Lessons learned from 40+ Years of Fill for Wetland Restoration in San Francisco Bay

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ESA

BCDC Commission
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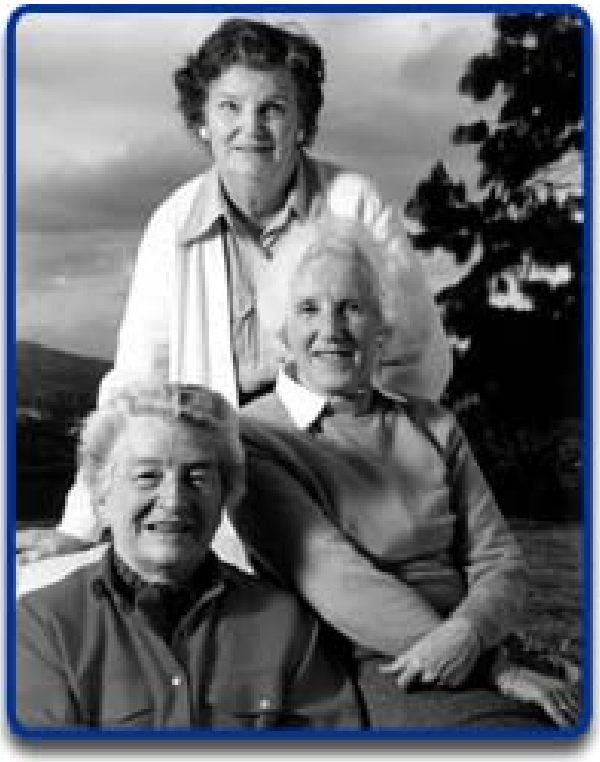
Acknowledgements

Philip Williams
Phyllis Faber
Jeffrey Haltiner

…and many others

An Age of Environmentalism



Save the Bay founders Kay Kerr, Sylvia McLaughlin and Esther Gulick

- 1961 Save San Francisco Bay Association
- 1965 The McAteer-Petris Act (regulates fill in bay)
- 1969 The Bay Conservation & Development Commission (BCDC)
- 1968 USGS begin monitoring of San Francisco Bay
- 1972 Clean Water Act
- 1973 Endangered Species Act
- 1976 California State Coastal Conservancy
- 1976 California Coastal Commission

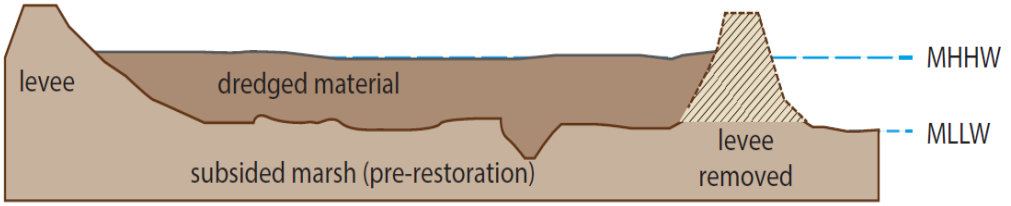
Tidal Wetland Restoration Approaches
San Francisco Bay History

Dates (approx.)	Era
1970s, 1980s "1st generation"	**Replicate Marshes** Driven by compensatory mitigation and dredged material disposal. Grade, plant and breach.
1990s, 2000s "2nd generation"	**Baylands Habitat Goals** Restore natural processes. Sediment as a resource. Larger scale restorations. Regional planning, goal of 100,000 acres
2010s – today Current issues	**Baylands Ecosystem Goals Update** "Complete shoreline" Sediment shortage Resilience to climate change Restoring functional landscapes Natural Infrastructure and other co-benefits

Note: modified from Williams and Faber 2001, Peter Baye 2015.


First Generation: Mature Marsh Model
China Camp

First Generation Muzzi Marsh



- Mitigation
- Filled to natural marsh elevation
- Breached 1976
- Vegetated marsh
- Limited diversity
  - Channels later excavated

Source: Google, 2018

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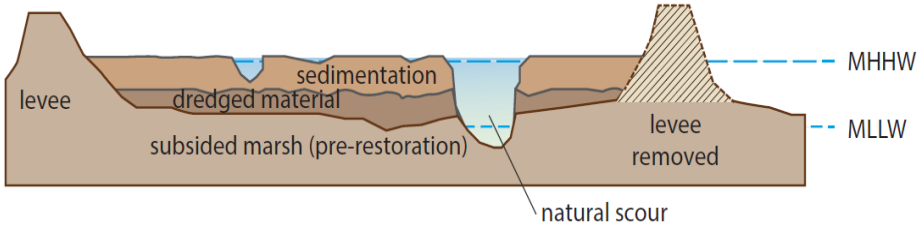
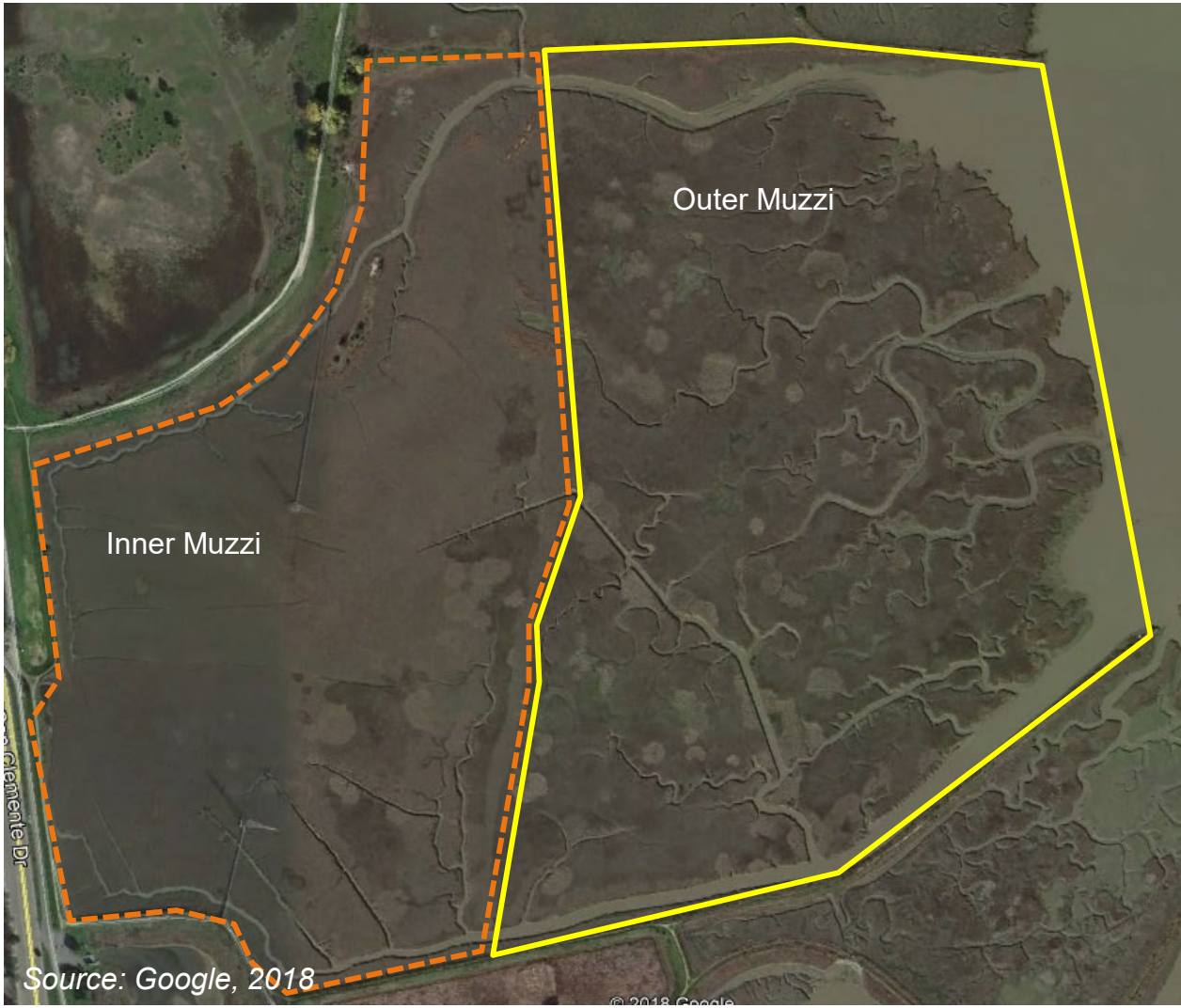
Second generation Outer Muzzi Marsh

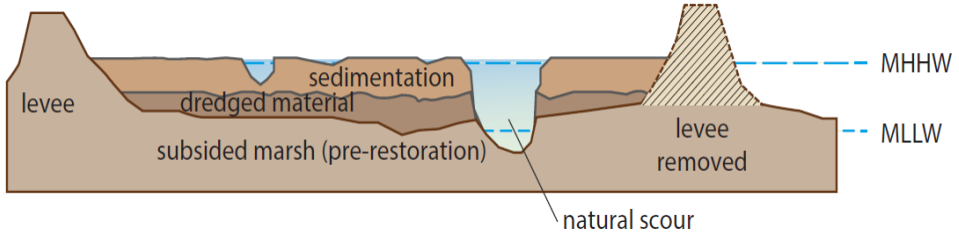


- Accidental overflow of dredged material
  - 1.6 ft below natural marsh
- Breached 1976 (same as Inner Muzzi)
- Higher diversity



2nd Generation Sonoma Baylands

- 1996
- Dredged material + estuarine sedimentation
- Natural vegetation colonization
- 300 acres



US Army Corps of Engineers

Coastal Conservancy

SONOMA LAND TRUST

Sonoma Baylands
Channels and Marsh Form Together

Photo: ESA c. 2006

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Sonoma Baylands
Special Status Species: Ridgway's Rail

- First detected onsite in 2004 (Year 8)
  - Foraging onsite
  - Nesting in outboard marsh
- 2017 update
  - 23 rails

Photo: ESA 2005

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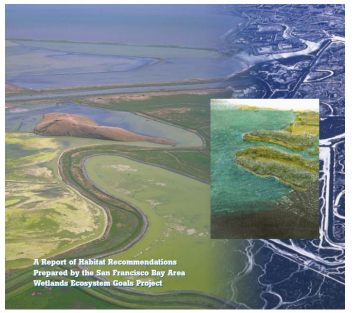
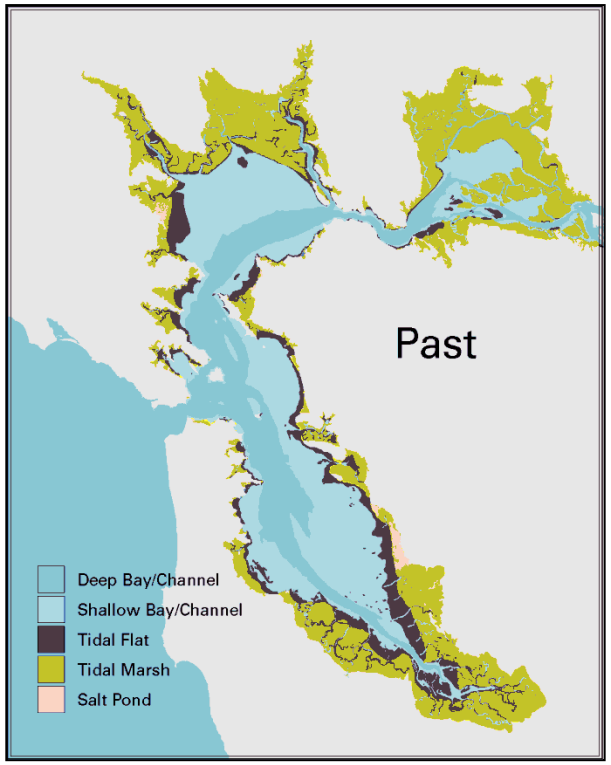
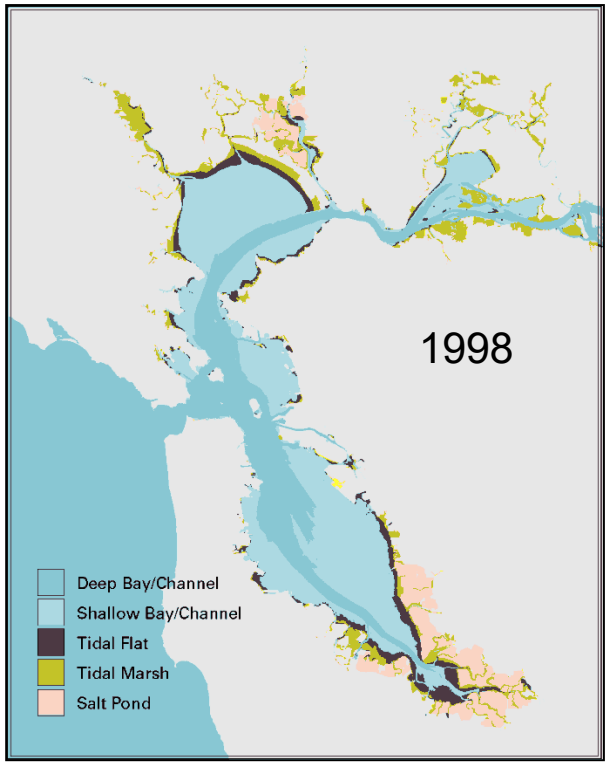
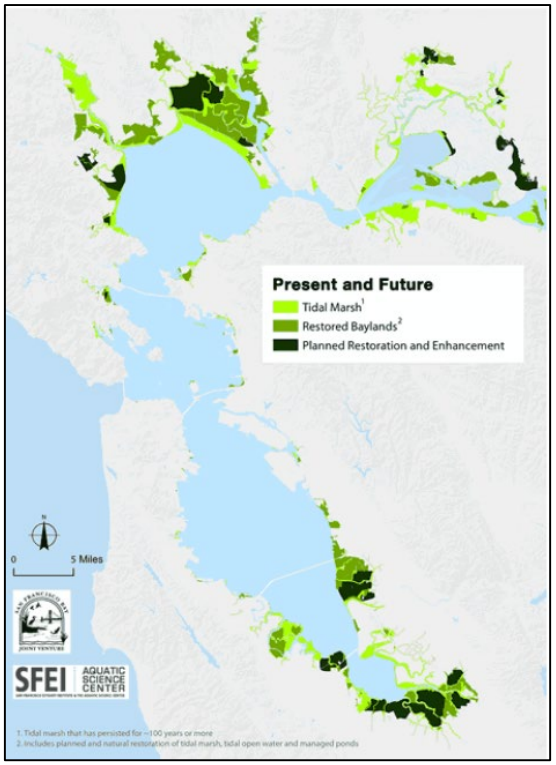
2nd Generation: Regional Planning Baylands Goals Project (1999)

Baylands Ecosystem Habitat Goals









190,000 ac **40,000 ac** **100,000 ac**

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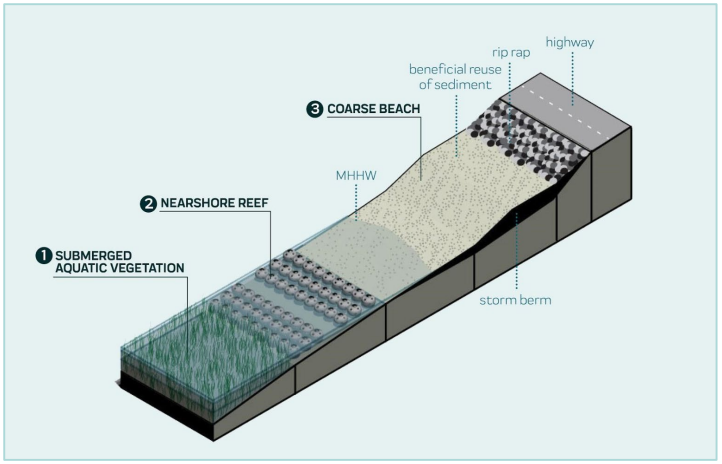
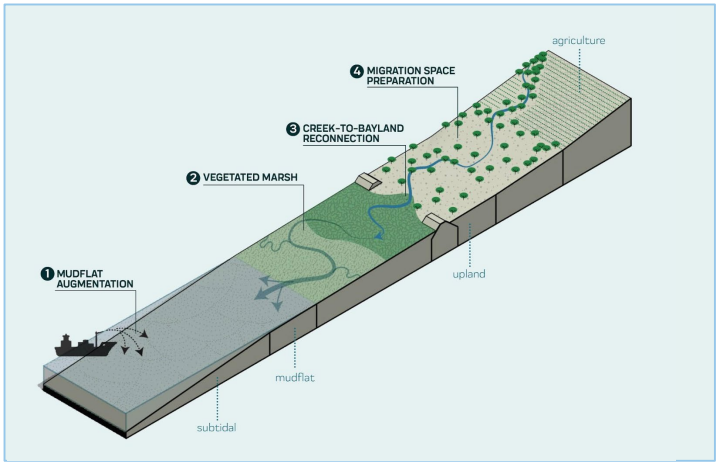
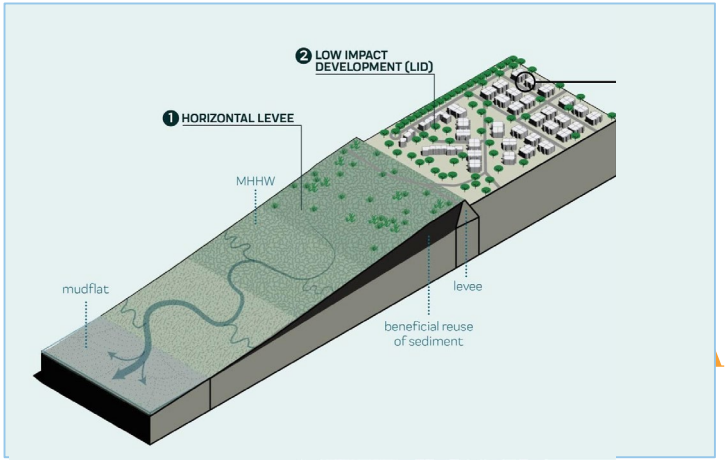
“Complete” shoreline

- Connected from subtidal to uplands
- Habitat diversity
- Ecological function



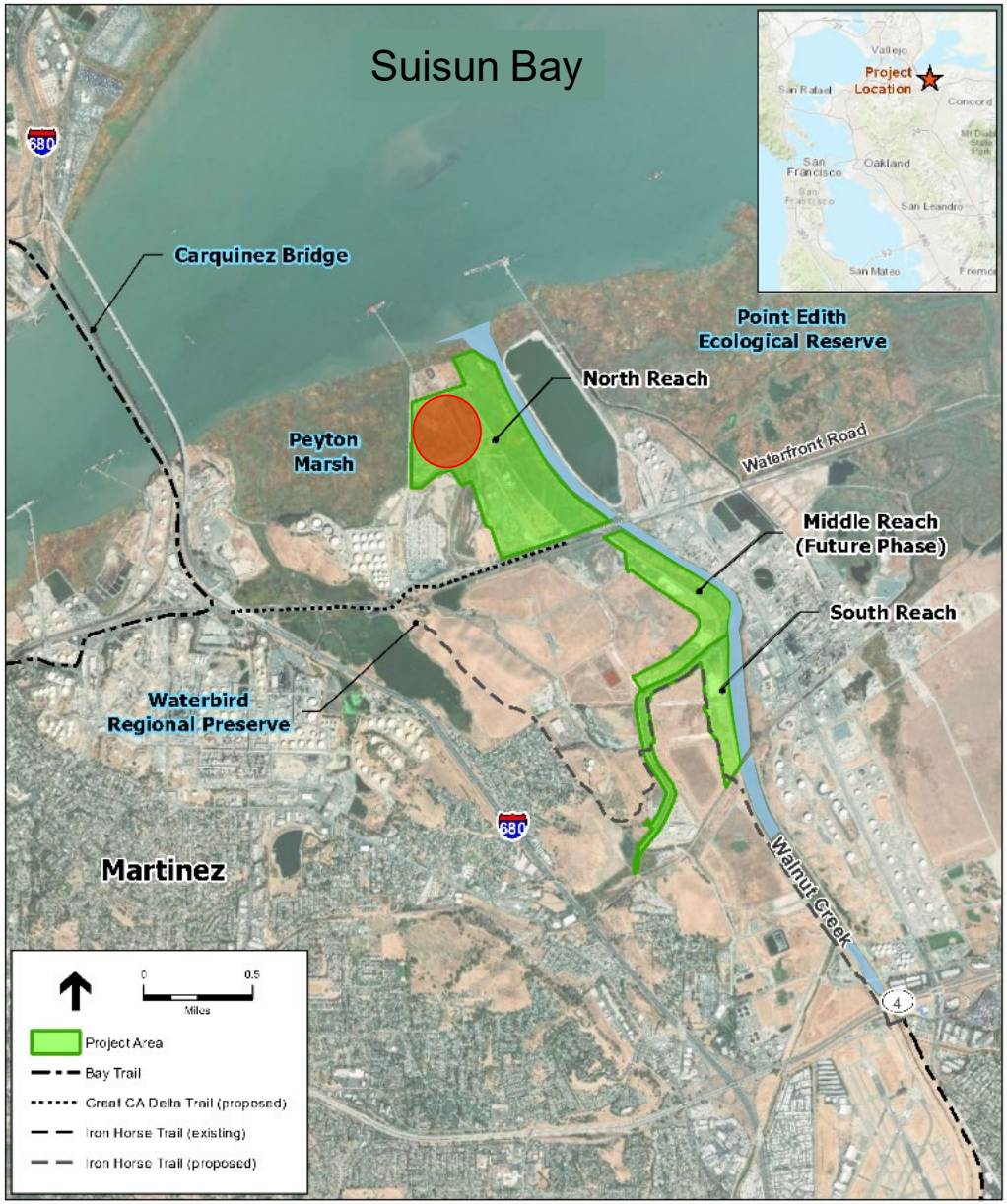




50 YEARS
1969-2019

3rd Generation Lower Walnut Creek Restoration

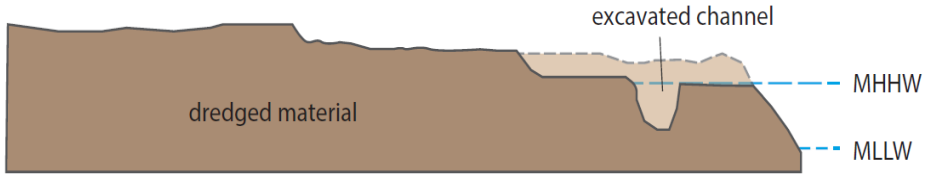
- Lower 4 miles of brackish tidal creek
- Dredged Material
- Change in design approach



Source: ESA 2017

Lower Walnut Creek Restoration

Marsh to Upland Ecotone



- Broad ecotone, gentle slopes
- Interdigitated
- Migrate landward with sea-level rise

North Reach (detail)

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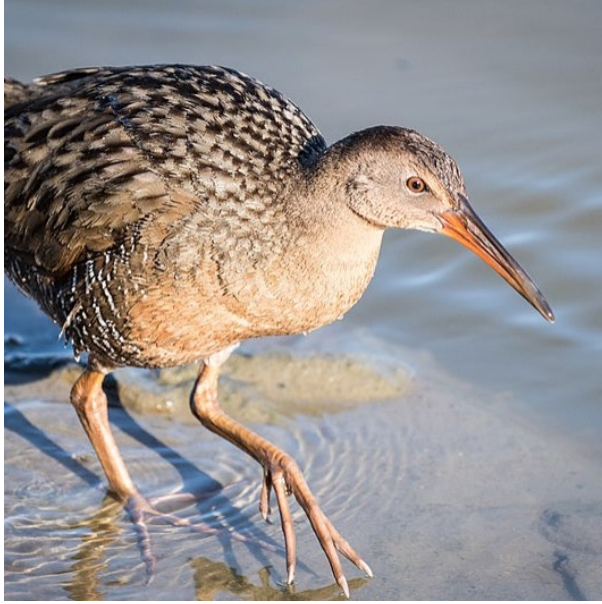
Marsh-Upland Ecotone

- High tide water refuge for terrestrial marsh wildlife
- Future marsh
- Opportunities for restoration rare

Suisun Marsh Aster
Photo: ESA

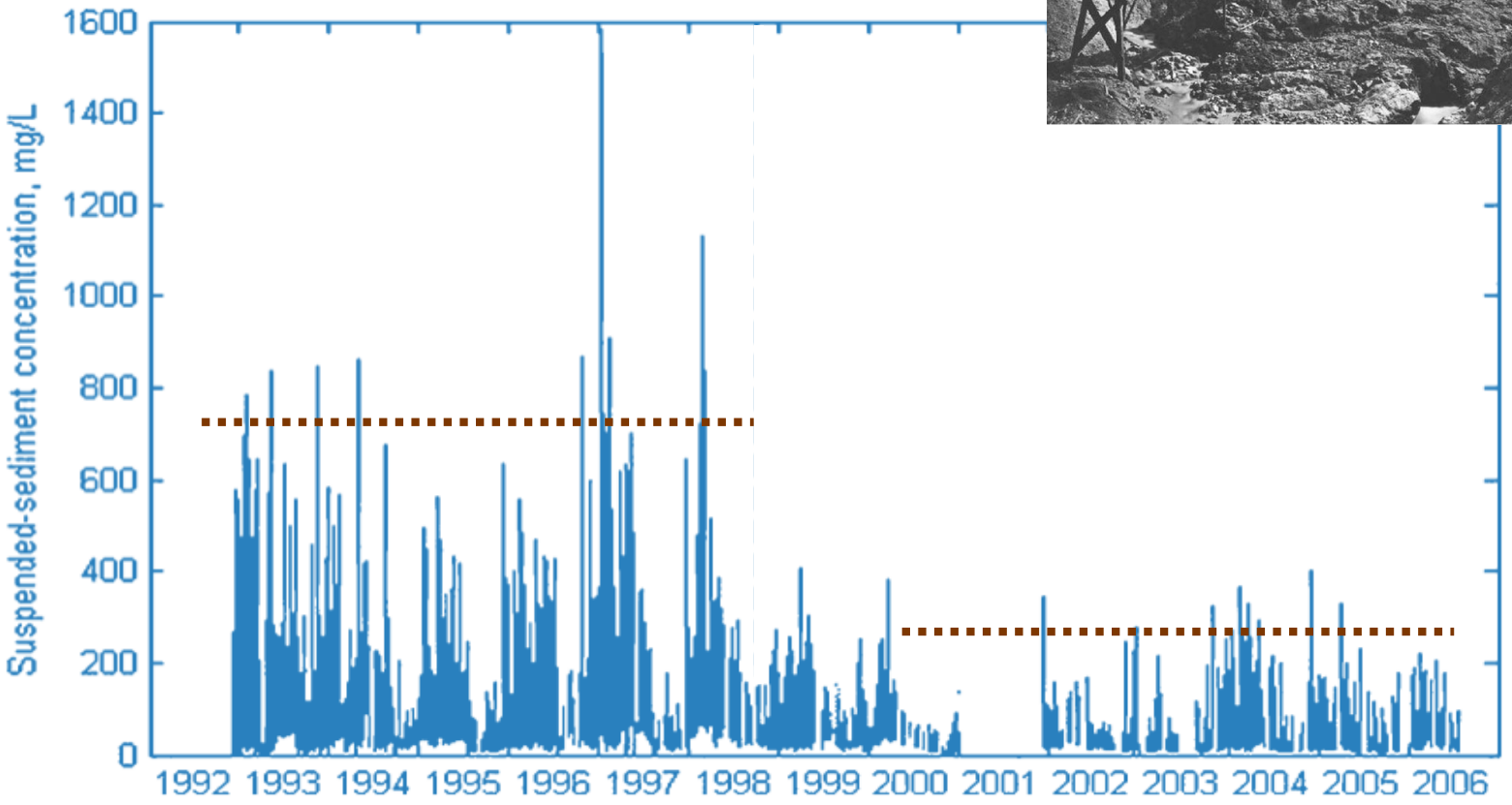


Ridgway's rail
Photo: Rebecca Matsubara, courtesy of Creative Commons

Salt Marsh Harvest Mouse
Photo: Pelican Media

Egrets at high tide
Photo: Michelle Orr

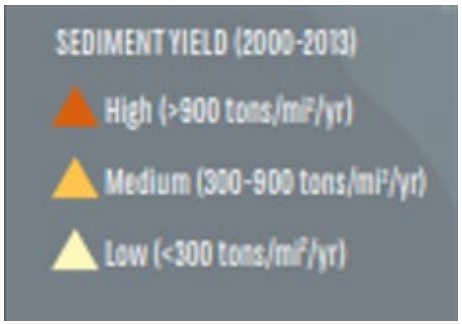
Sediment Shortage



Suspended Sediment concentrations, Point San Pablo.
Source: Schoellhamer, 2011.

Watershed sources of sediment

- How much sediment do we have?
- How much mudflat and tidal marsh is sustainable?
- Where are the most sustainable areas?



Source: SFEI 2017

Conclusions and Looking Forward

- In the beginning, big steps forward but overly simplistic approach, expectations of “instant marsh”
- 2nd generation
  - Recognize importance of site evolution and sustainable natural processes
  - Regional goals
- Current focus on resilient landscapes, climate resilience
  - New restoration approaches may require more fill, different types of fill, and fill in new locations
    - Restoring marsh to upland transitions
- Sediment has shifted from something to dispose of to a valuable resource
  - In increasingly short supply, especially with sea level rise