Risks and Consequences of Sea Level Rise for Tidal Wetlands Resilience

Maya Hayden, PhD
Coastal Adaptation Program Leader

Sam Veloz, PhD
Climate Adaptation Group Director

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Restoration Authority Board Meeting
September 21, 2018

Important points we will cover

- Two ways for marshes to be sustained with rising seas:
  - Build up in place
  - Move to higher ground
- Losing tidal marsh results in loss of biodiversity, levee protection, and carbon stored in plants
- Vulnerabilities are not the same everywhere around the Bay
- Sediment availability is a critical factor, and should be considered in how we prioritize the location of and types of restoration efforts.
- In prioritizing restoration efforts TODAY, consider where marshes are likely to be sustained in the future, not just where they are now

Marsh elevations change through time

June 2011

April 2008

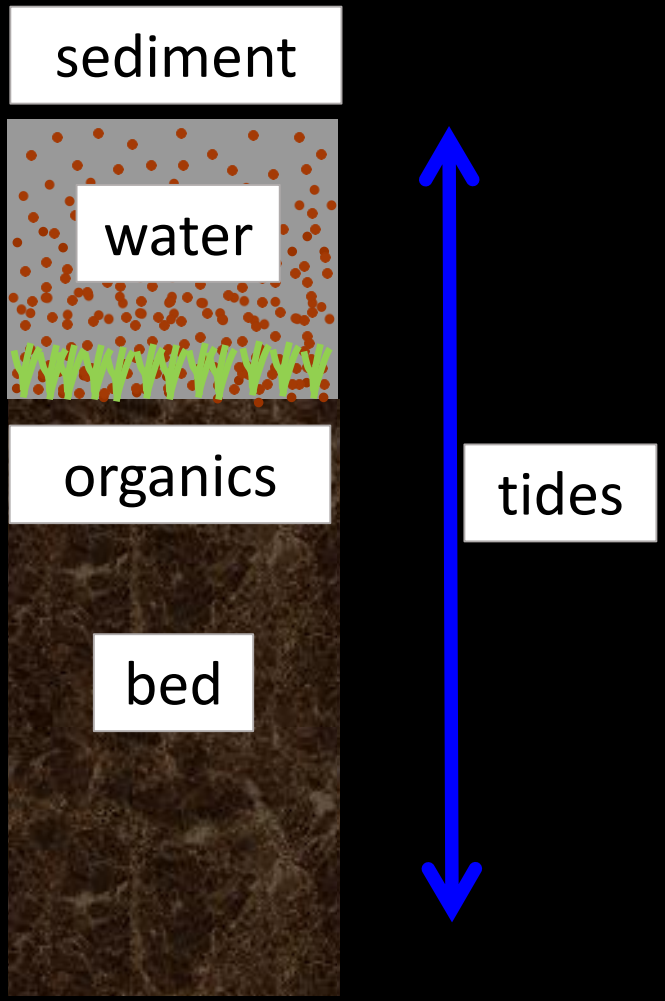

Image Credits: C. Benton

South Bay Salt Pond A21 marsh accretion after tidal action restored

Marsh elevations change through time

June 2011

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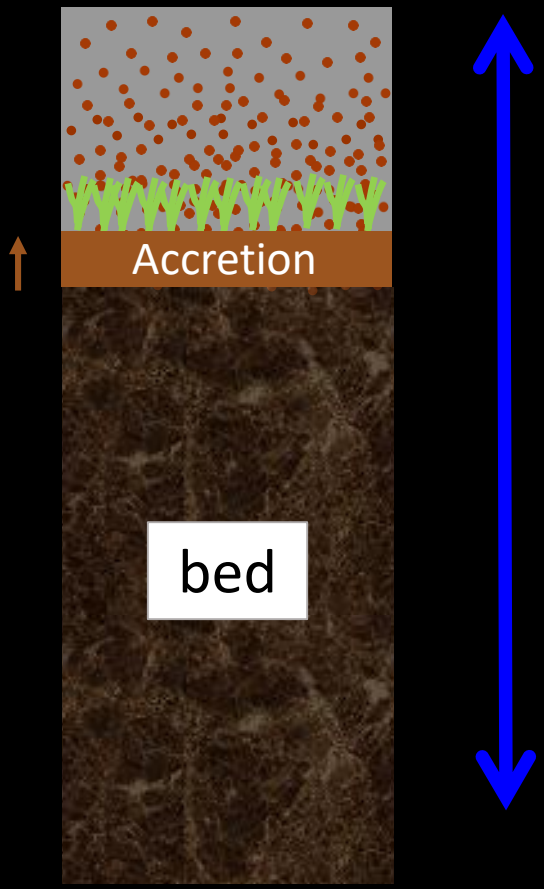

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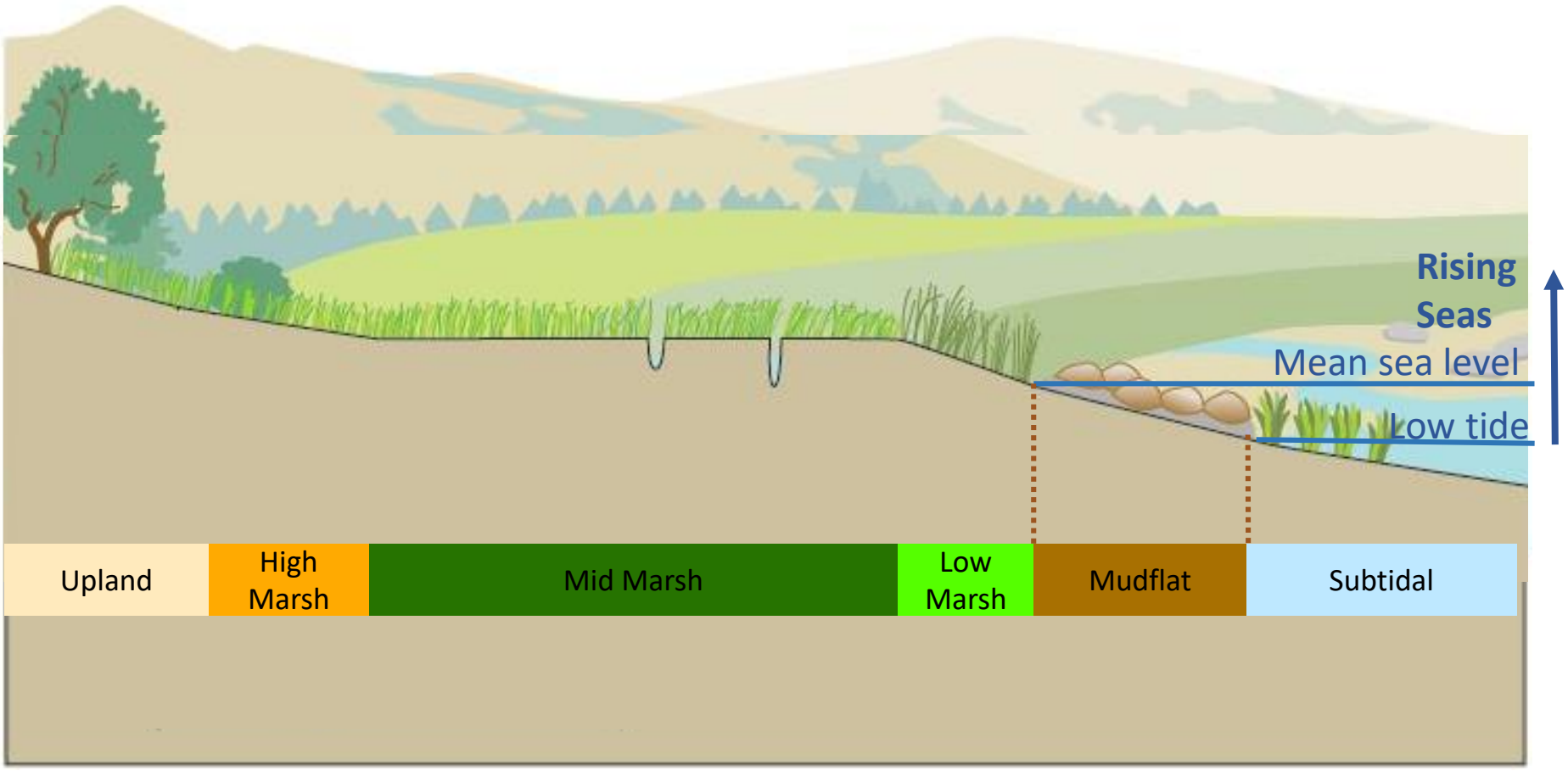
South Bay Salt Pond A21 marsh accretion after tidal action restored

Marshes “move” to higher ground

If they can’t accrete fast enough



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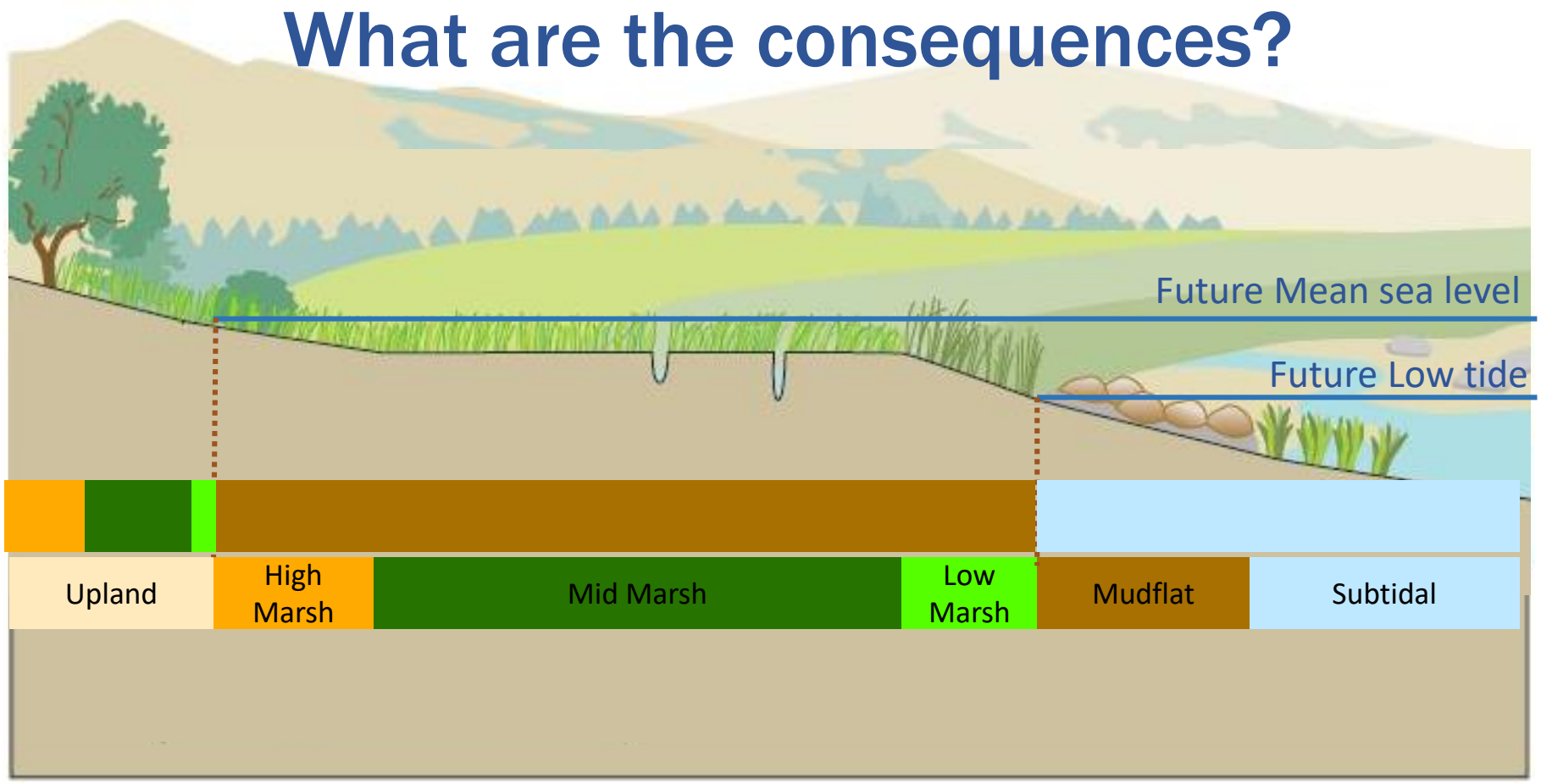
Marshes “move” to higher ground

If they can’t accrete fast enough

What are the consequences?



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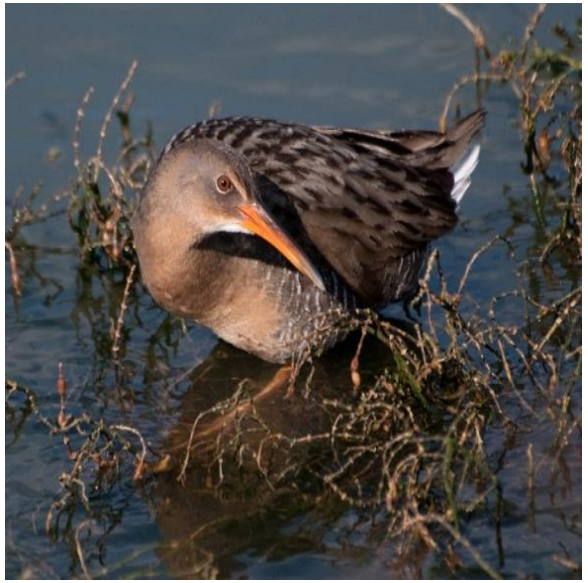
Wetlands Provide Multiple Benefits

- ✓ **Coastal Protection**
  - Buffer from storms and flooding
  - Decreased wave energy/run-up
  - Reduced erosion
  - Accretion of sediment
- ✓ **Fish & Wildlife Habitat**
- ✓ **Recreation**
- ✓ **Carbon Sequestration**
- ✓ **Improved Water Quality**



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Credits: The Nature Conservancy (top left), State Coastal Conservancy (top right, lower right), US Army Corps of Engineers Visual Digital Library (lower left).

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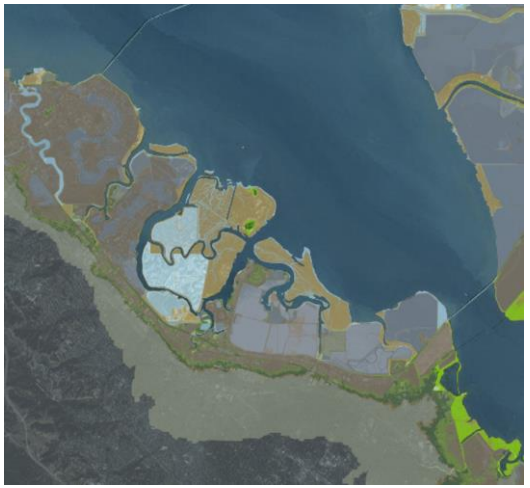
What/where are the risks & consequences of wetland loss with projected SLR?



Current conditions → Projected future habitat

Where should adaptation actions be prioritized to maximize benefits in the face of SLR?

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What benefits did we model?

Selection criteria:

- Represent a range of ecological and social benefits
- Leverage existing models/data
- Provide best available science within time constraints of decision-making

Wetland Habitat

Marsh Accretion w/ SLR

Biodiversity Support

Tidal Marsh Bird Indicator Abundance

Coastal Protection

Wave Attenuation

Climate Regulation

Carbon Stock

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Input Assumptions and Scenarios

Developed with Steering Committee

1 SLR curve (High)

2 Sediment Supply (H/L)

Output Change Relative to 2010 Baseline

Year	SLR (cm)	Sediment
2040	25	High Low
2070	100	High Low
2100	225	High Low

Wetland Habitat

Marsh Accretion w/ SLR

Biodiversity Support

Tidal Marsh Bird Indicator Abundance

Coastal Protection

Wave Attenuation

Climate Regulation

Carbon Stock

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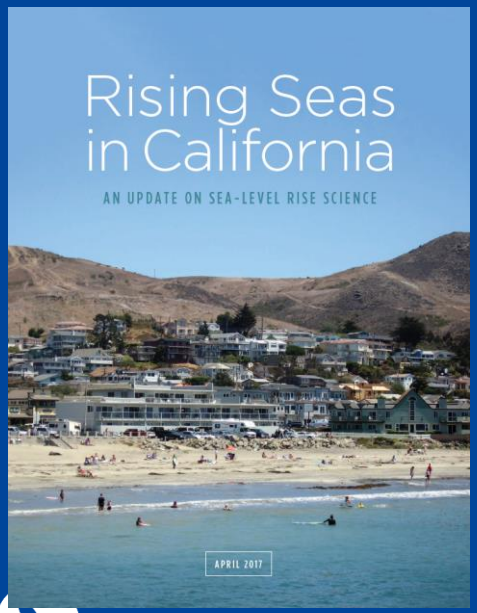
SLR

Creating Probabilistic Sea Level Rise Projections
to support the 4th California Climate Assessment

Daniel R. Cayan
Julie Kalansky
Sam Iacobellis
David Pierce
with important input from Robert Kopp, Rutgers University

Division of Climate, Atmospheric Sciences, and Physical Oceanography
Scripps Institution of Oceanography
La Jolla, CA
06 June, 2016



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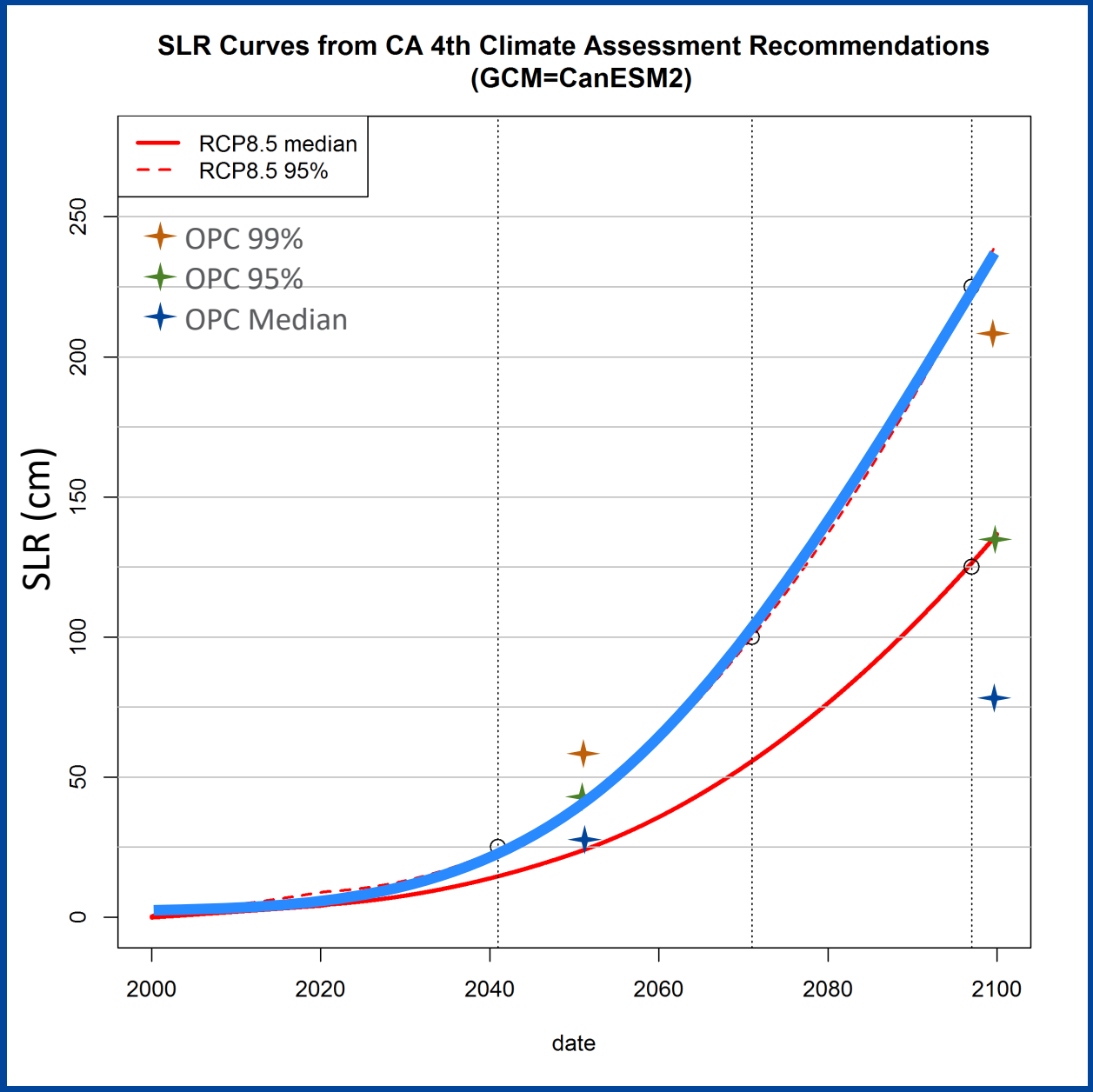
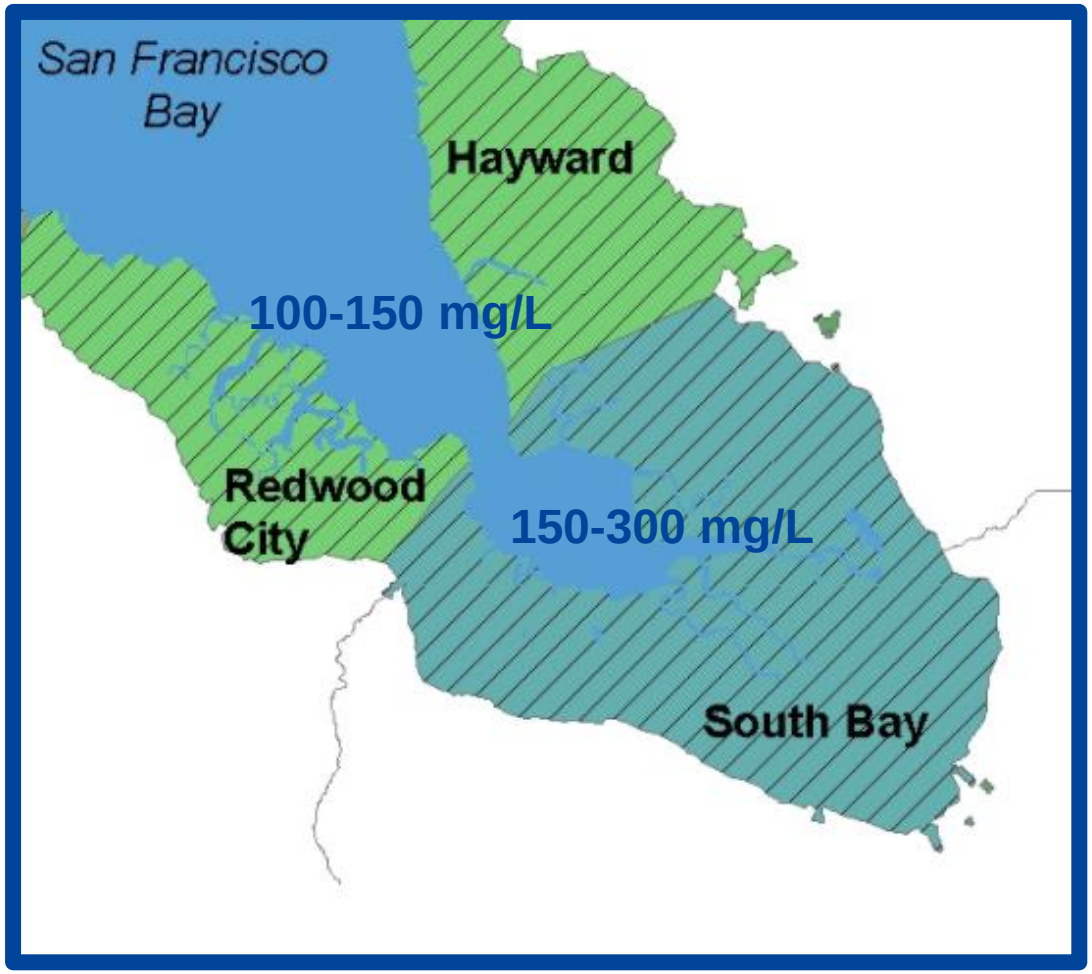


Sediment

Mineral Sediment

- **Low and High scenario** for each region
- Based on local/regional data
- Stralberg et al. 2011, PLoS ONE



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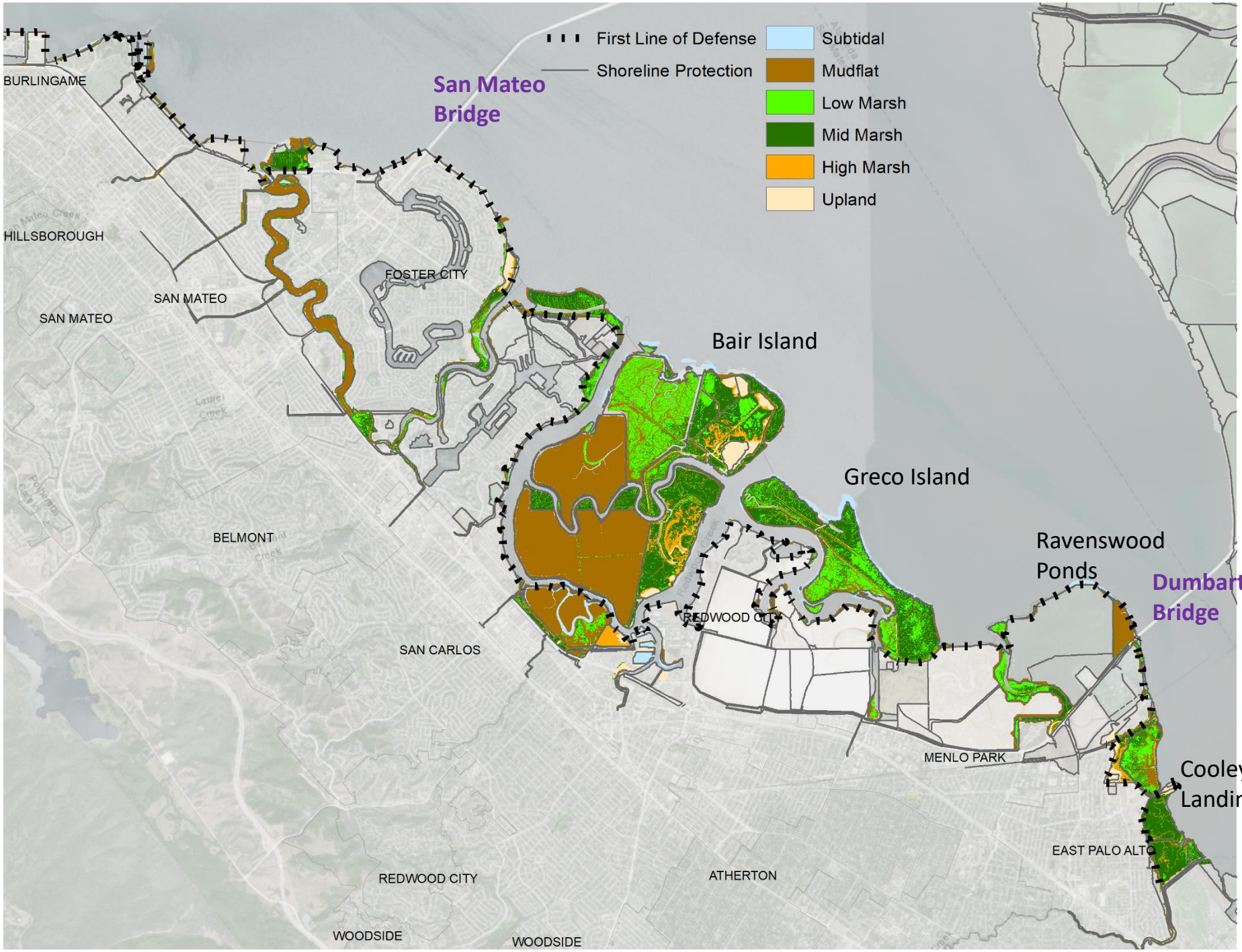
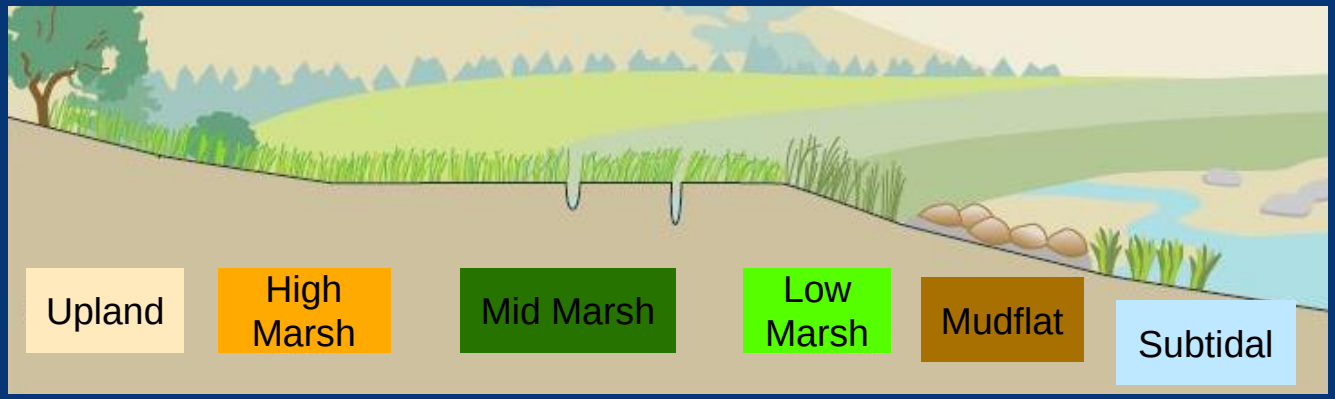
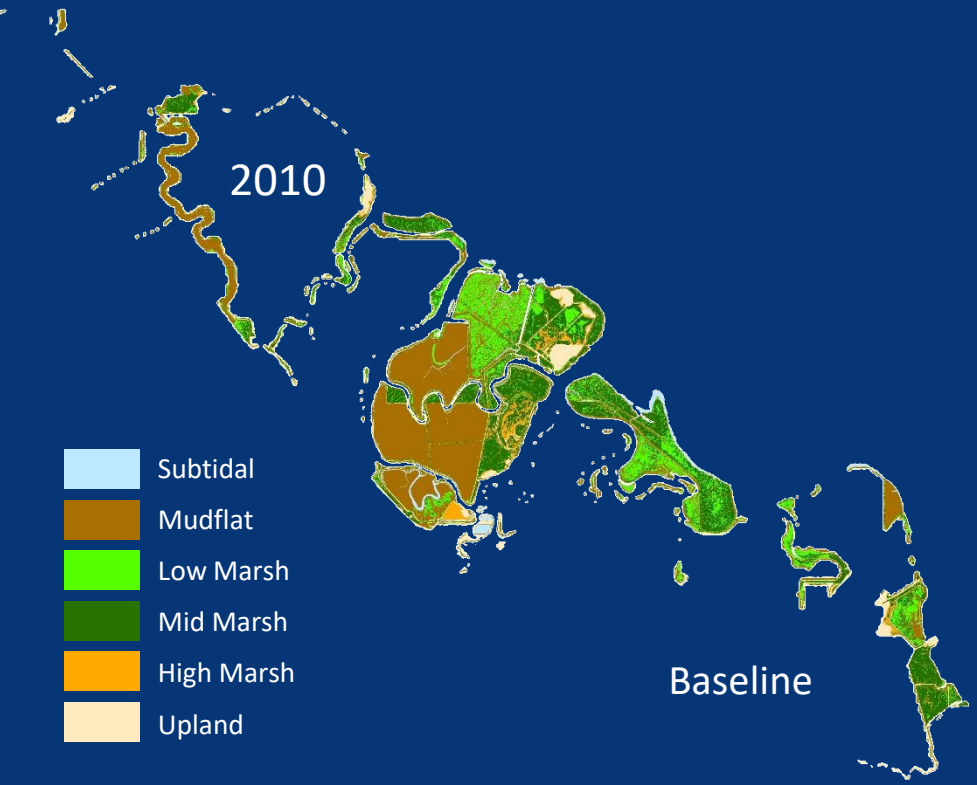

First Line of Defense
Shoreline Protection
Subtidal
Mudflat
Low Marsh
Mid Marsh
High Marsh
Upland
San Mateo Bridge
Bair Island
Greco Island
Ravenswood Ponds
Dumbarton Bridge
Cooley Landing
BURLINGAME
HILLSBOROUGH
SAN MATEO
SAN MATEO
FOSTER CITY
BELMONT
SAN CARLOS
REDWOOD CITY
MENLO PARK
EAST PALO ALTO
ATHERTON
REDWOOD CITY
WOODSIDE
WOODSIDE

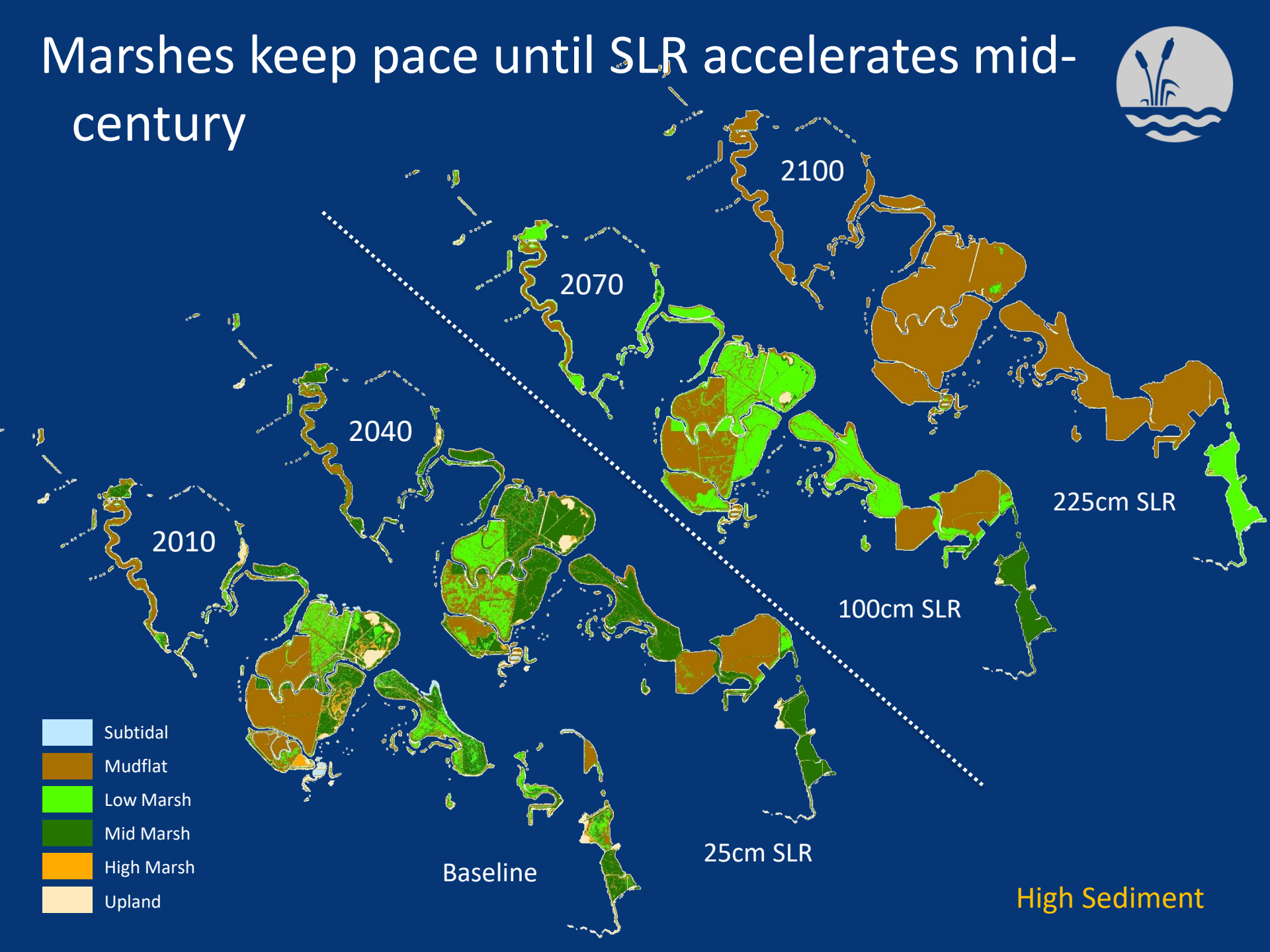


Goals Project 2015

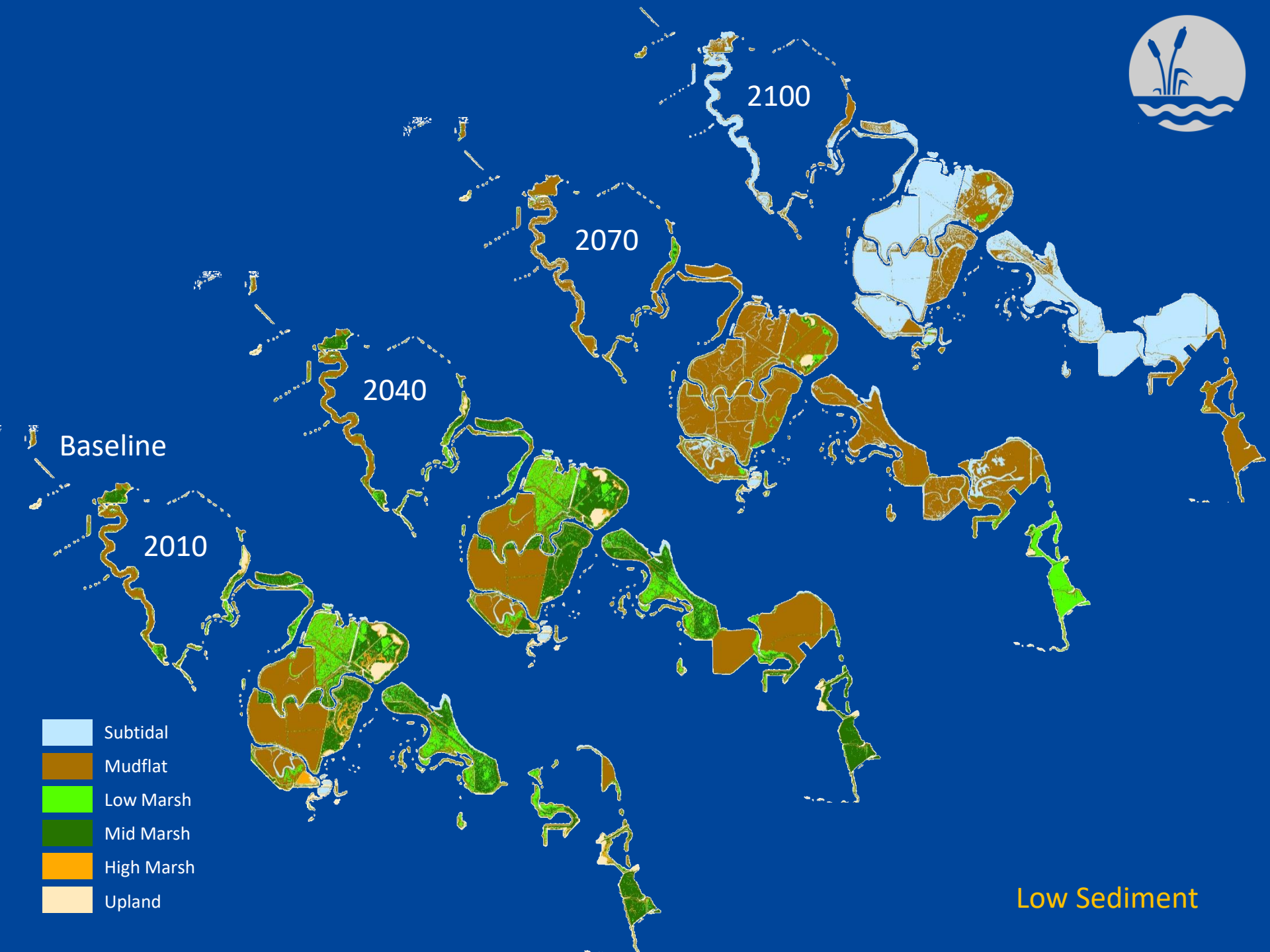
Profile view of a tidal marsh.



Marshes keep pace until SLR accelerates mid-century



High Sediment

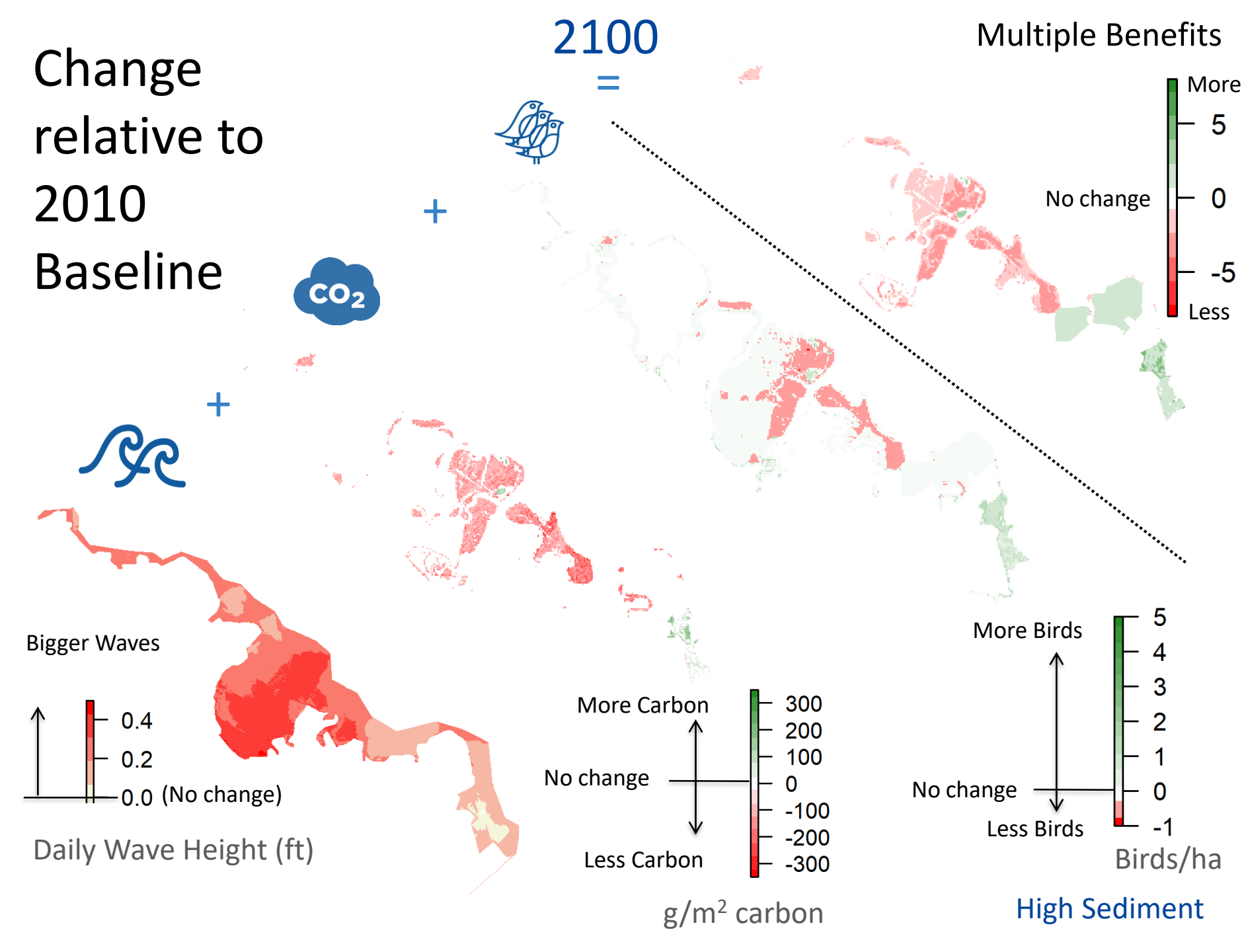

2100
2070
2040
Baseline
2010
Subtidal
Mudflat
Low Marsh
Mid Marsh
High Marsh
Upland
Low Sediment

Change relative to 2010 Baseline

2100

=

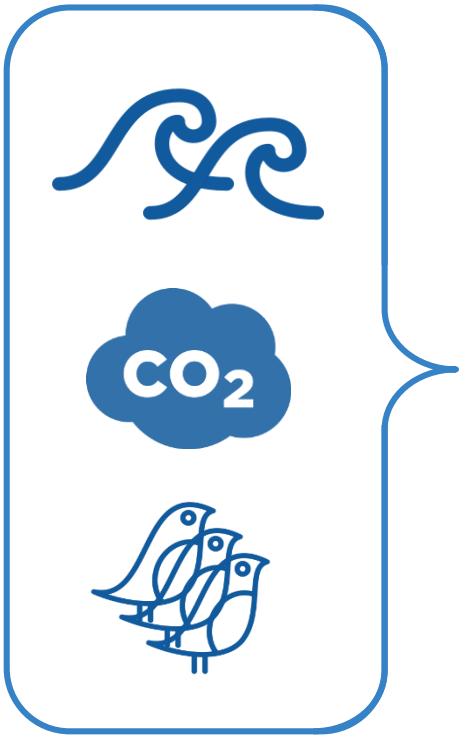
Multiple Benefits

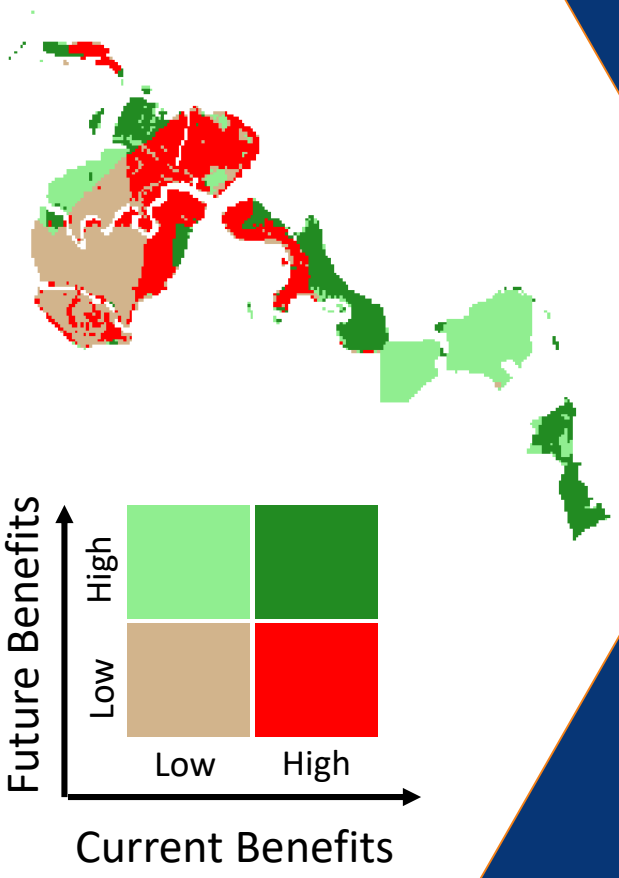


High Sediment

Where will benefits be retained or lost?

Wetland Vulnerability Assessment





Inform Adaptation Planning

Where should adaptation actions be prioritized to maximize benefits in the face of SLR?

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Key Takeaways

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- Losing tidal marsh results in loss of biodiversity, levee protection, and carbon stored in plants
- Vulnerabilities are not the same everywhere around the Bay
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Thank You!

Maya Hayden
mhayden@pointblue.org

Sam Veloz
sveloz@pointblue.org

Partners:

Funding:

Steering Committee:

Hilary Papendick	San Mateo County, Office of Sustainability
Kelly Malinowski	State Coastal Conservancy
Michael Barber	San Mateo County Board of Supervisors
Erika Powell	San Mateo County, Flood Resilience Program
Chris Barr	USFWS National Wildlife Refuge
John Bourgeois	South Bay Salt Pond Restoration Project
Len Materman	San Francisquito Creek JPA
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