Salt Marsh Management and the Coastal Ecosystem Response to Climate Change: A bottom-up approach for informing adaptation strategies

Karen M. Thorne, *Research Ecologist, USGS Western Ecological Research Center*

Roy W. Lowe*, Project Leader, Oregon Coast National Wildlife Refuge Complex*

Three Arch Rocks National Wildlife Refuge

Oregon Islands National Wildlife Refuge

Bandon Marsh National Wildlife Refuge

Nestucca Bay National Wildlife Refuge

Siletz Bay
National
Wildlife Refuge
Nicky

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Project Partners and PIs

USGS – John Takekawa, Glenn Guntenspergen, Mike Casazza, Neil Ganju, Bruce Jaffe, Patrick Barnard, Cory Overton, Susan De La Cruz, Judy Drexler, David Schoellhammer

Oregon State University – Bruce Dugger, Chris Janousek (postdoc), Kevin Buffington (phd student)

University of California, Davis – Mark Schwartz, Kat Powelson (MS student)

University of California, Los Angeles – Glen MacDonald, Rich Ambrose, Jordan Rosencranz (phd student), James Homquist (postdoc), Lauren Brown (MS student)

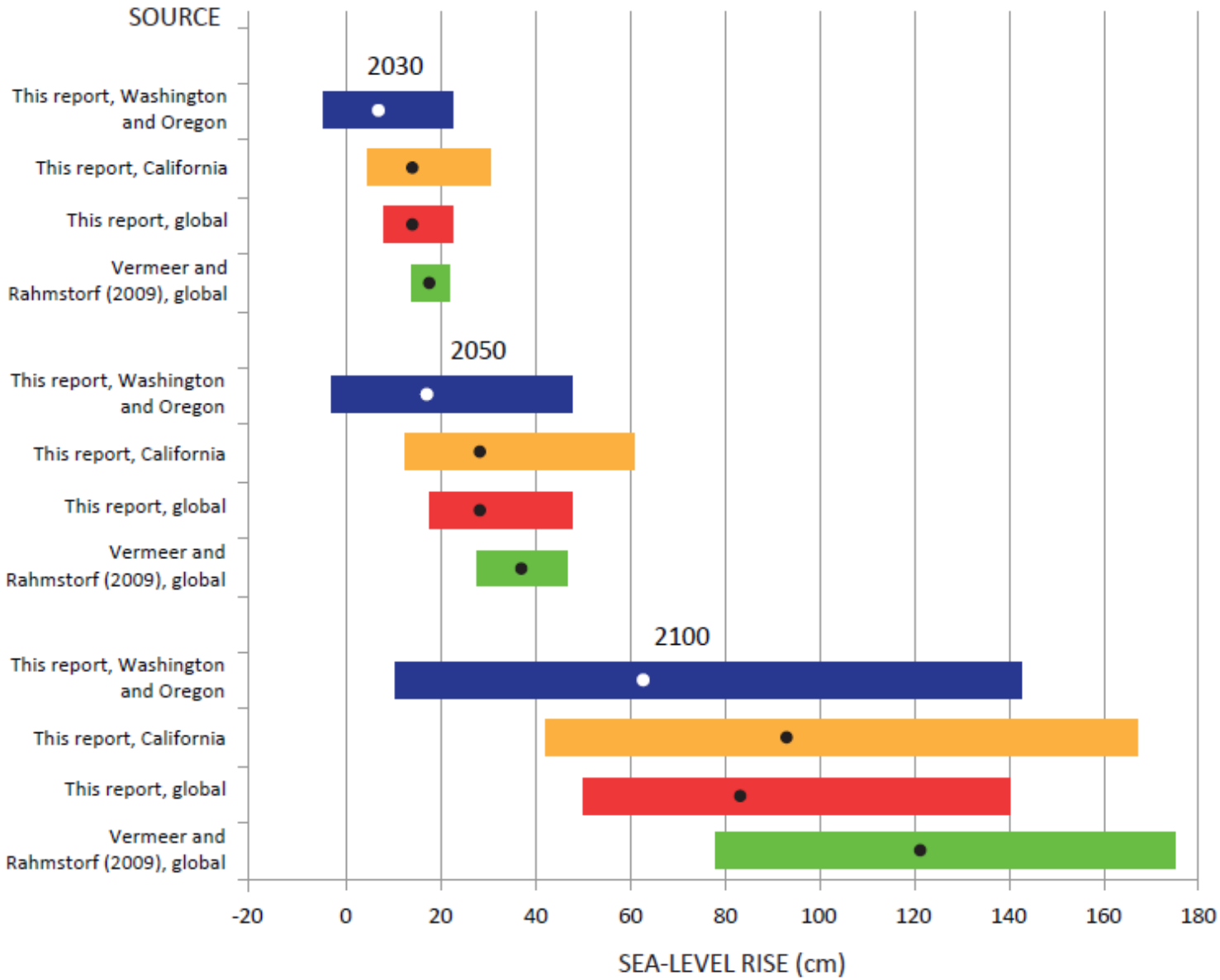
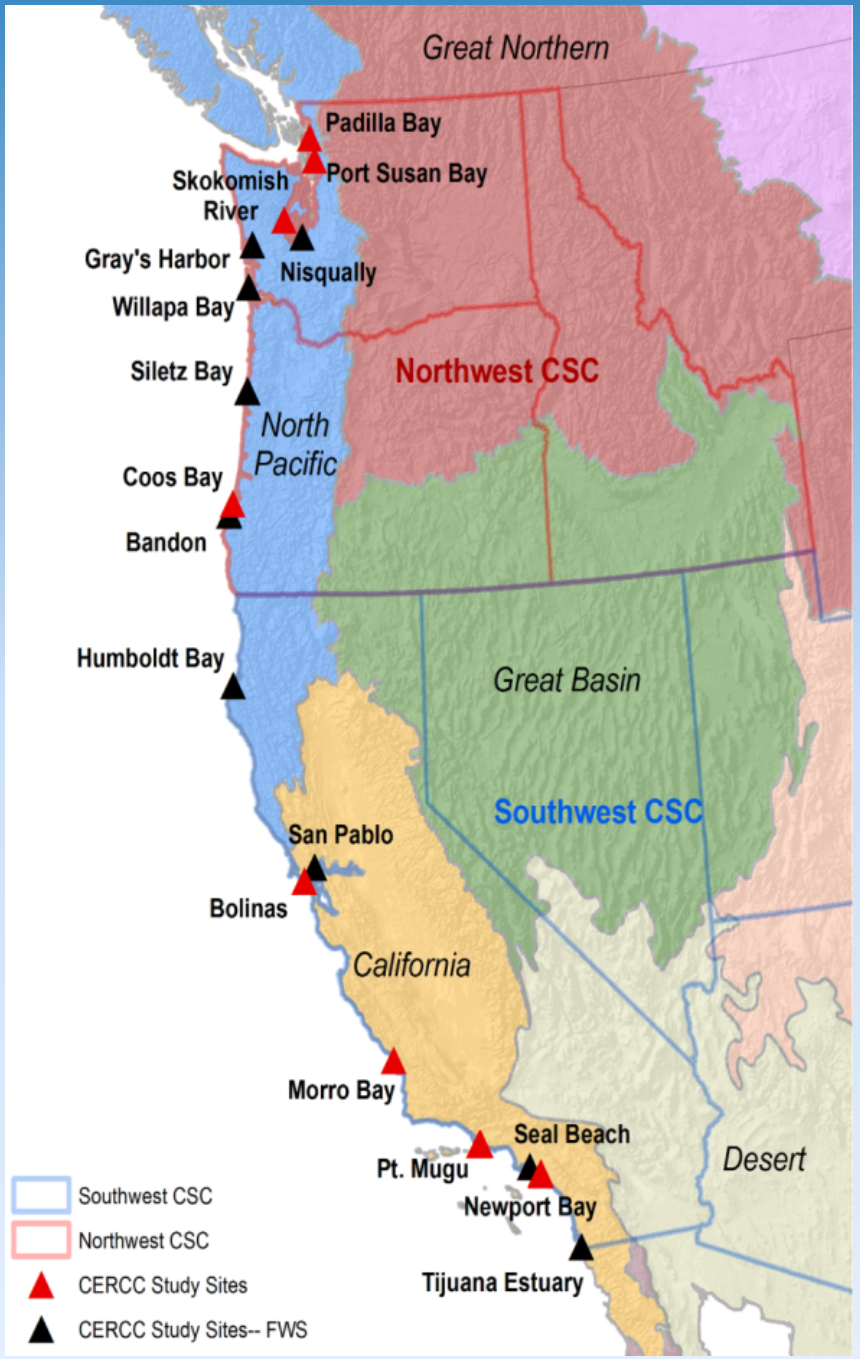


FIGURE 5.10 Committee's projected sea-level rise for California, Oregon, and Washington compared with global projections. The dots are the projected values and the colored bars are the ranges. Washington and Oregon = coastal areas north of Cape Mendocino; California = coastal areas south of Cape Mendocino.

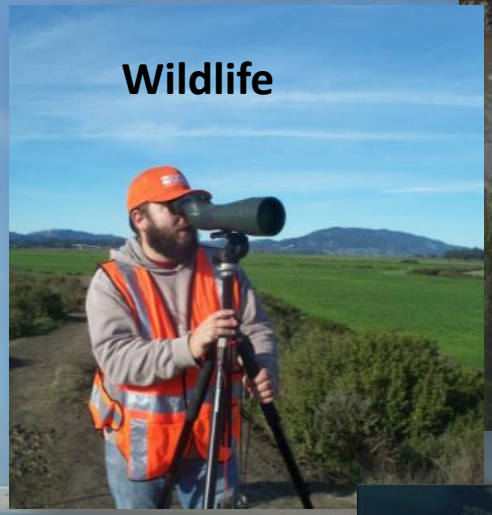
NRC 2012

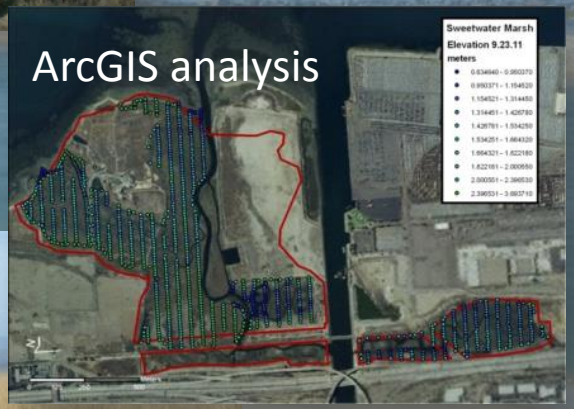
Tidal Marsh Network

- 17 Estuaries
- 1,700 ha
- 30,000 RTK GPS survey locations
- 7,000 Vegetation Surveys
- 83 water loggers
- 36 Surface Elevation Tables (SET)



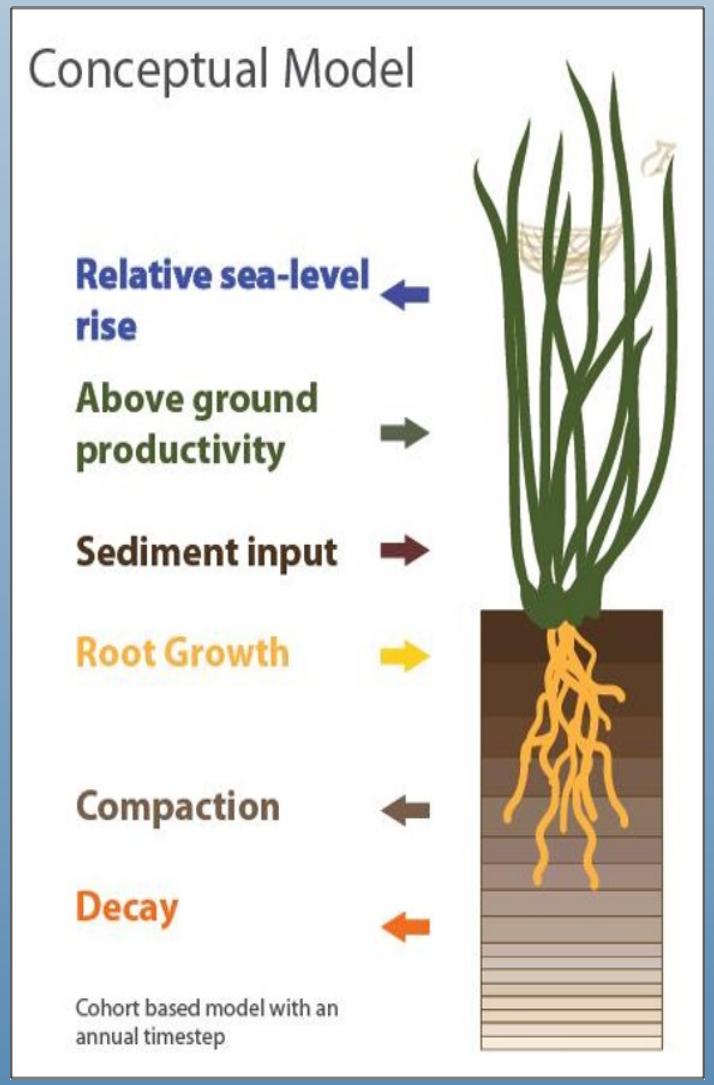
Data Collection





Marsh Sustainability Modeling

- Wetland Accretion Rate Model for Ecosystem Resilience (WARMER)
- 1-D cohort model simulating marsh soil processes
- Sea-level rise projections (NRC 2012)
  - 12 cm
  - 63 cm
  - 142 cm



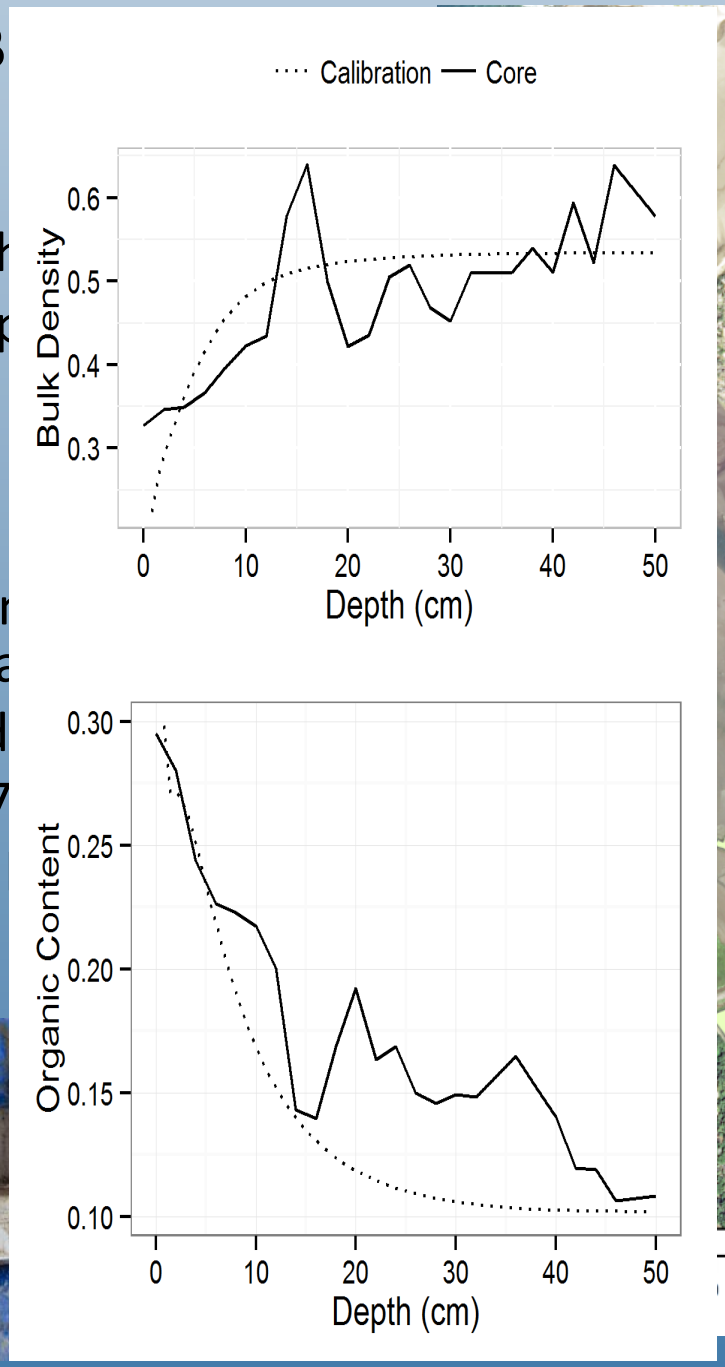
Swanson *et al.* 2013

Study site: Siletz B
Millport Slough

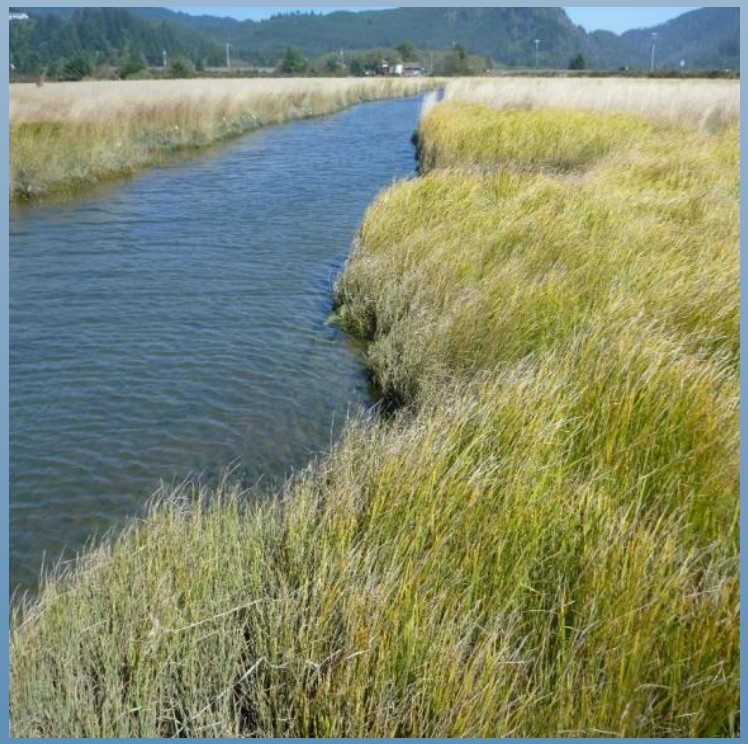
- 55 ha
- Mid-high marsh
- Highly diverse p
  community

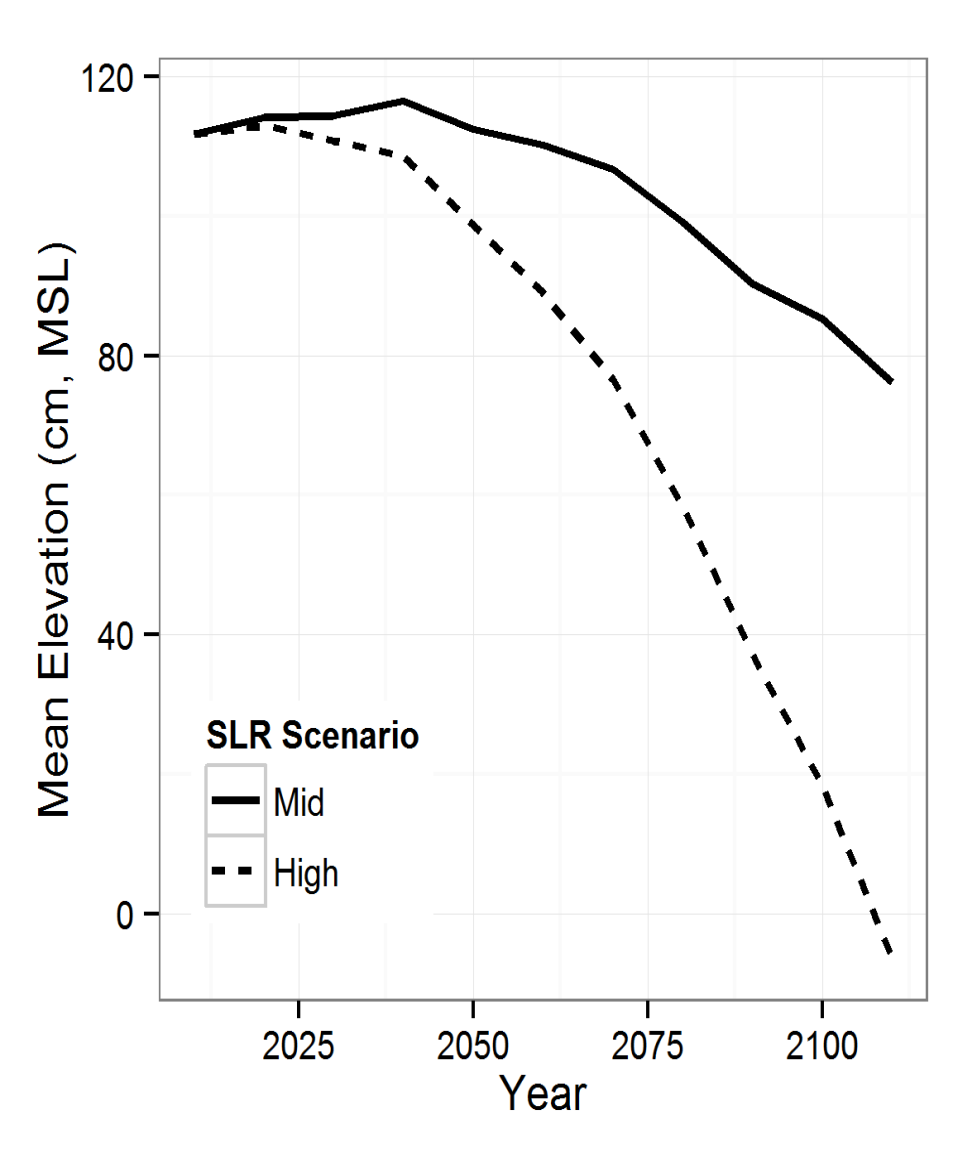
soil cores:

- 50 cm cores sar
  an elevation tra
- Cut into 1 cm d
- Dated with 137
- Bulk density &
  ignition



Results: Siletz NWR





Is this type of result useful to management?

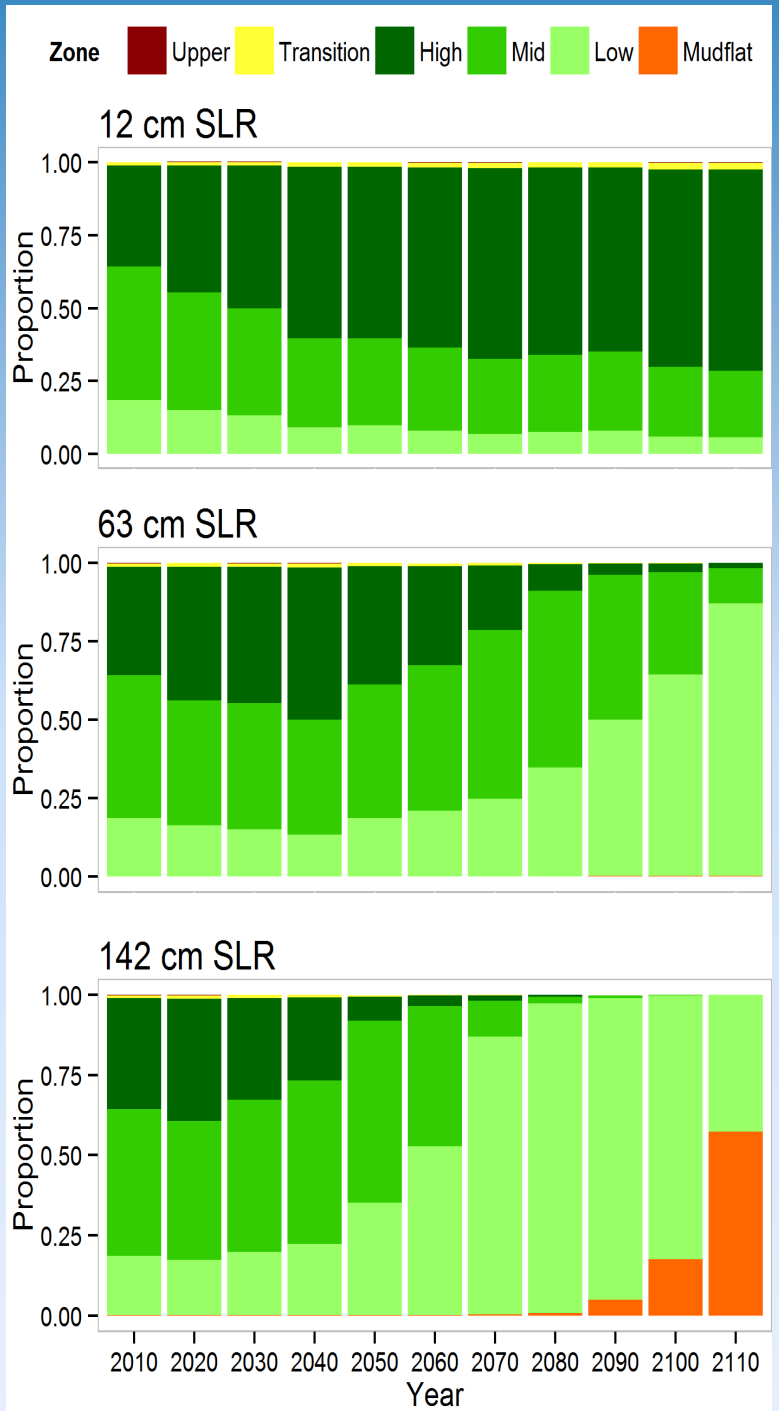
Oregon tidal marsh plant zonation – Siletz NWR

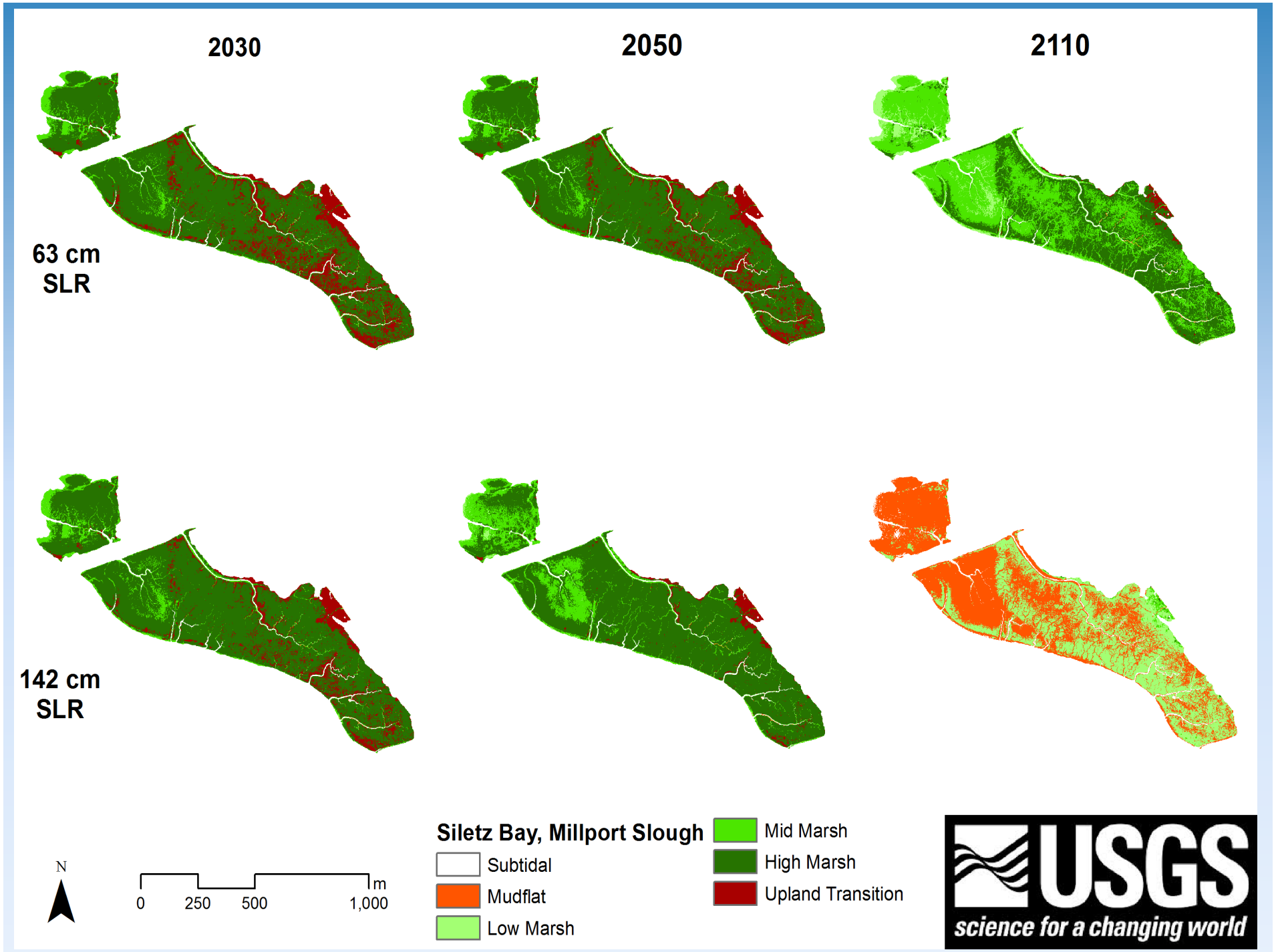
Marsh zone	Representative species
Transitional marsh	*Potentilla anserina, Carex obnupta, Angelica lucida*
High marsh	*Juncus balticus, Deschampsia cespitosa*
Mid marsh	*Deschampsia cespitosa, Agrostis stolonifera*
Low marsh	*Carex lyngbyei, Sarcocornia perennis, Jaumea carnosa*

Photos by CN Janousek, US EPA

Results: Siletz NWR
Marsh Zones

- Mid SLR
  - Mudflat: 0%
  - Low: 68% gain
  - Mid: 34% loss
  - High: 33% loss
- High SLR
  - Mudflat: 57% gain
  - Low: 24% gain
  - Mid: 46% loss
  - High: 35% loss




2030
2050
2110
63 cm SLR
142 cm SLR
N
0
250
500
1,000
m
Siletz Bay, Millport Slough
Subtidal
Mudflat
Low Marsh
Mid Marsh
High Marsh
Upland Transition
USGS
science for a changing world

Next Steps: Siletz NWR marsh organs

1. How does increased flooding affect plant growth and decomposition?
2. Which species are most sensitive to greater flooding?

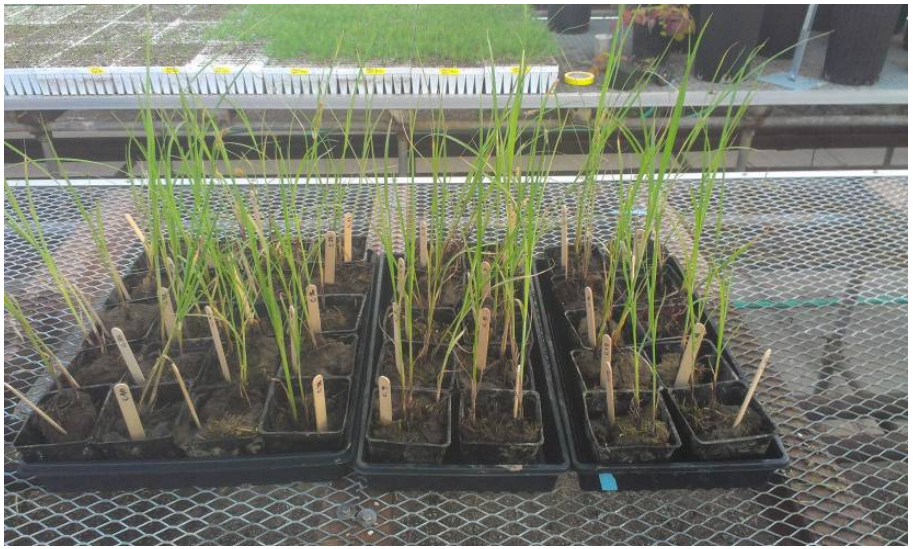
2014 experiment		
Species	Elevations tested	Replicates per elevation
Juncus balticus & *Carex lyngbyei*	6 tidal elevations, from above MHHW to about MTL	6 (plants); 3 (litter bags)

- Plant height, shoot and root biomass
- Seed production
- Decomposition in litter bags

Oregon State University OSU

USGS science for a changing world

Siletz marsh organs – April 2014 installation



Siletz marsh organs – August 2014 harvest

Conclusion

- Sea-level rise modeling efforts vary due to input datasets and local conditions
- Investment in intensive site-specific data collection results in quality baseline characterization that is used to develop sea-level response models at a scale relevant to management decisions.
- Establishing baseline conditions can allow the monitoring of change with sea-level rise
- Planning may be best considered in two periods: short-term (10-50 years) and long-term (50-100 years)

Partners & Funders

USGS Western Ecological Research Center
USGS National Climate Change and Wildlife Science Center
U.S. Fish & Wildlife Service I & M Program
U.S. Fish & Wildlife Service - Refuges
NOAA NERR – China Camp SP, Tijuana Estuary
NW & SW USGS Climate Science Centers
USGS Native American Internship Program
California Department of Fish & Wildlife
East Bay Regional Parks
North Pacific and California LCC
Oregon State University
University of California, Davis
University of California, Los Angeles