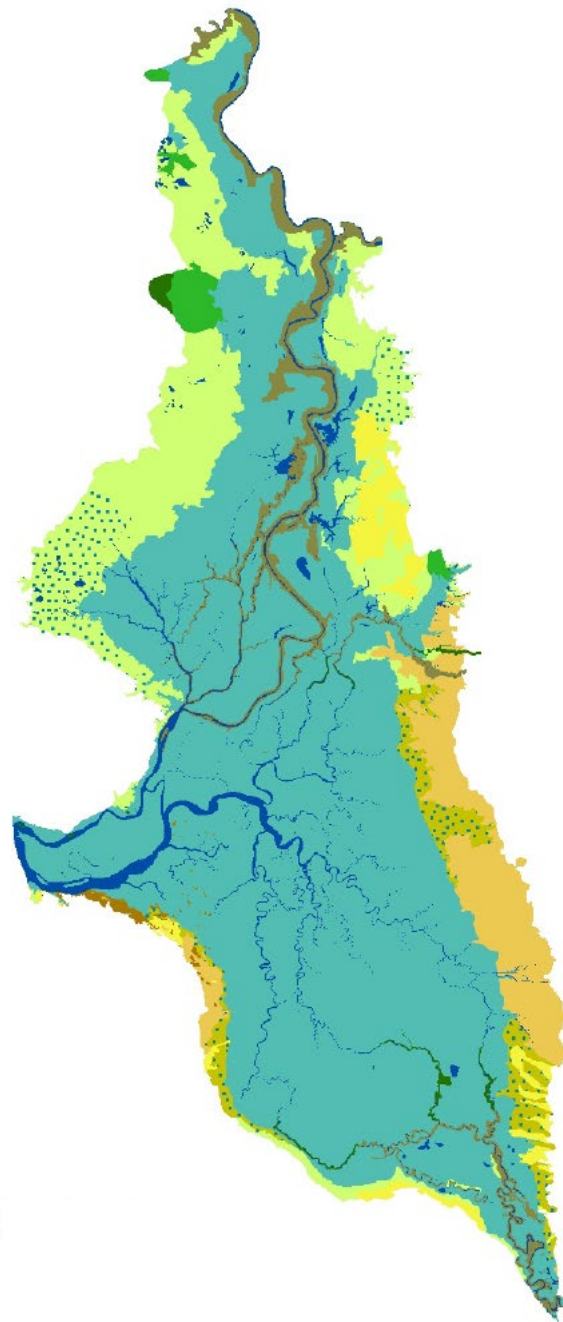
Pre-European Delta

Ancestral and current un-ceded territory of Bay Miwok, Coast Miwok, Plains Miwok, Maidu, Nisenan, Ohlone, Patwin, Pomo, Wappo, Wintun, and Yokuts



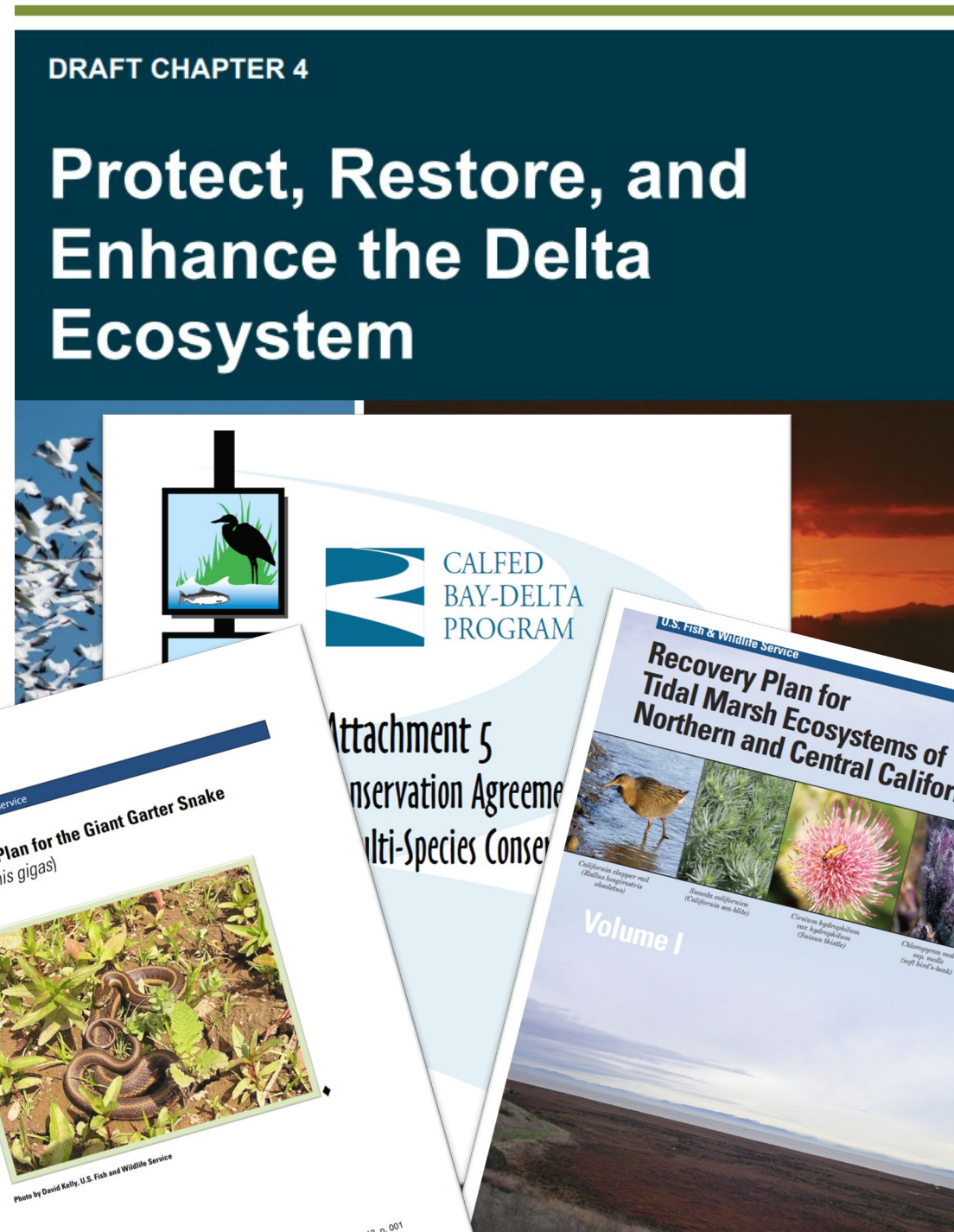
Pre-European vs. Modern

- Removal of traditional management practices
- ~96% of tidal wetlands lost
- Complete alteration of watershed hydrology and ecosystem connectivity



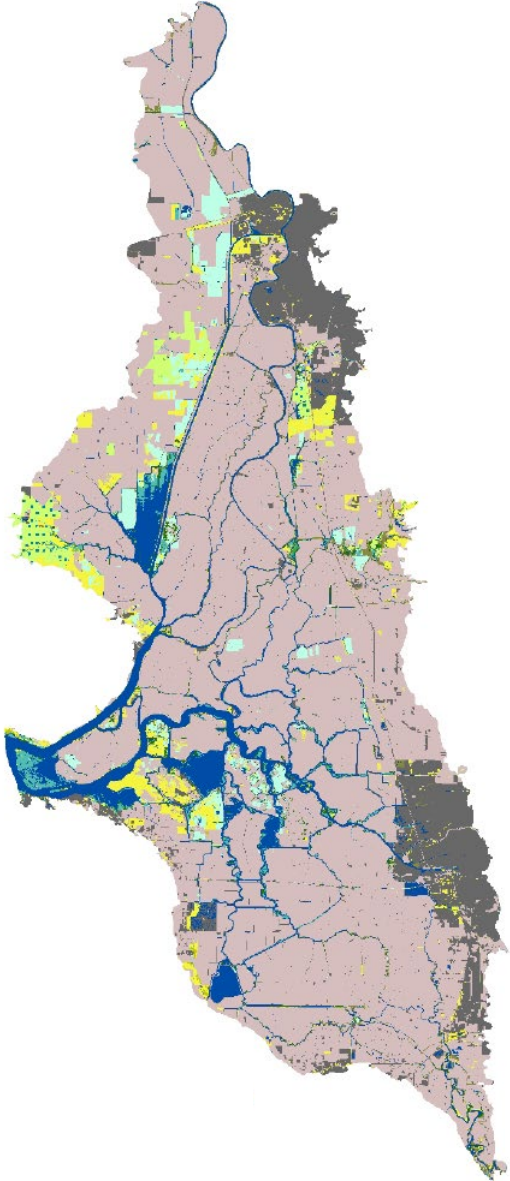
Delta Plan Chapter 4 Amendment

- **Targets: 60-80k acres** of restoration by **2050** above **2007** baseline
 - Informed by 14 recovery plans, conservation strategies, and species-specific resiliency plans
- **Five core strategies:**
 - More natural, functional flows
 - Restore ecosystem function
 - Protect land for restoration
 - Protect native species, reduce impact of nonnative invasive species
 - Improve institutional coordination
- **Other Considerations:**
 - Good neighbor checklist
 - Compatible with adjacent land uses
 - Tribal involvement
 - Social benefits



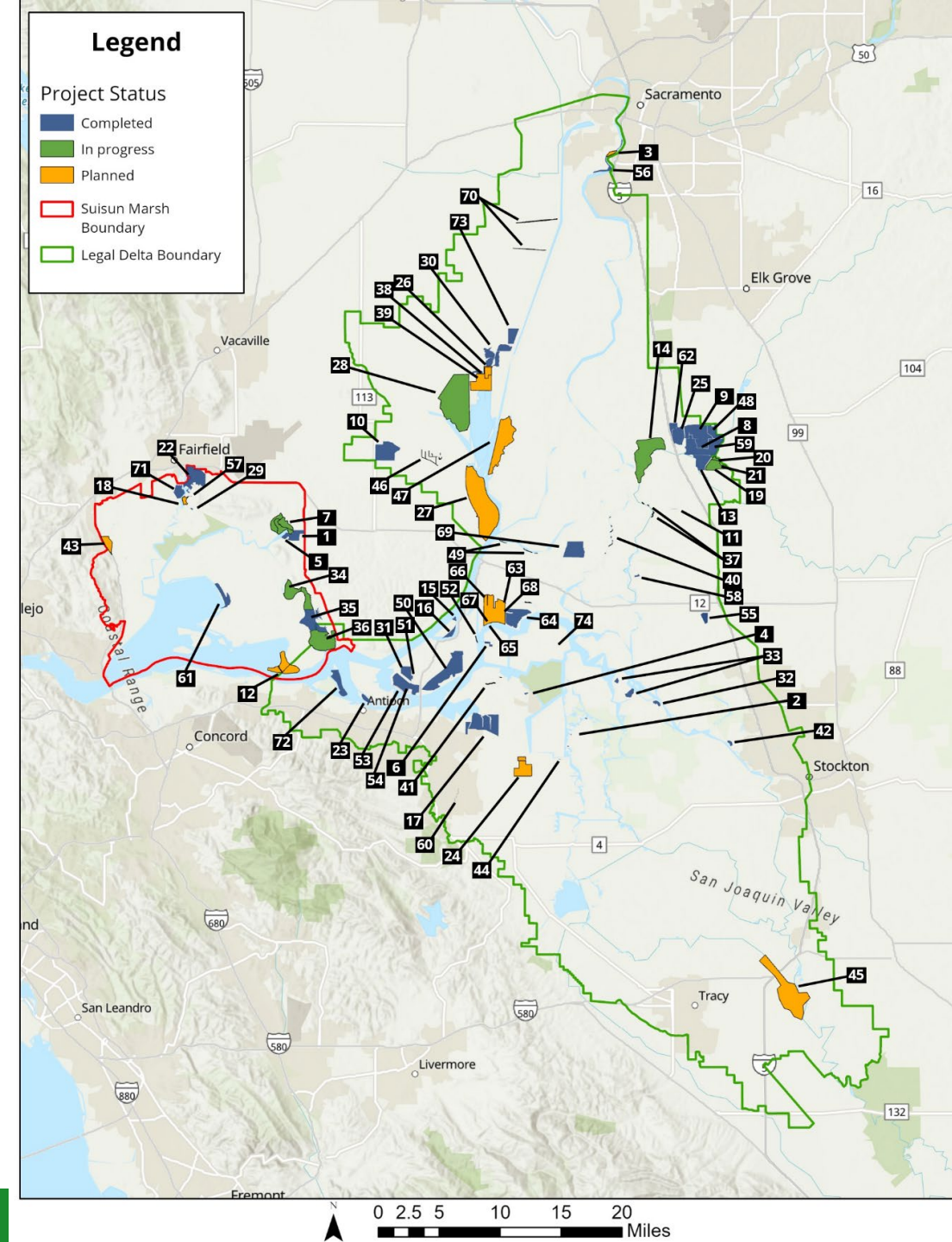
Delta Plan 2050 Restoration Targets

Ecosystem Type	Historic Ac.	2007 Baseline Ac.	Target Ac. Net Increase from Baseline	2050 Target Total Area
Non-tidal wetlands (Seasonal Wetland Wet Meadow, Nontidal Wetland, Alkali Seasonal Wetland, <i>many acres of subsidence reversal projects</i>)	116,524	5,800	19,230	24,330
Riparian (+ Floodplain) (Willow Riparian Scrub/Shrub, Valley Foothill Riparian, Willow Thicket)	51,427	14,200	16,300	30,500
Tidal Wetland (Brackish (Suisun), Fresh (Delta))	530,541	19,900	32,500	52,400



Restoration Progress Review: Scope

- **What progress has been made towards the Delta Plan Restoration Targets and what has motivated it?**
- **Spatial:** Legal Delta and Suisun Marsh (Delta Plan Boundaries)
- **Projects:**
 - Spatially explicit with acreages identified
 - Reestablishment of physical and/or biological processes
- **Phase:** Completed, In Progress, and Planned
- **Literature review:** science and management across restoration types



Data Sources

EcoAtlas

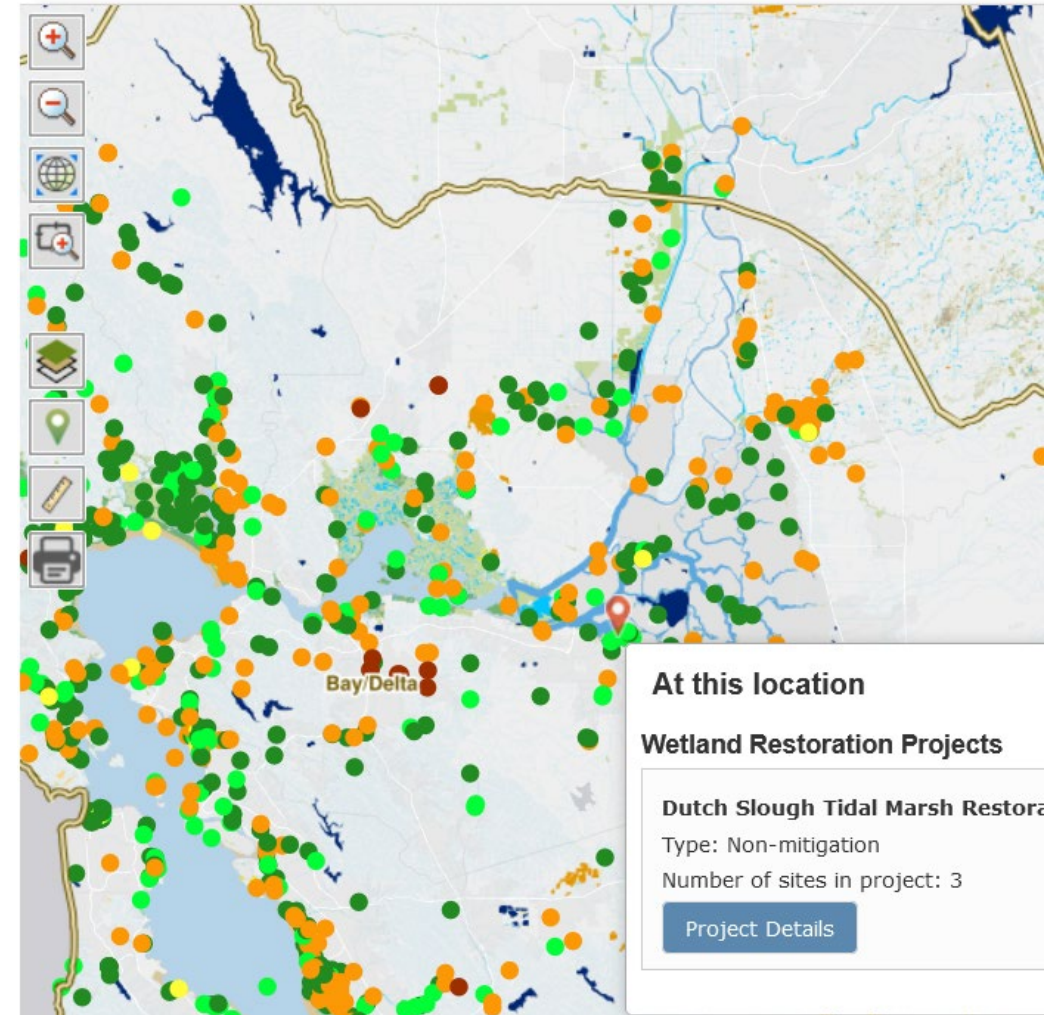
- Ecosystem types with measurable progress
- Initial projects: **n=178**
- Projects meeting scope: **n=63**
- Projects from other sources: **n=18**
- **Total projects included: n=81**

Other Sources

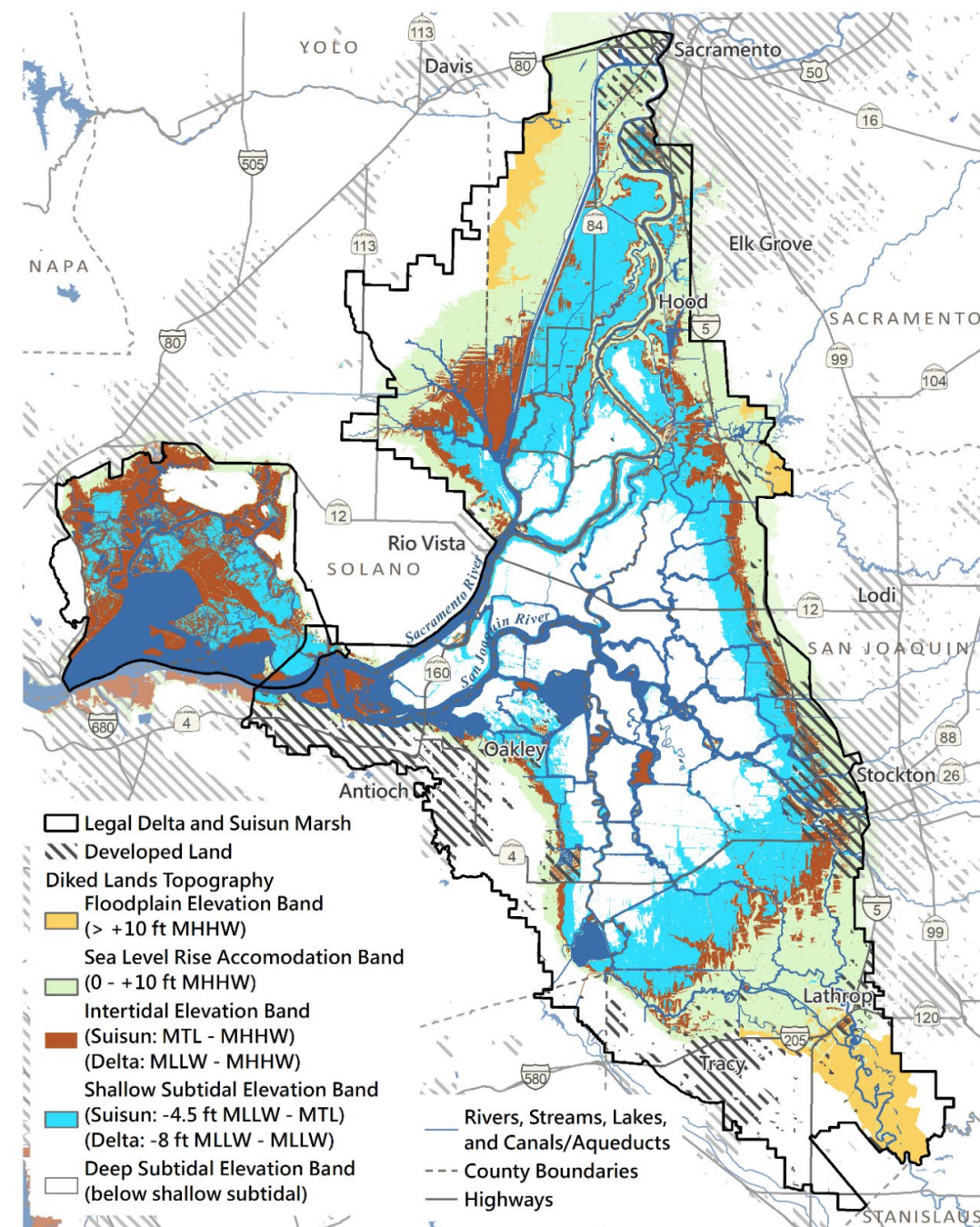
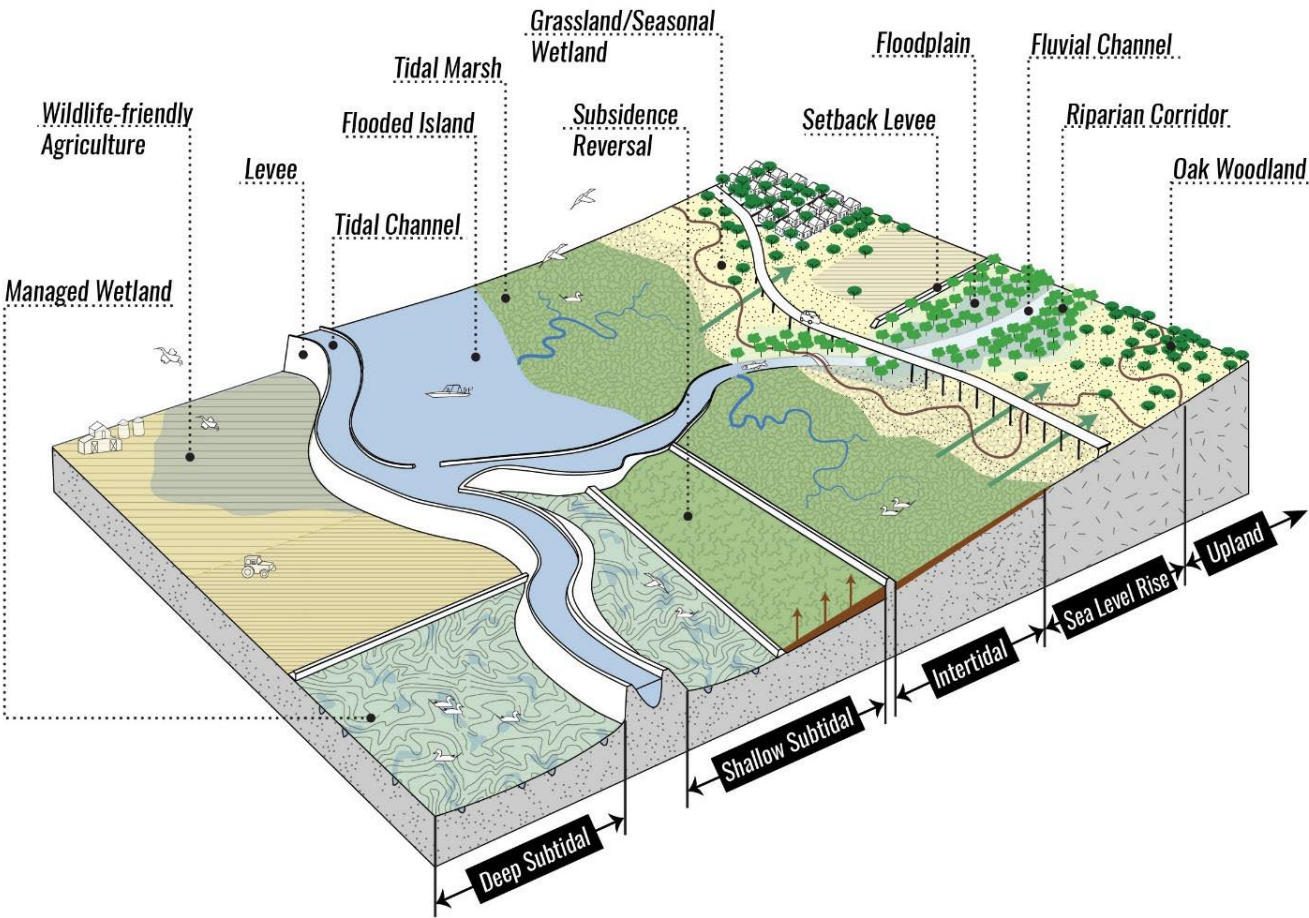
- DSC Covered Actions
- Expert Interviews

Documents

- Agency reports
- CEQA documents
- EcoRestore project fact sheets
- Bond Accountability reports
- If no official documents available: online articles, press releases, other media

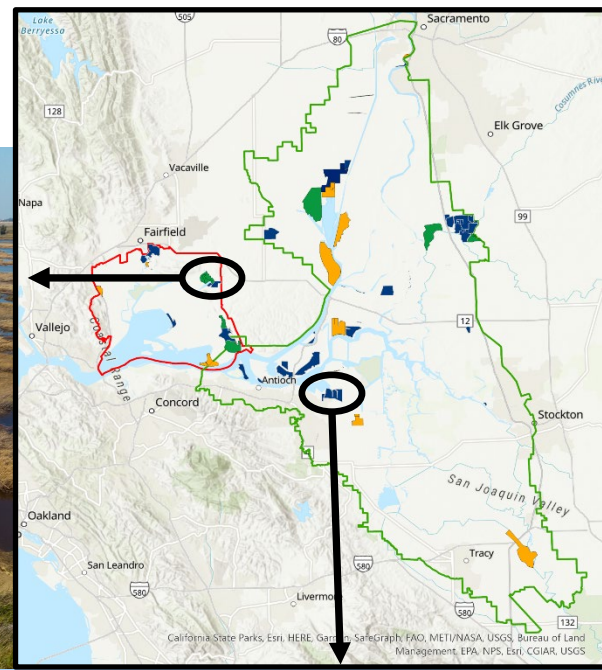


Elevation is Destiny for Restoration

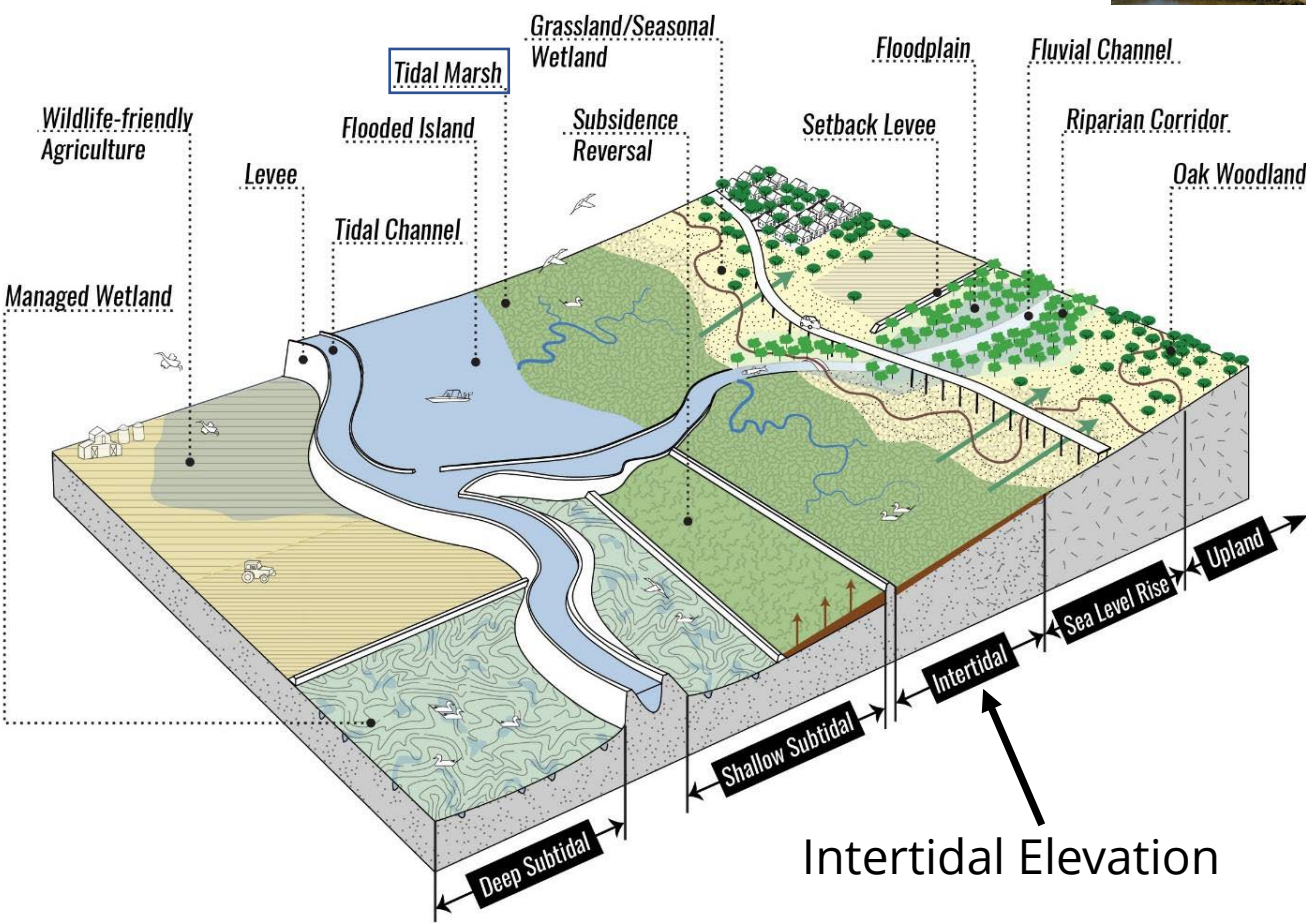


Tidal Wetland: daily tidal inundation, tidal channels

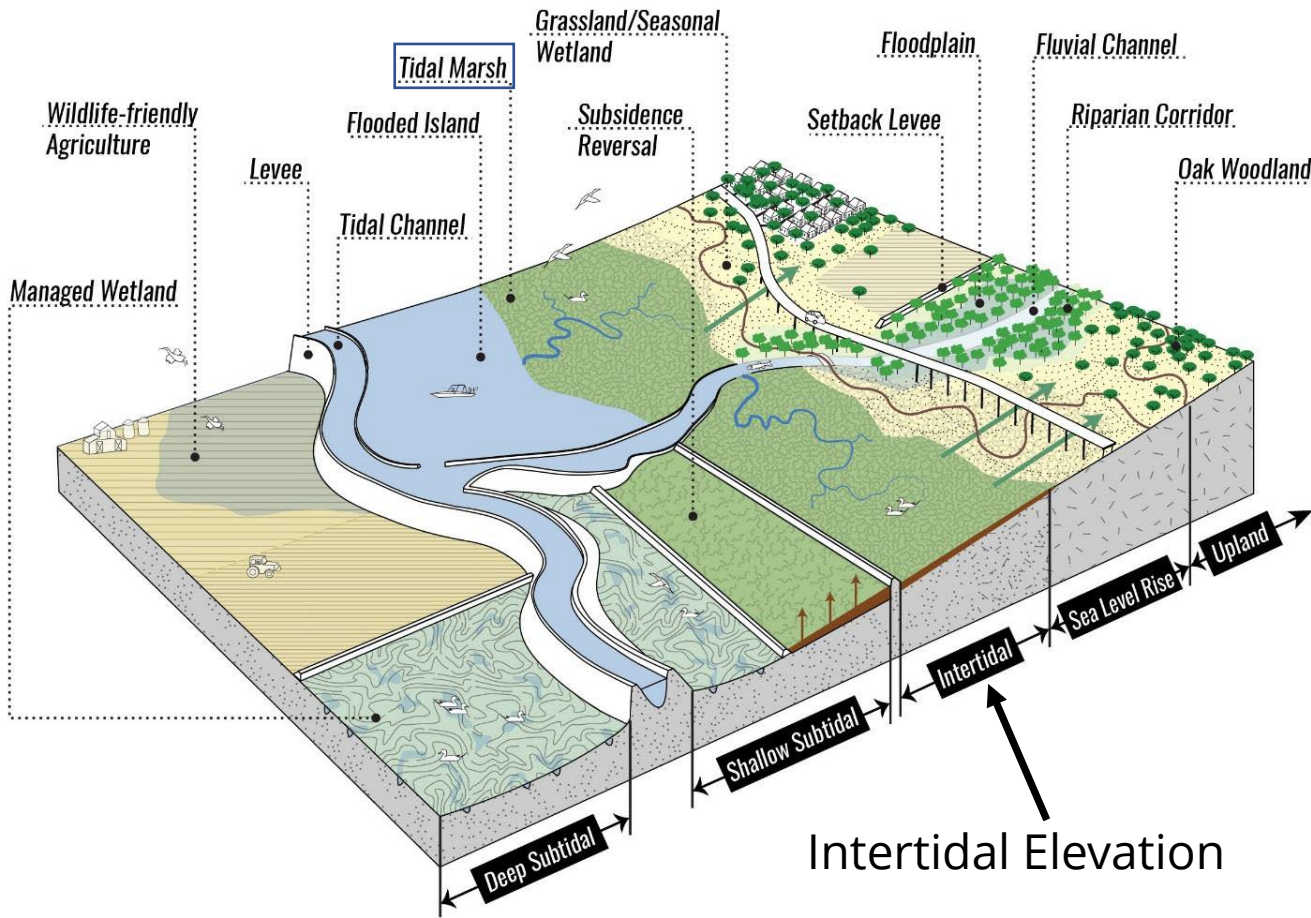
Bradmoor Island, Suisun Marsh



Dutch Slough, Oakley

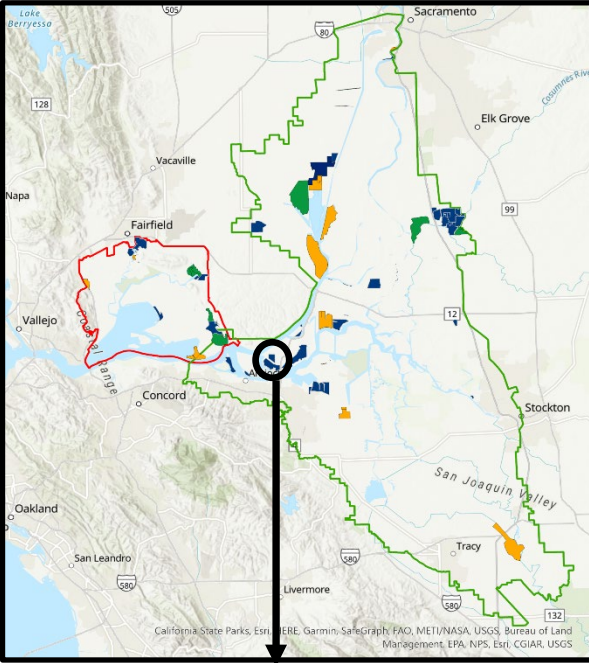
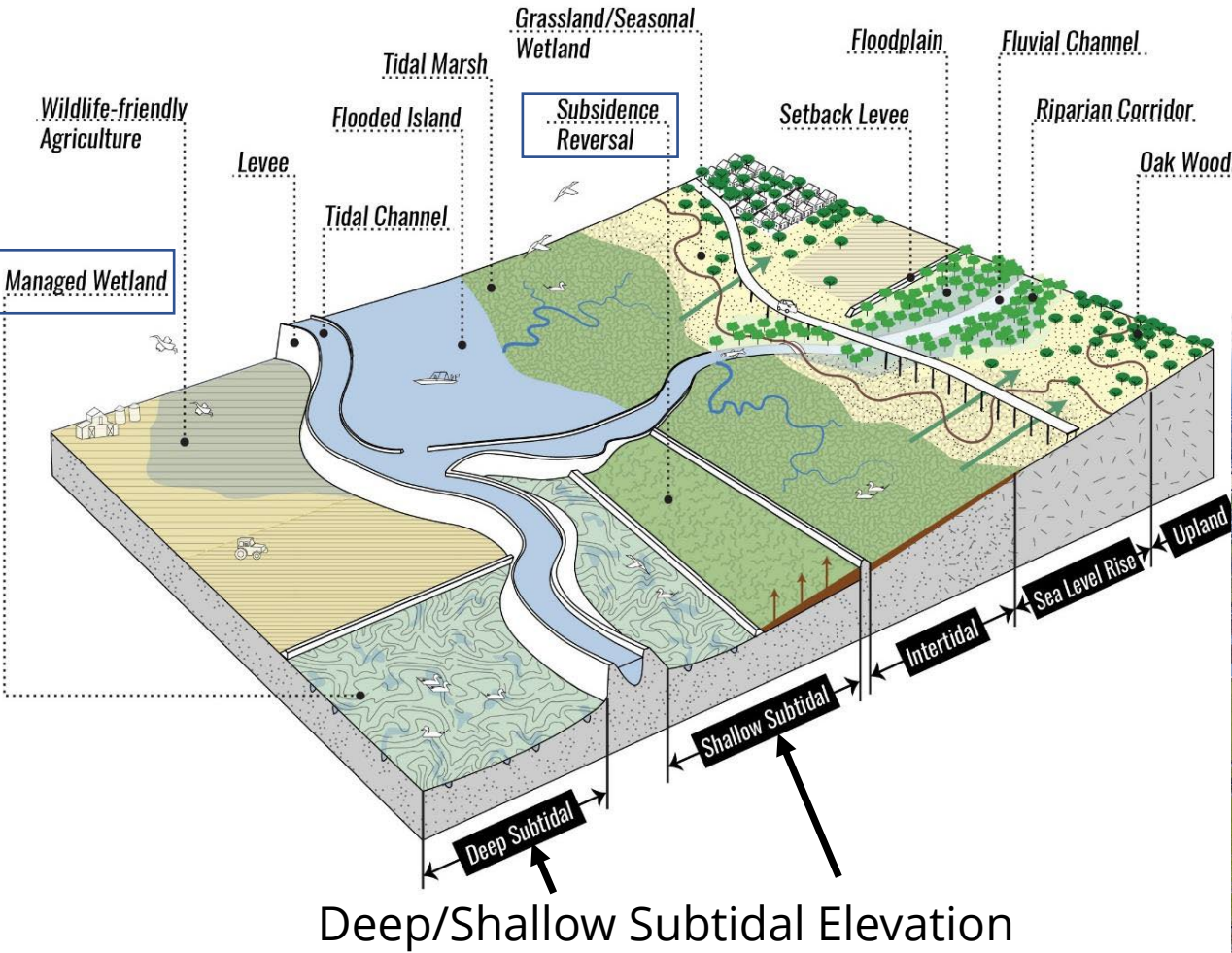


Tidal Wetland: daily tidal inundation, tidal channels



- Delta Plan Target: 32,500 ac
- Completed post 2007: 5729 ac
- In-progress: 5234 ac
- Planned: 3422 ac

Non-Tidal Wetland: no direct connection to rivers or tides, often subsidence-reversal projects

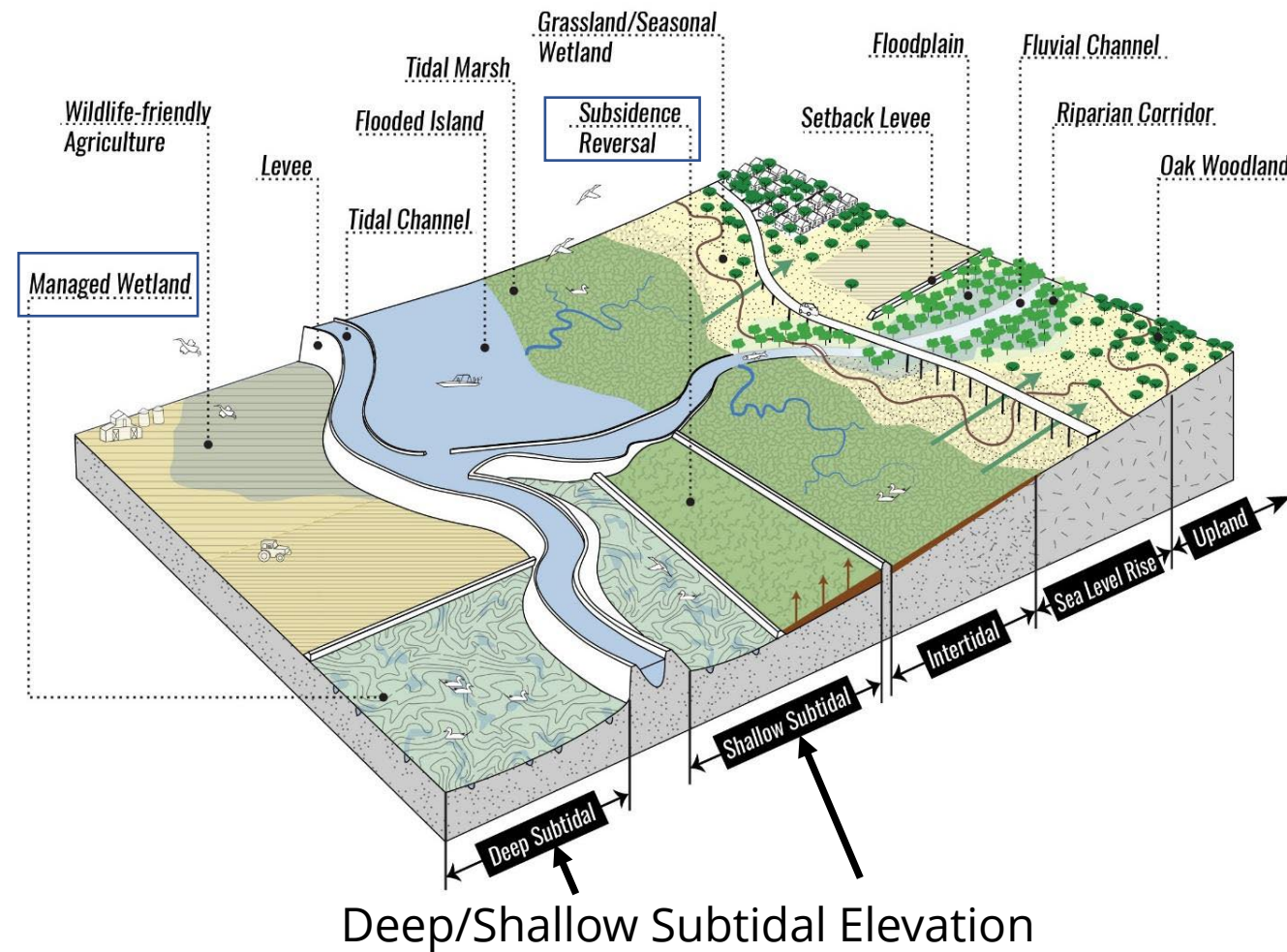


Mayberry Wetland, Whale's Mouth Wetland, Sherman Island

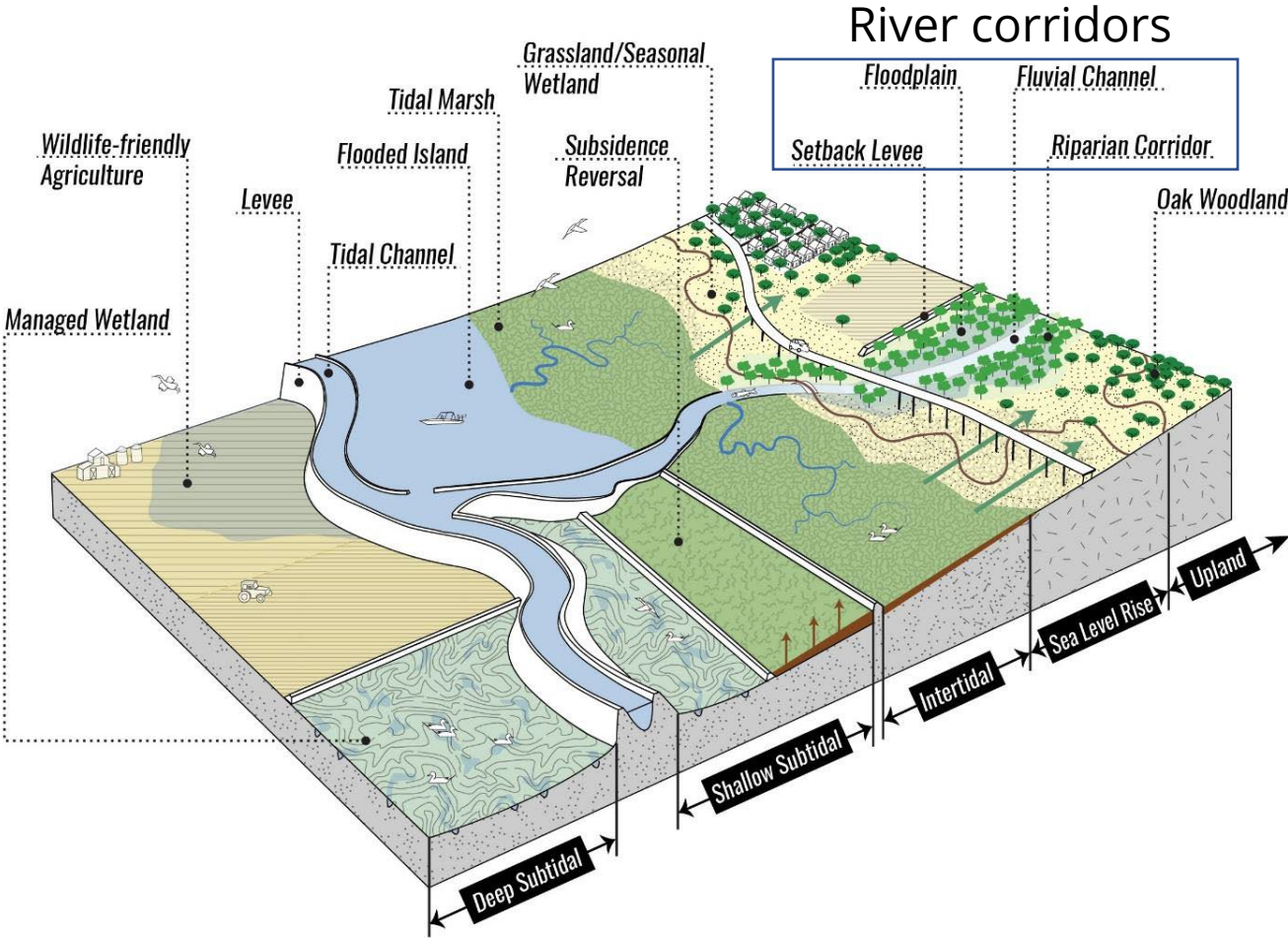


Non-Tidal Wetland: no direct connection to rivers or tides, often subsidence-reversal projects

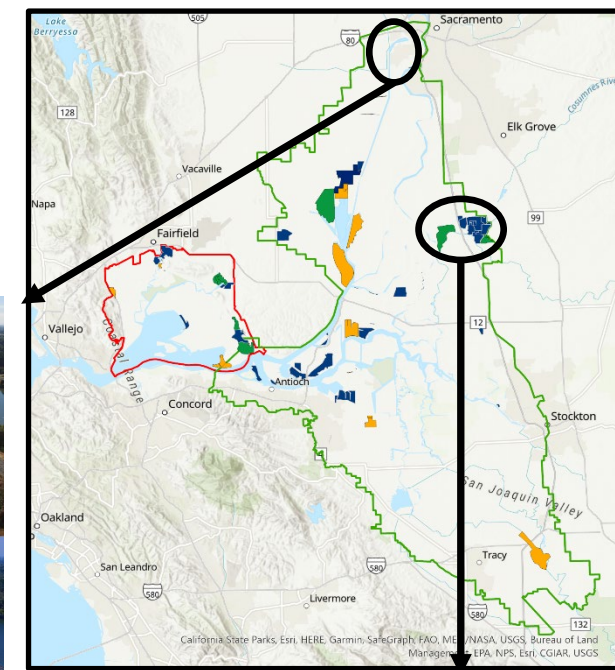
- Delta Plan Target: 19,500 ac
- Completed post 2007: 2777 ac
- In-progress: 18 ac
- Planned: 5613 ac



Riparian and Floodplain: Connected to river corridors, along levee edges, and groundwater-wetted areas



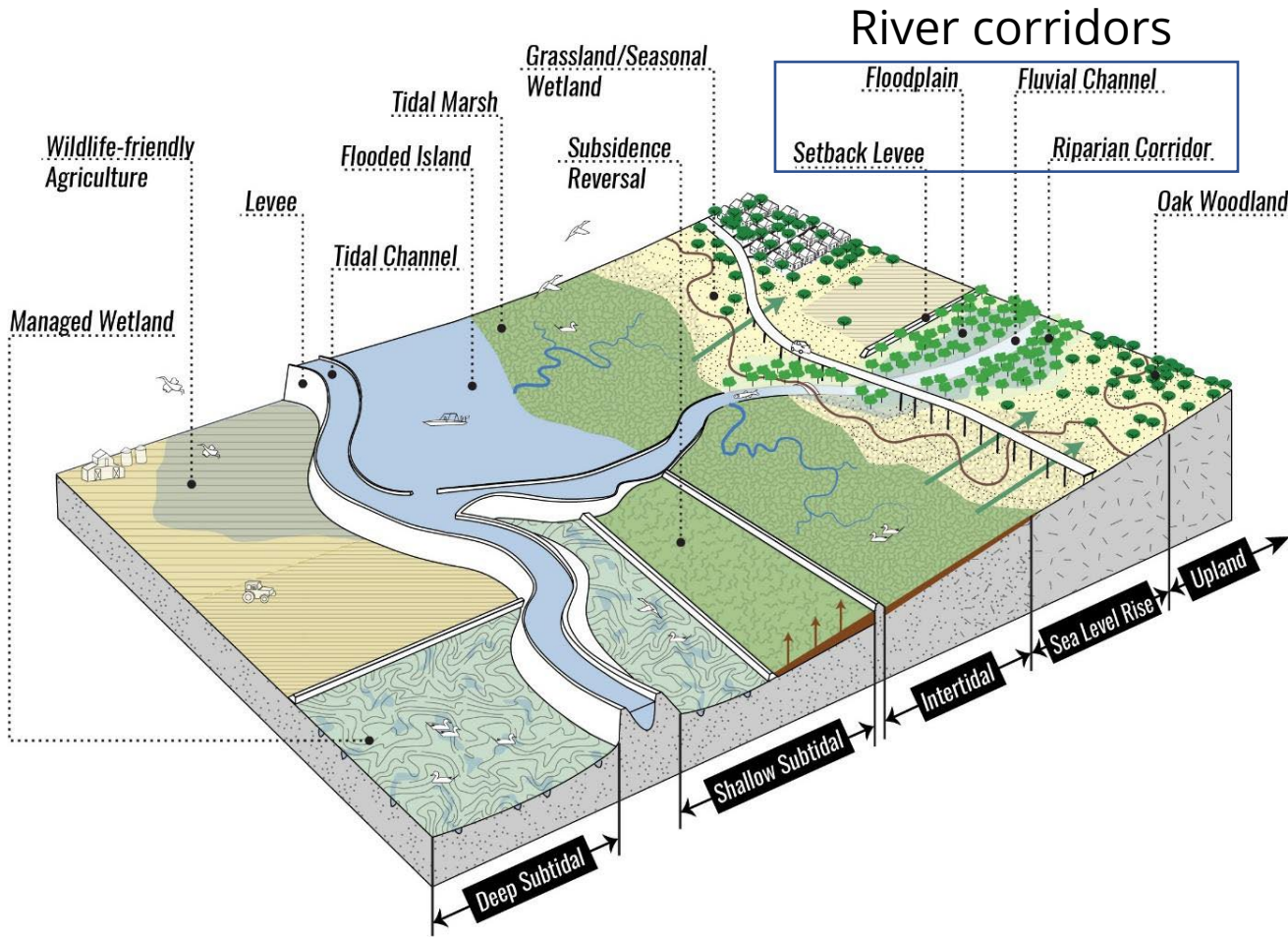
Southport Levee, West Sacramento



Cosumnes River Preserve, Galt

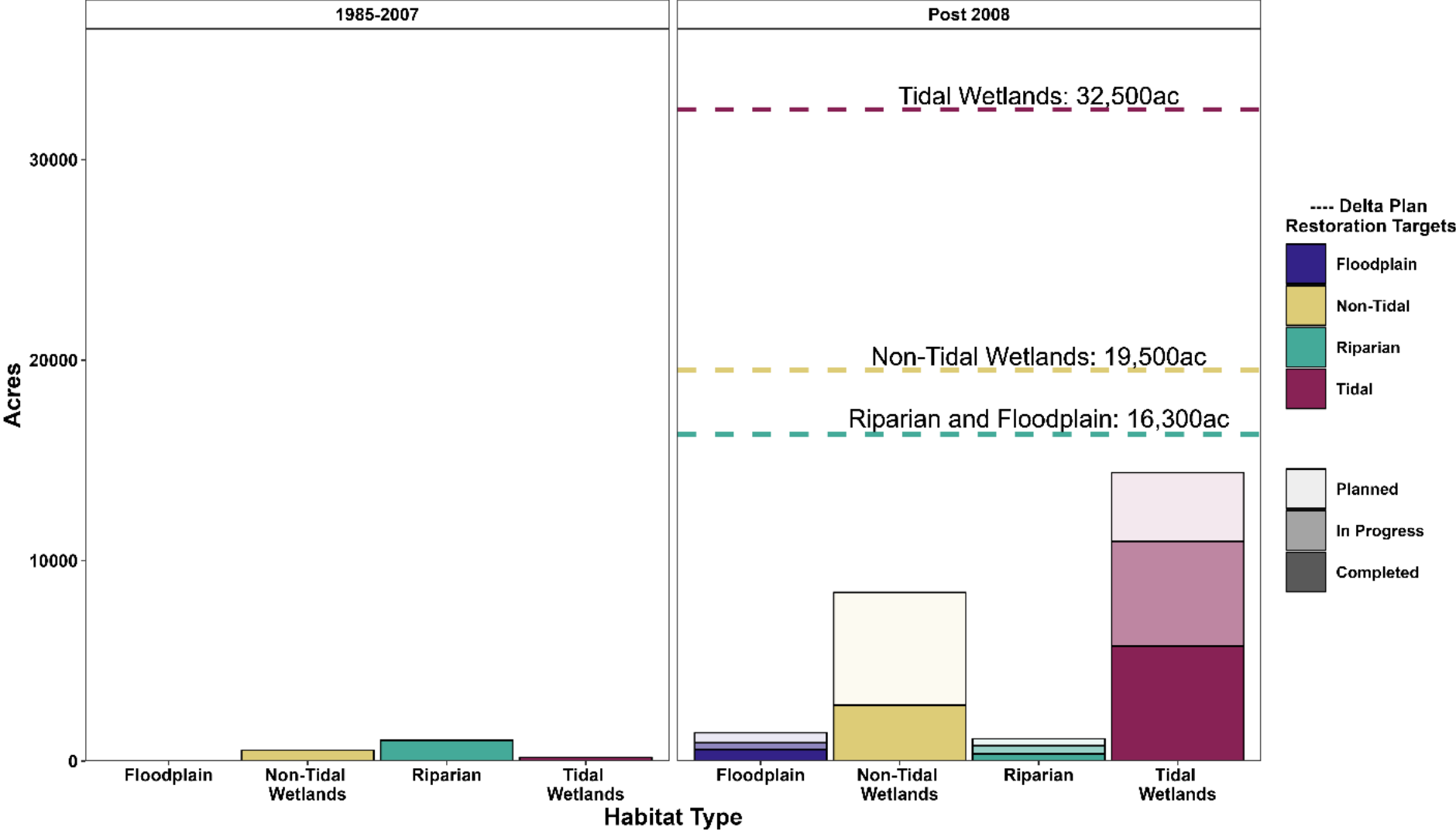


Riparian and Floodplain: Connected to river corridors, along levee edges, and groundwater-wetted areas



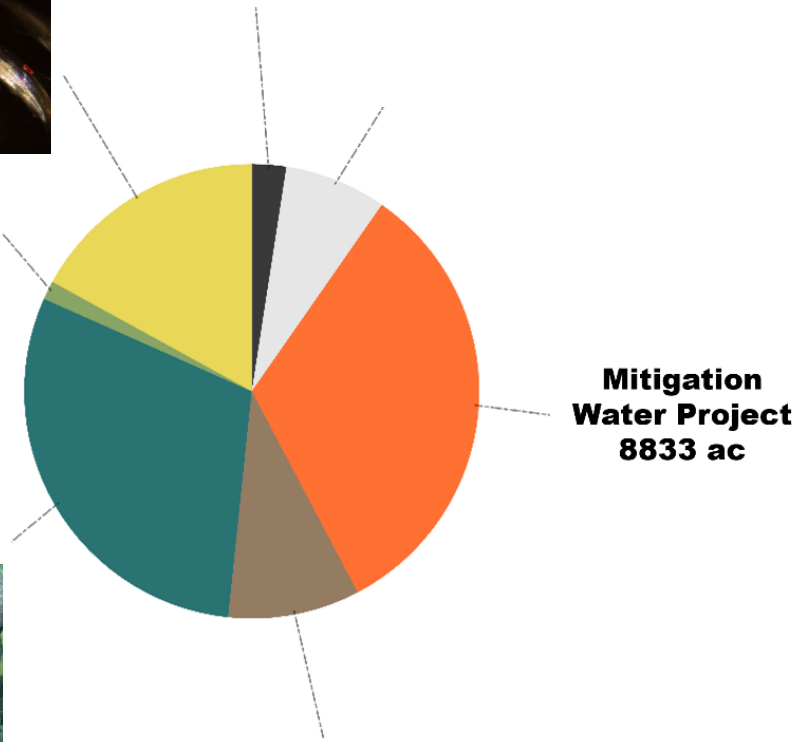
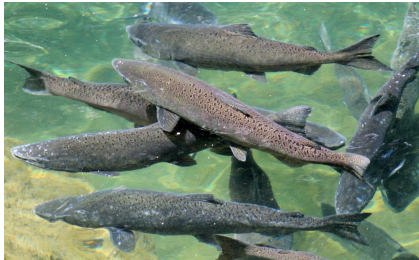
- Delta Plan Target: 16,300 ac
- Completed post 2007: 940 ac
- In-progress: 738 ac
- Planned: 851 ac

Completed, In Progress, and Planned Restoration Acreage



Restoration Motivations: Water Project Mitigation

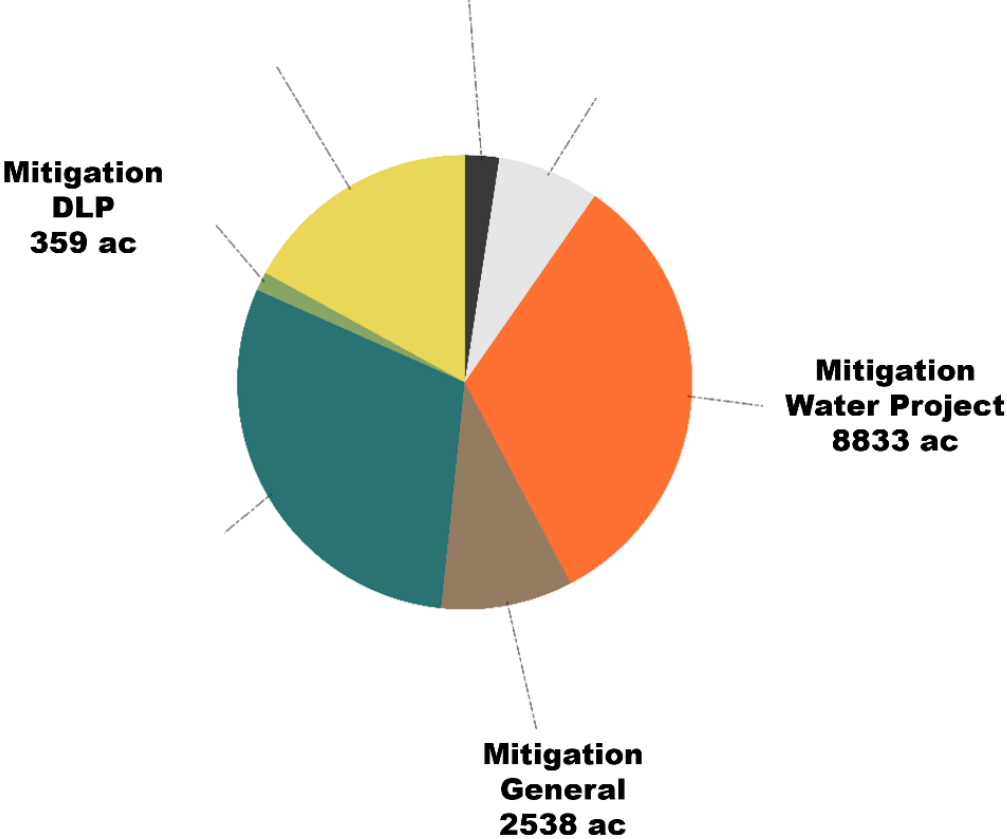
- Federally Endangered Species: Delta Smelt, Chinook Salmon, Steelhead, and Green Sturgeon
- 8,000 acres of tidal wetland mitigation required for water project operations by USFWS and NOAA ESA Biological Opinions
- 800 additional acres of tidal wetland restoration for Longfin Smelt
- Led by DWR, monitored by CDFW



Acreage across completed, in-progress and planned projects

Restoration Motivations: All Mitigation

- Other mitigation required by CEQA & NEPA
- **43% (11,730 acres)**



Acreeage across completed, in-progress and planned projects

Restoration Motivations: DWR Delta Levees Program AB 360

- DWR Delta Levees Program
- AB 360 “ecological uplift”
- **17% (4607 acres)**



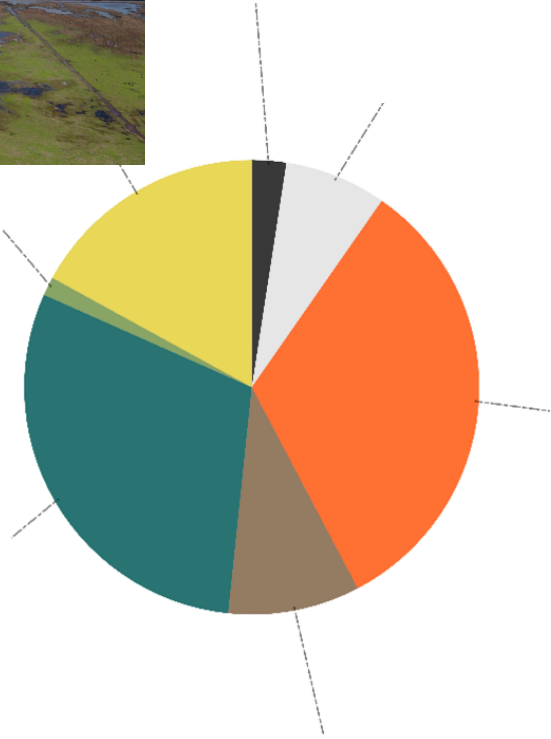
Acreage across completed, in-progress and planned projects

Restoration Motivations: Ecosystem Services and Green Infrastructure

- Restoration for specific ecosystem services
- Mostly non-tidal wetlands for subsidence reversal
- 3,500 acres are planned Metropolitan Water District project on Webb Tract
- **30% (8130 acres)**



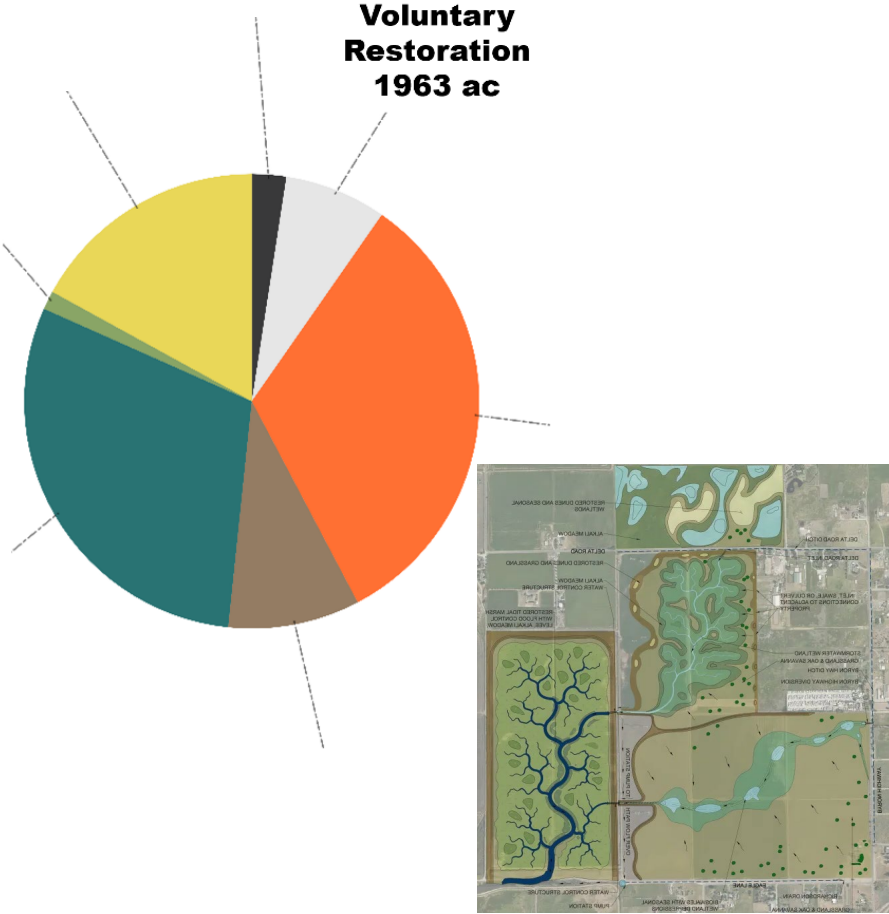
**Ecosystem Services
and Green
Infrastructure
8130 ac**



Acreage across completed, in-progress and planned projects

Restoration Motivations: “Voluntary” restoration

- Non-required restoration for ecological benefit
- **7% (1963 acres)**
- Contrast to SF Bay and California at large, which accounts for 40% of national voluntary restoration (Gittman et al. 2019)



Acreage across completed, in-progress and planned projects



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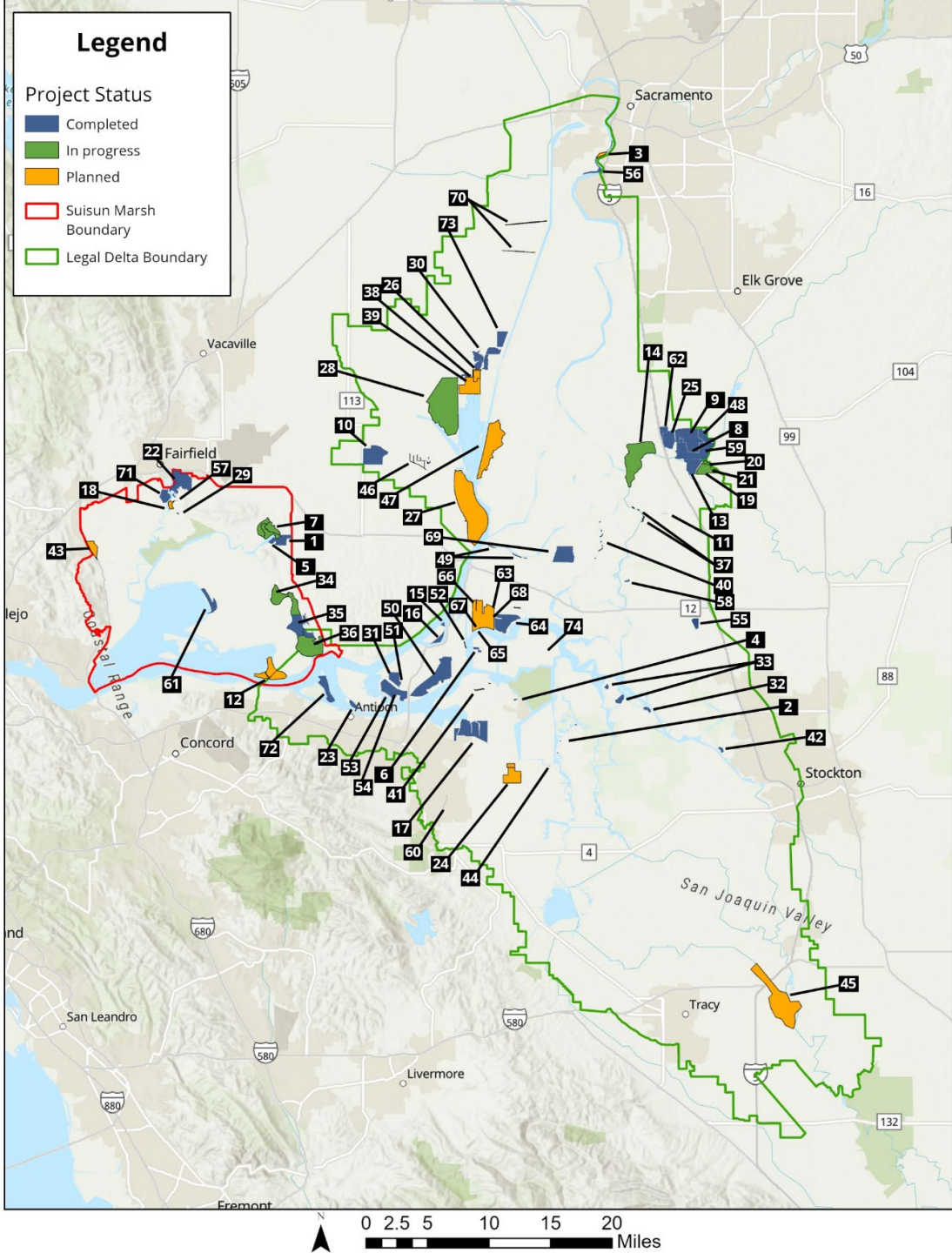


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Science and Management Gaps

- Integrating Bay and Delta data
- Analysis of restoration outcomes
- Tribal involvement and co-management (Hankins 2018, Zedler and Stevens 2018)
- Community involvement



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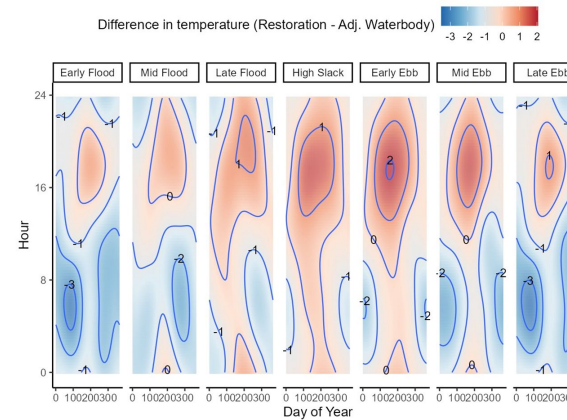
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Preliminary Insights: DWR/CDFW Fish Restoration Program

Invertebrate
Productivity



Temperature
refugia



Presence of
salmon and
smelt

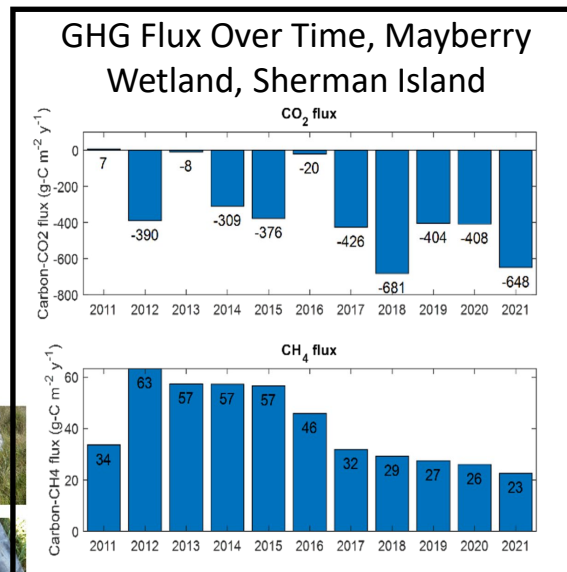
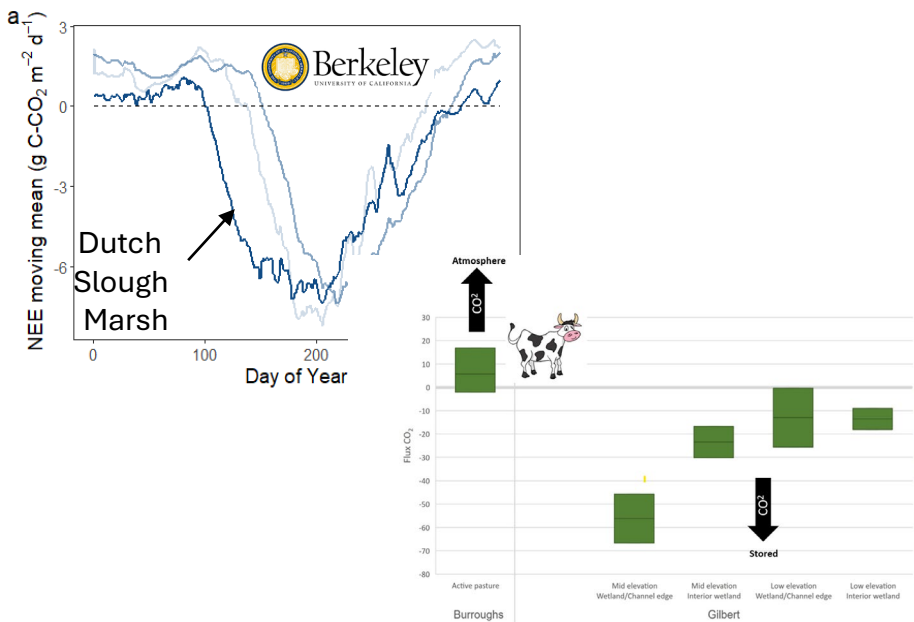


Preliminary Insights: Dutch Slough and Mayberry Wetlands

Tidal Carbon Sequestration

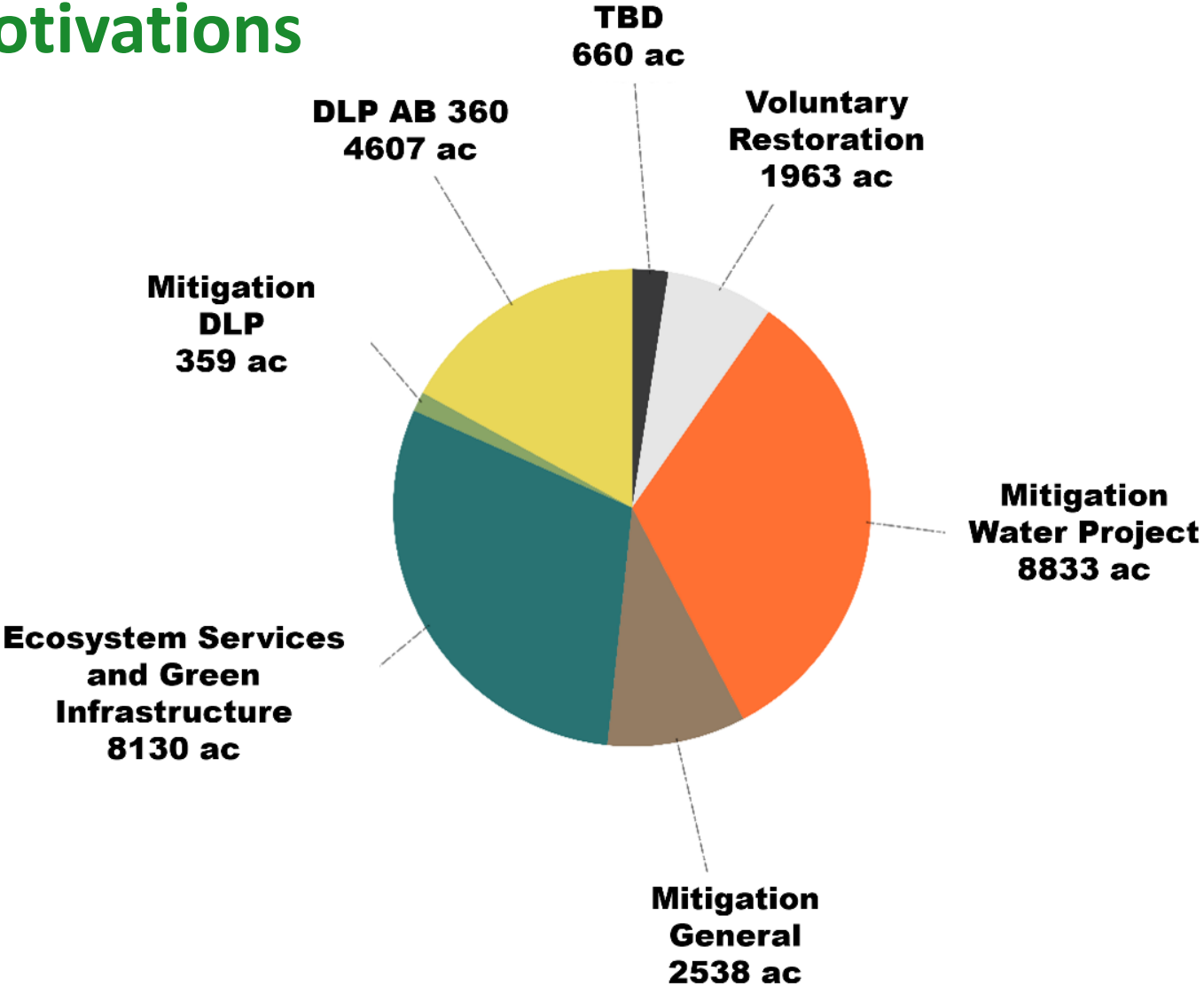
Non-Tidal Methane Production

Terrestrial Species Use



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Restoration Motivations



Acreage across completed, in-progress and planned projects