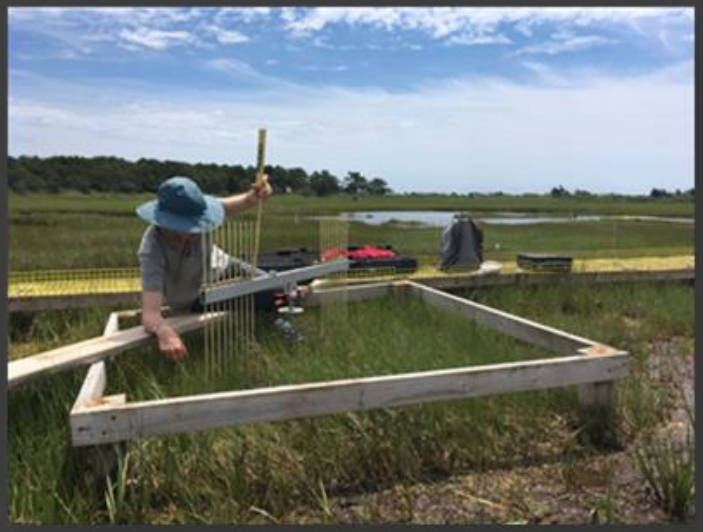
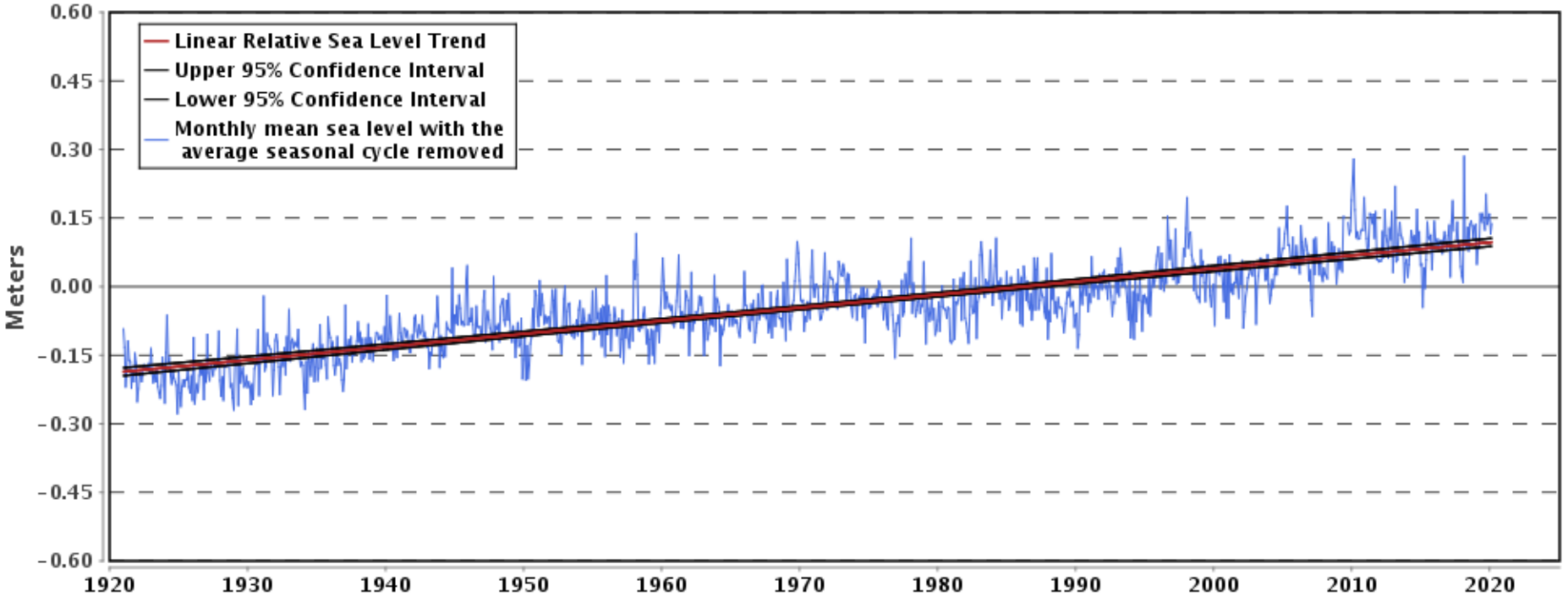
Waquoit Bay National Estuarine Research Reserve
Teachers on the Estuary (Remote for 2020): Data Analysis
Megan Tyrrell, Research Coordinator

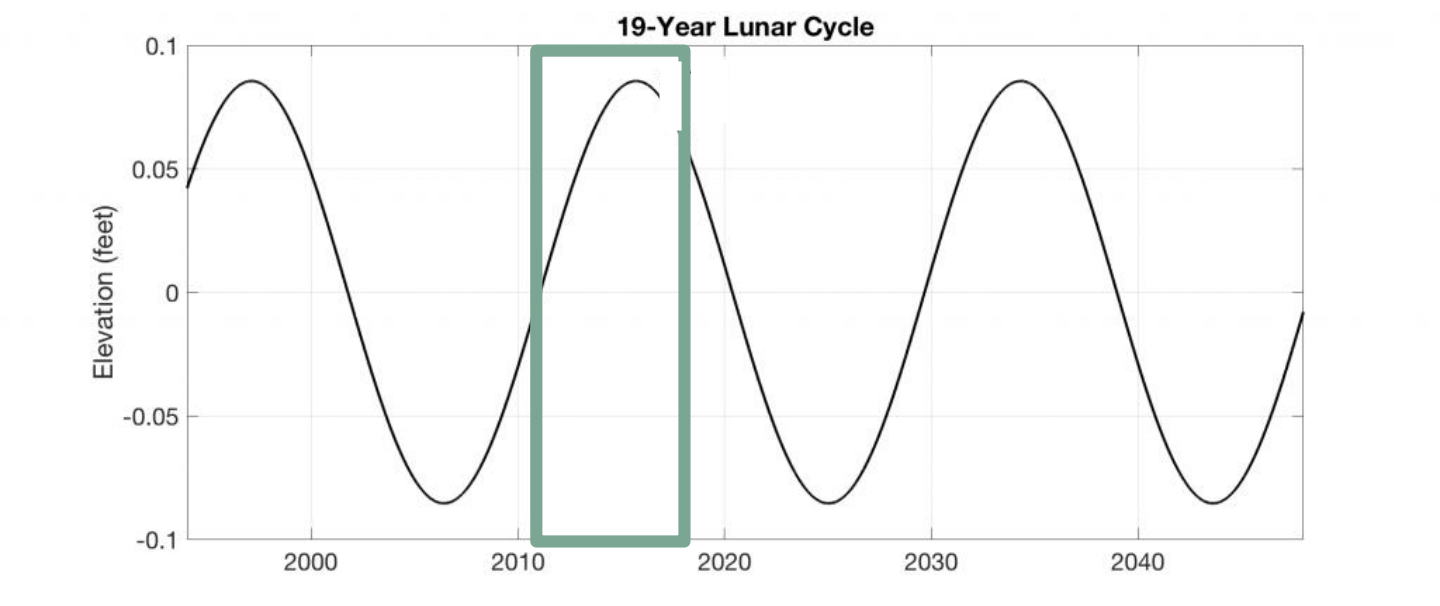


How are salt marshes affected by sea level rise?

Boston tide gauge, 100 year record, has upward trend that averages 2.86 mm/year

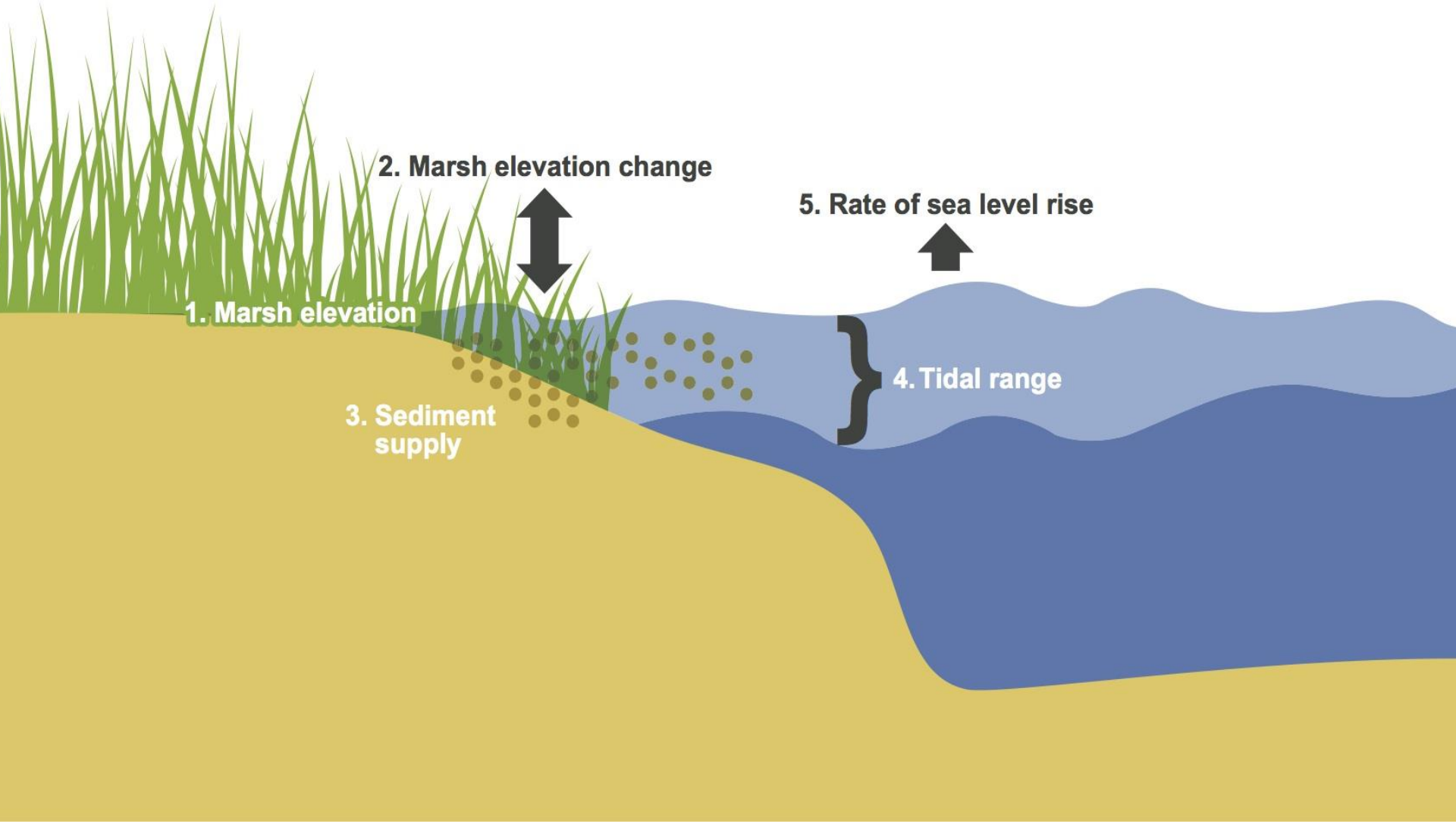


Sea level also changes over shorter term, predictable cycles



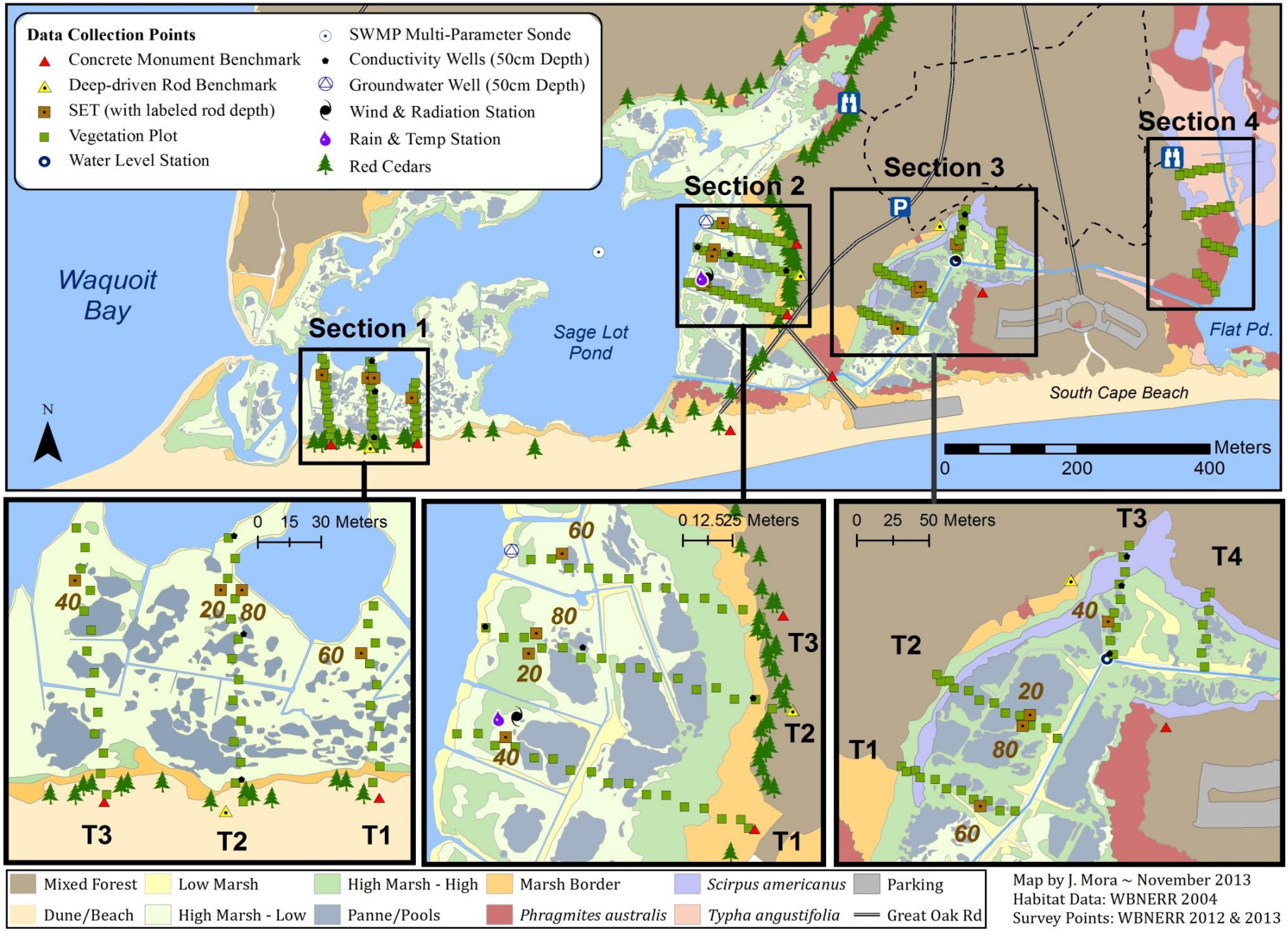
2015 was the most recent peak of the lunar nodal cycle

https://www.johnenglander.net/wp-content/uploads/2018/02/Lunar-Nodal-Cycle-line-only-1.png


2. Marsh elevation change
5. Rate of sea level rise
1. Marsh elevation
4. Tidal range
3. Sediment supply

Sage Lot Pond Salt Marsh

WBNERR Salt Marsh Observatory (SMO): Long-Term Salt Marsh Biomonitoring Project



Map by J. Mora ~ November 2013
Habitat Data: WBNERR 2004
Survey Points: WBNERR 2012 & 2013

Synthesizing NERR Sentinel Site data to improve coastal wetland management across New England

Project lead:
David Burdick
Jackson Estuarine Laboratory,
University of New Hampshire

Name of Reserves involved in the project:
Wells, ME, Great Bay, NH, Waquoit Bay, MA
Narragansett Bay, RI

Different methods to monitor vegetation

Point-intercept

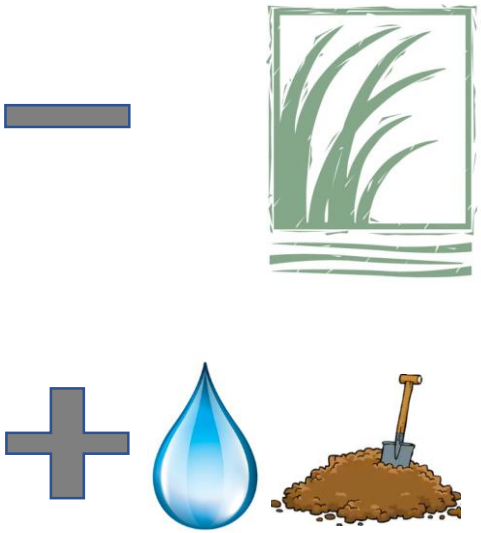
VS.

Visual Estimates of Cover

Narragansett Bay NERR, RI
Wells NERR, ME

Waquoit Bay NERR, MA
Great Bay NERR, NH

New England Salt Marsh Sentinel Site Synthesis



General Results from vegetation monitoring:

*Declines/loss in flooding sensitive plant species

*More open water/less vegetated area, more dead plants

Narragansett Bay, RI

2011 → 2016

Is the marsh surface tracking sea level rise?

Analysis of Change:

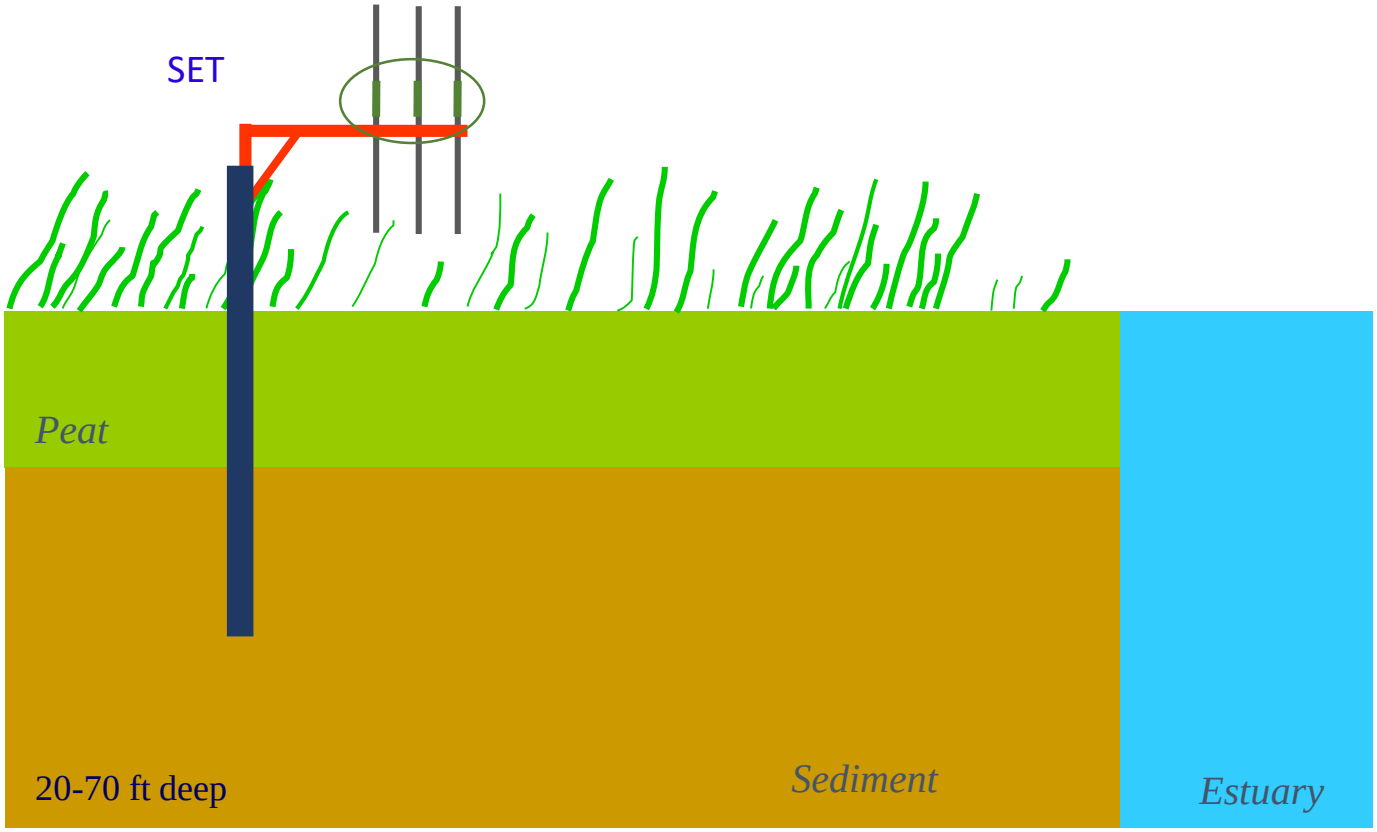
Wetland Surface Elevation Table Data

Waquoit Bay National Estuarine Research Reserve, Massachusetts, 2013- 2018

Project Lead: Kim Cressman, Grand Bay National Estuarine Research Reserve
Email: kimberly.cressman@dmr.ms.gov

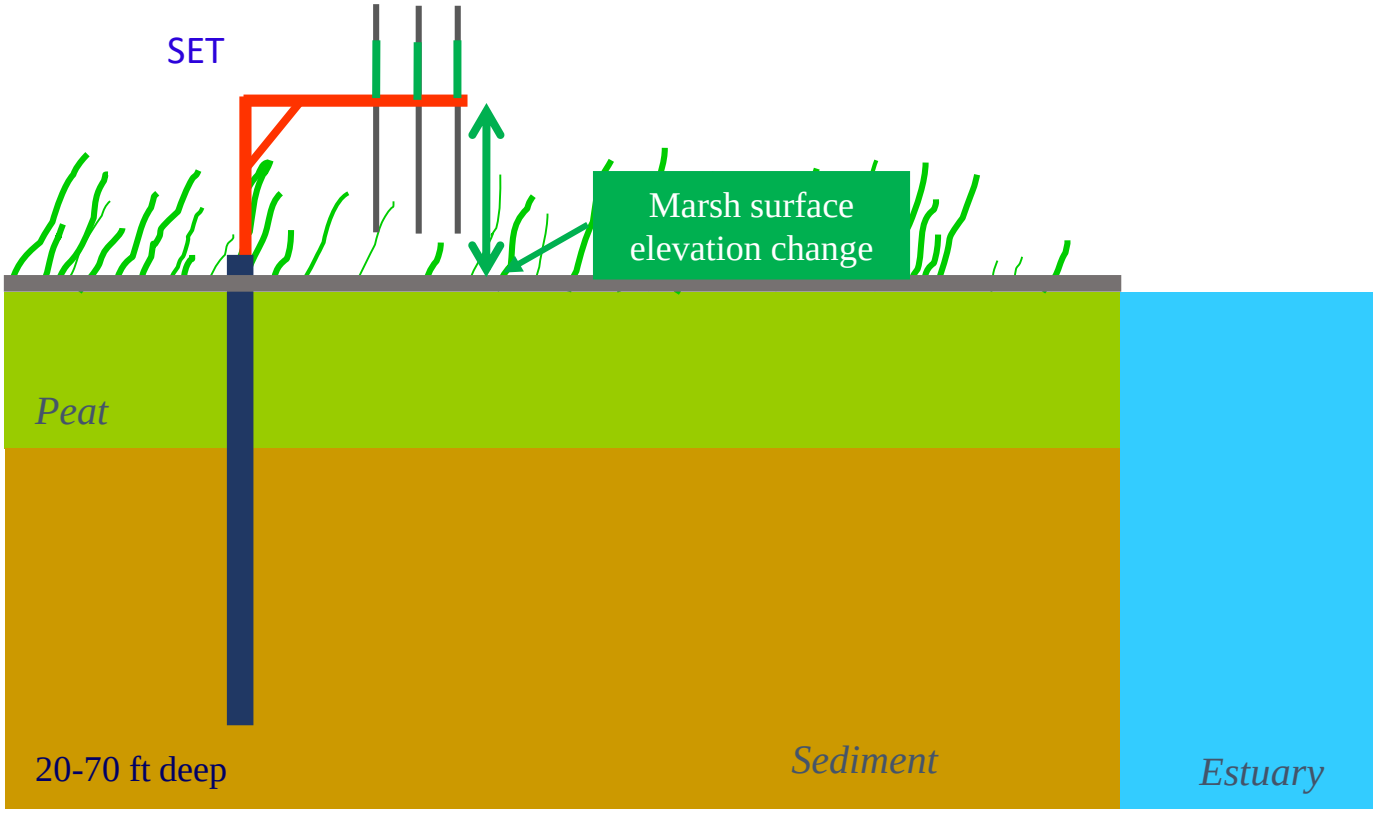
To learn more about project and related products visit: http://www.nerrssciencecollaborative.org/project/Cressman18

Monitoring Salt Marsh Elevation Change



Animation by Kelly Medeiros, Cape Cod National Seashore

Monitoring Salt Marsh Elevation Change



Animation by Kelly Medeiros, Cape Cod National Seashore

If the marsh surface is rising (B), the observer will read higher numbers at each pin (A)

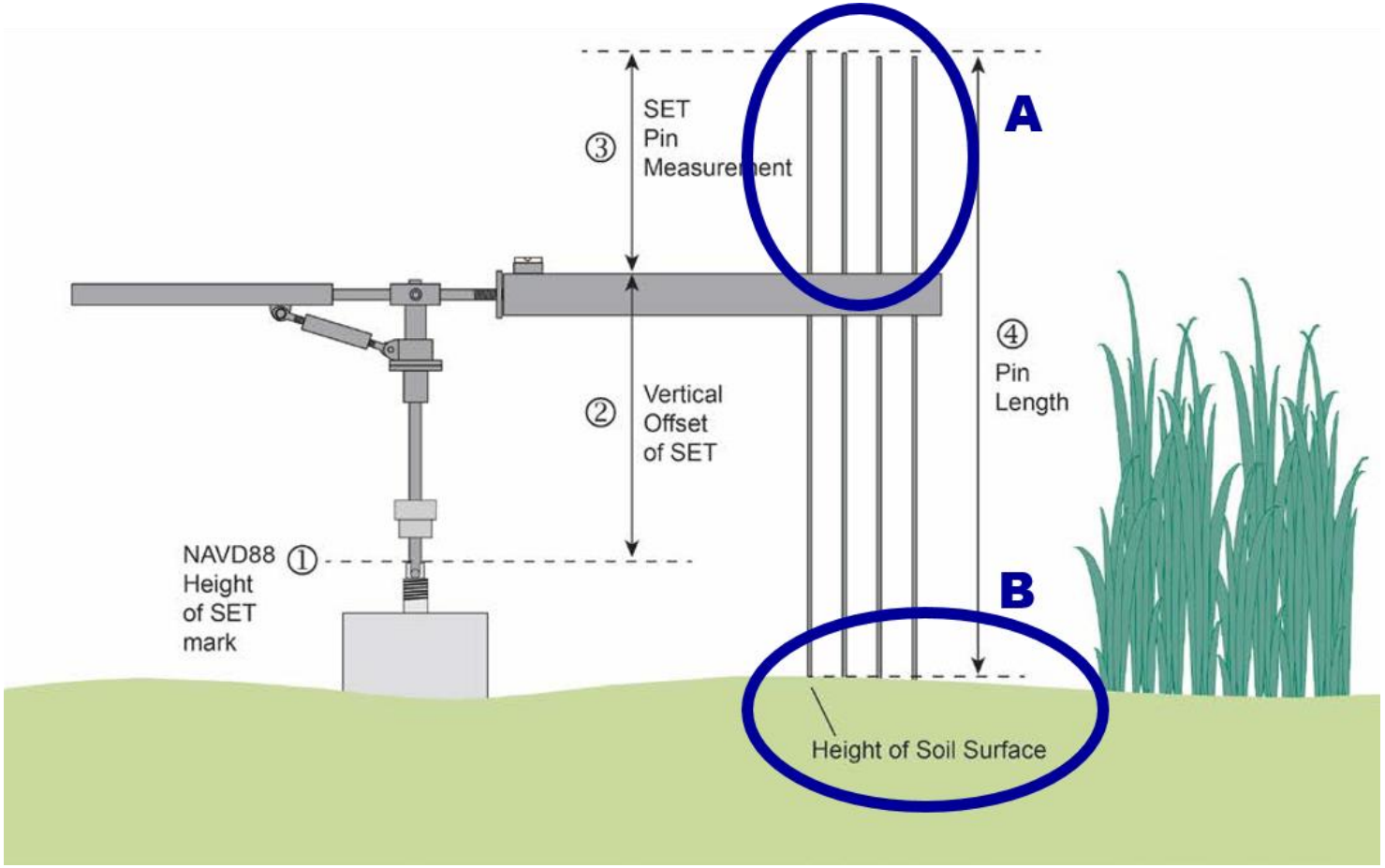
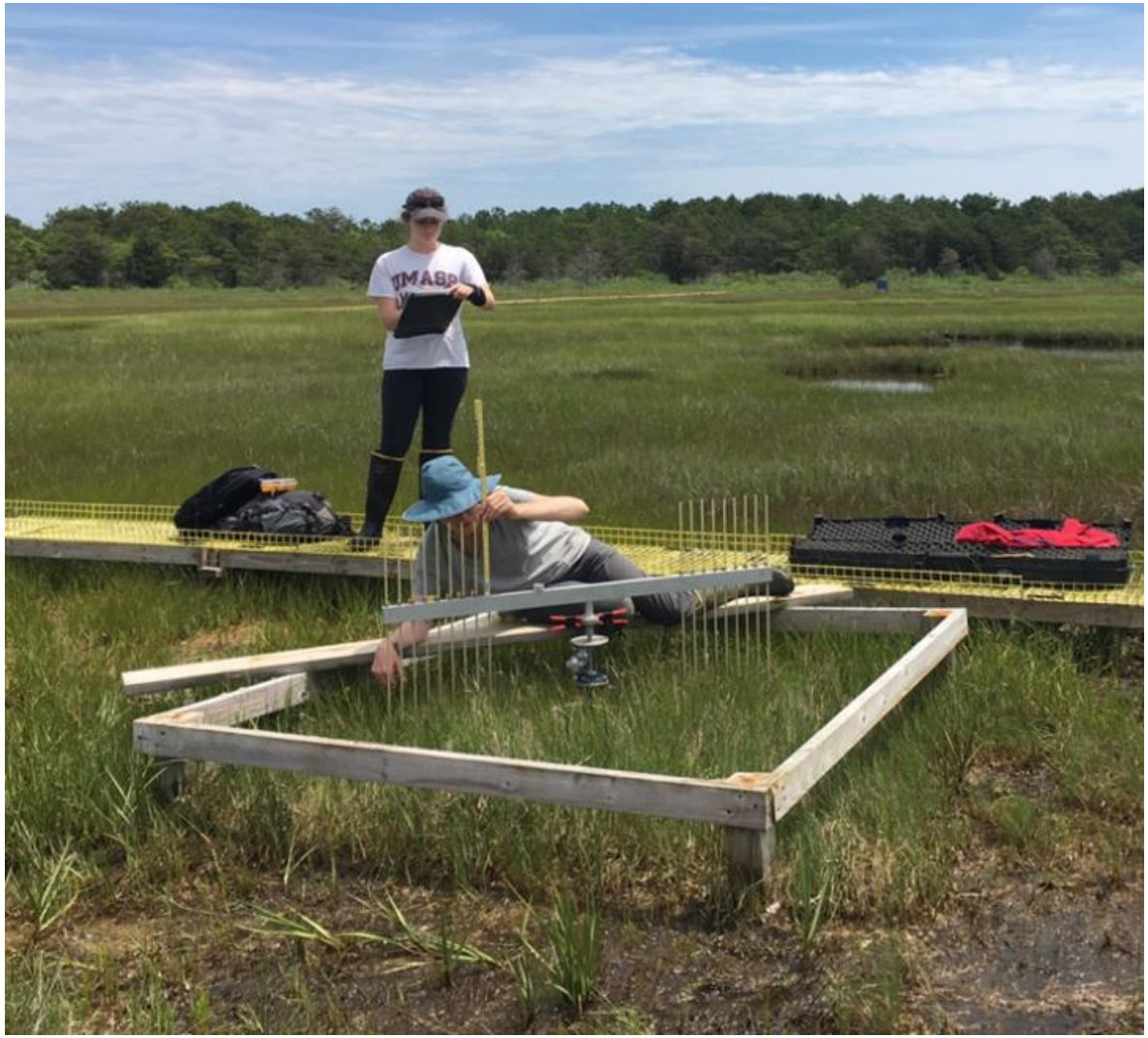


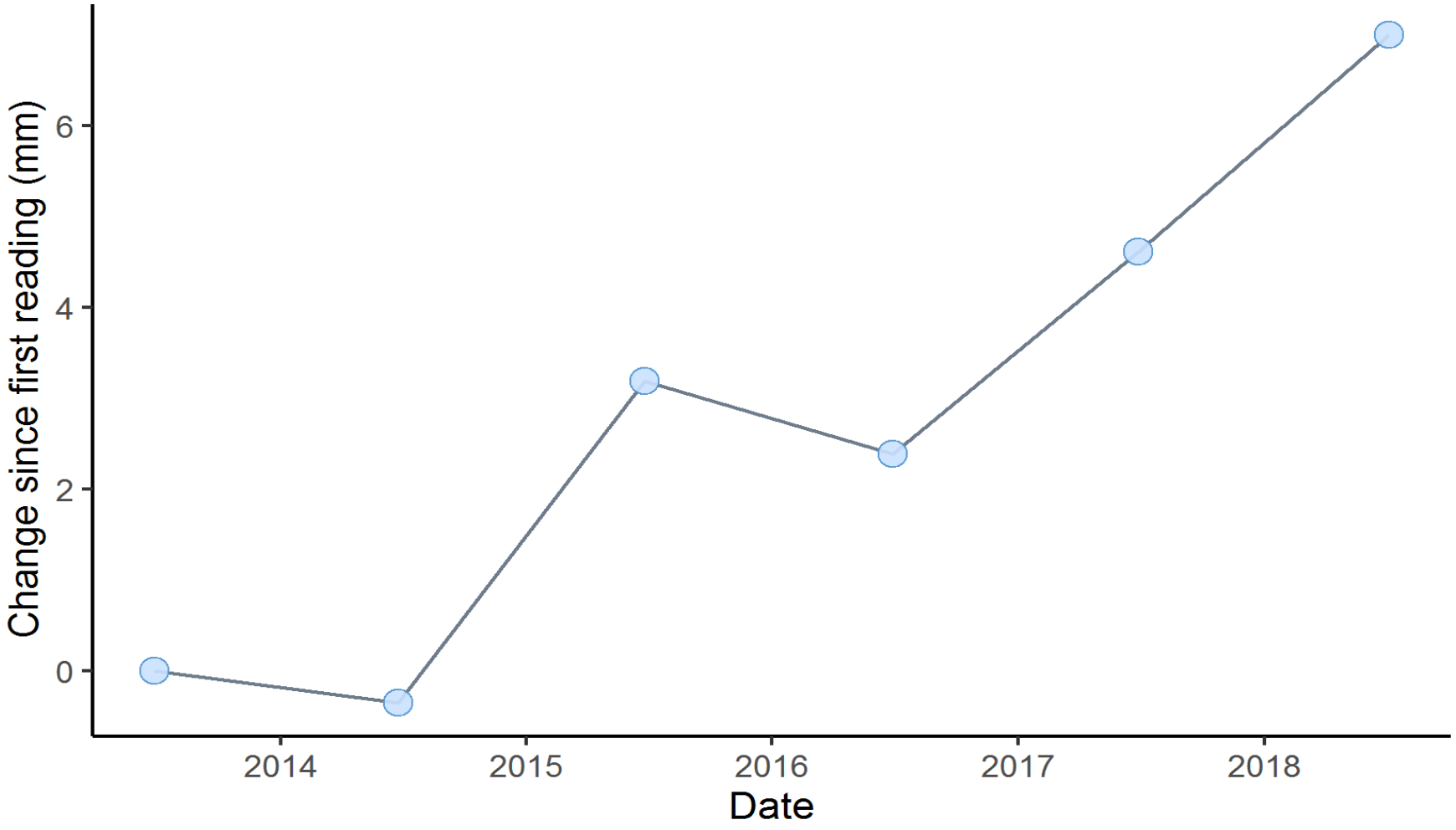
Figure 1. Example of a SET. Pin heights above the horizontal arm (A) are a proxy for the shape of the marsh surface (B) (adapted from Lynch et al. 2015).

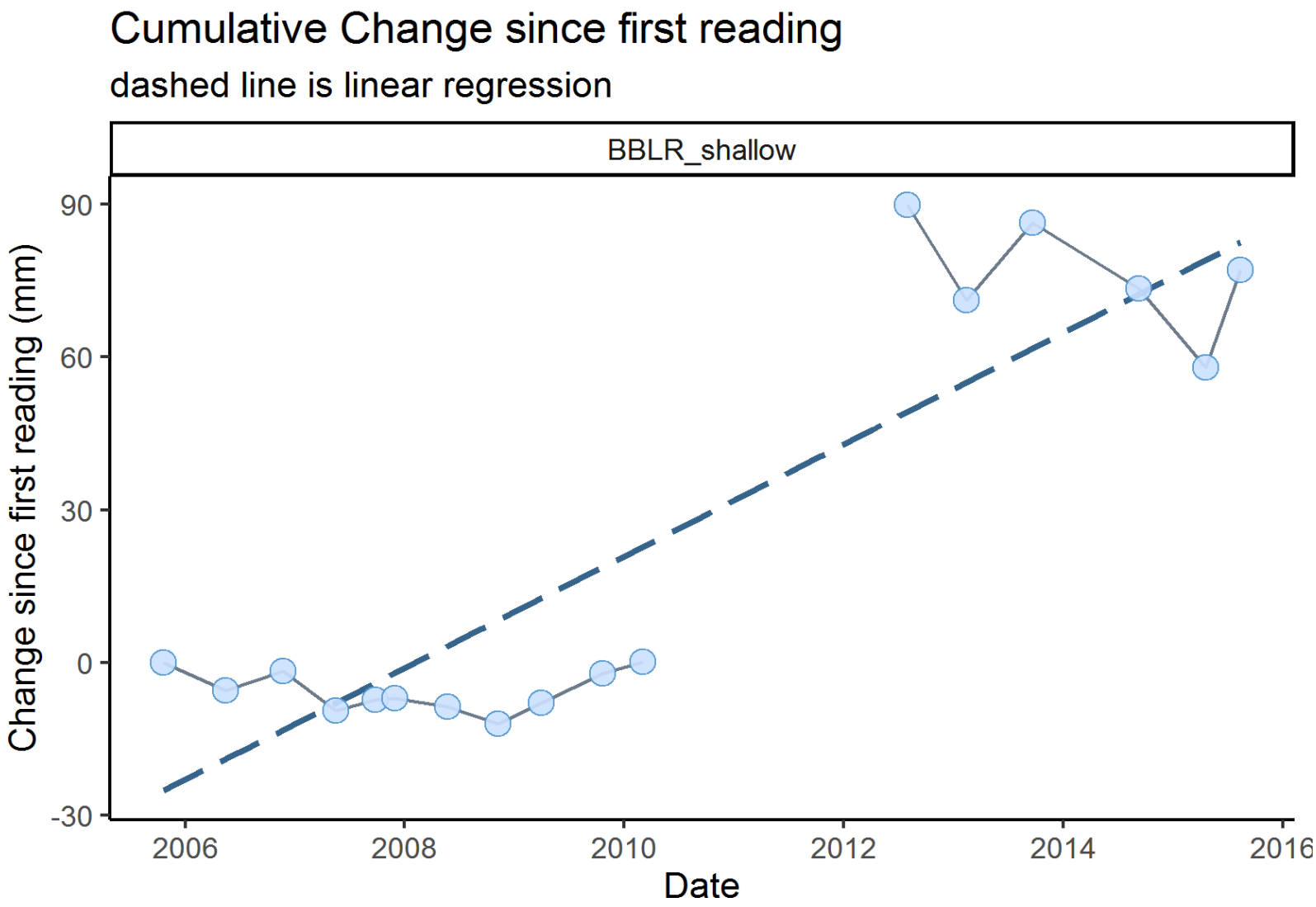
Each observation (reading height of the pins above the arm) takes a long time to set up. It is very important to go slowly and carefully because we expect only millimeters of change over a year.

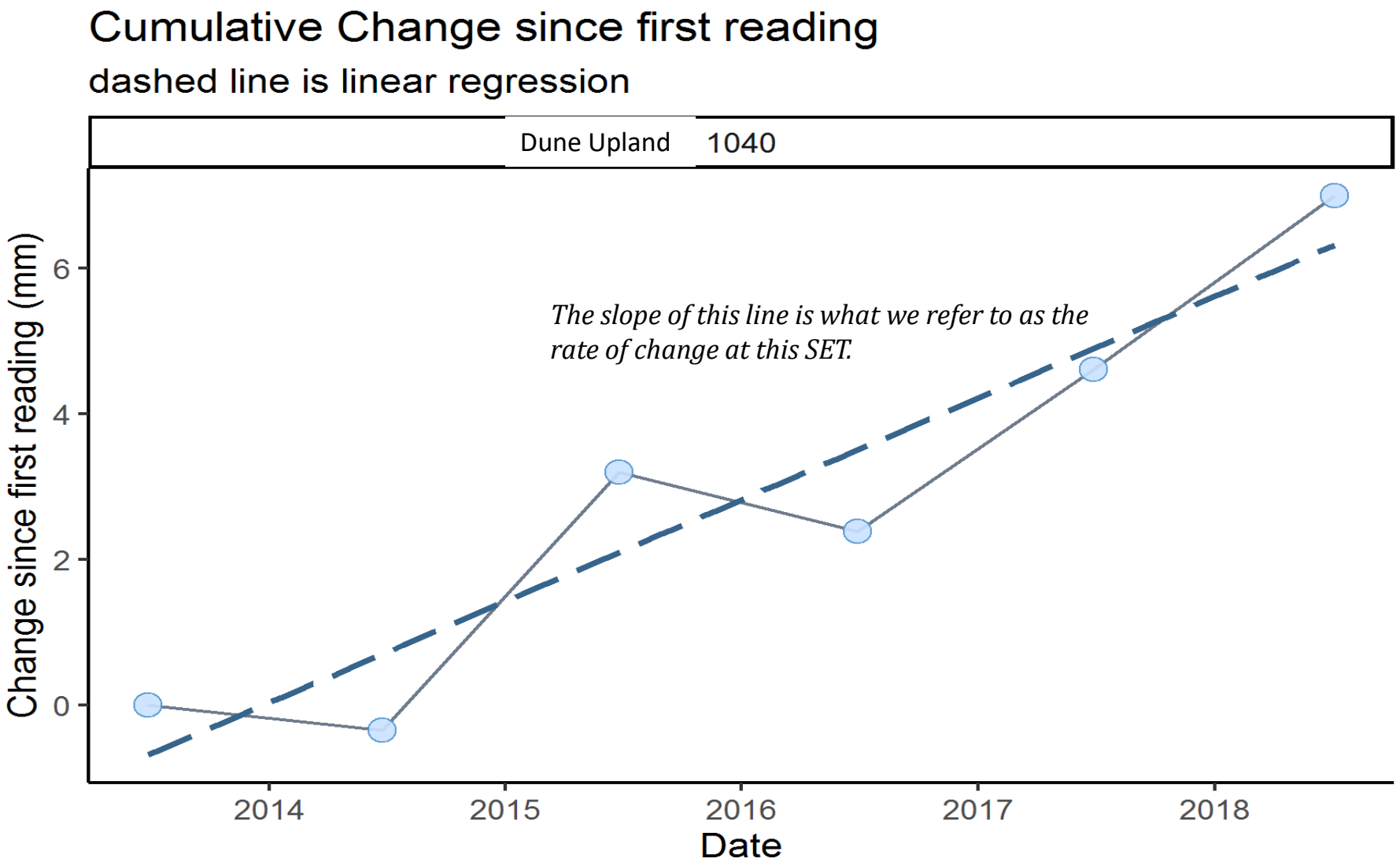


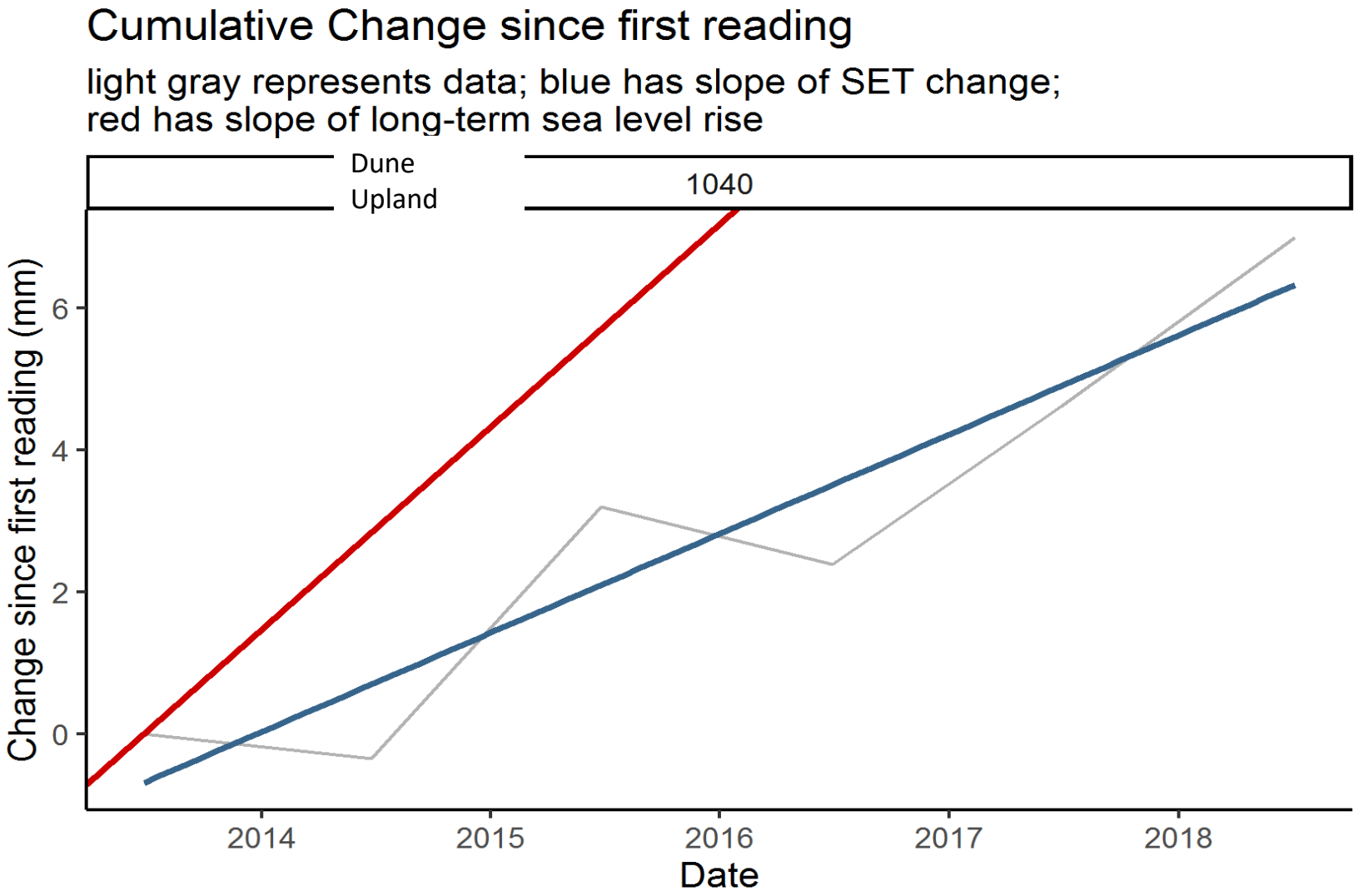
After reading 18 pins in this orientation, we pick it up, rotate 90 degrees, re-level, and repeat.

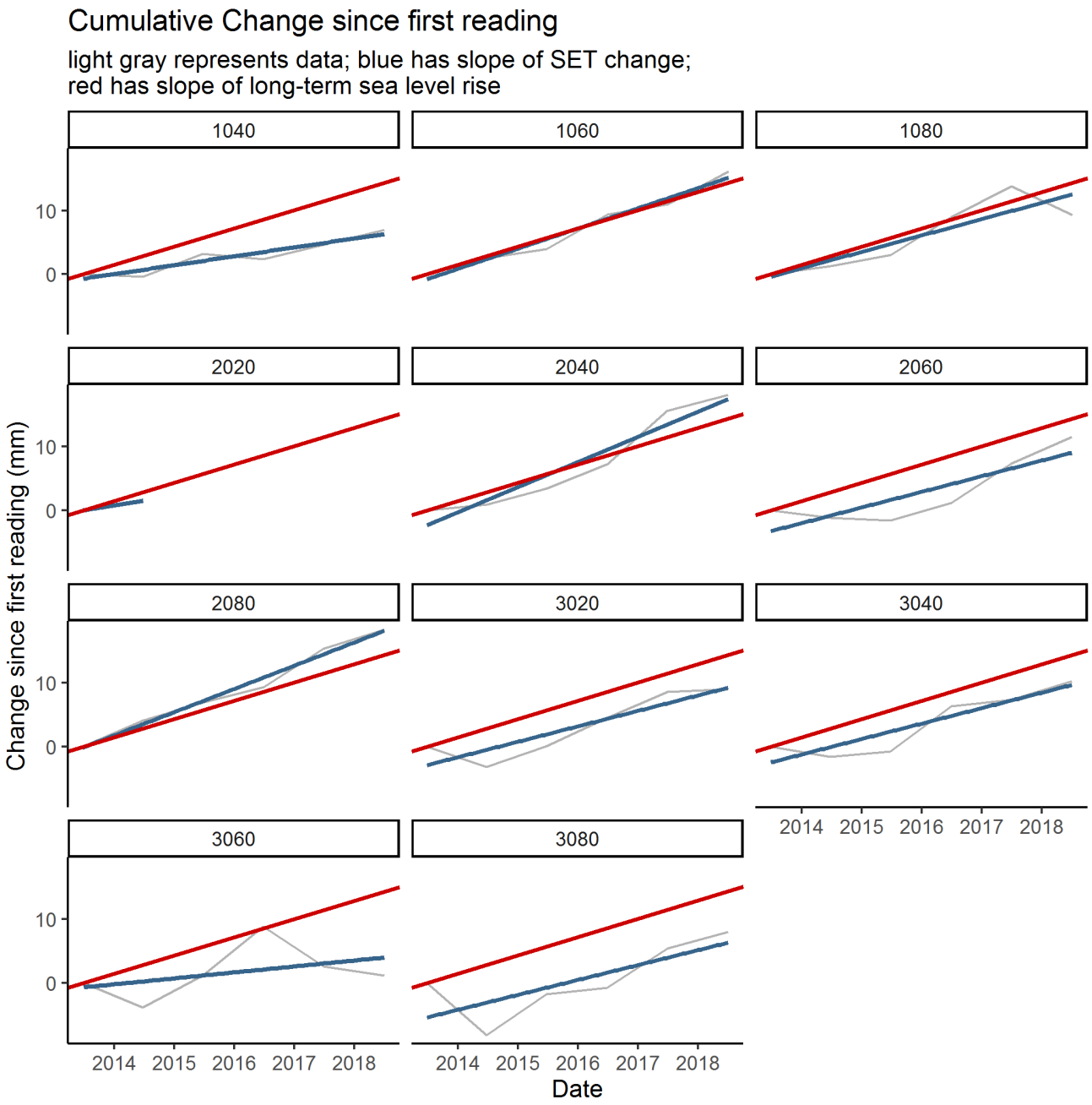
single SET – change over time; each dot represents all 36 pins averaged together




Cumulative Change since first reading
dashed line is linear regression
BBLR_shallow
Change since first reading (mm)
90
60
30
0
-30
2006
2008
2010
2012
2014
2016
Date

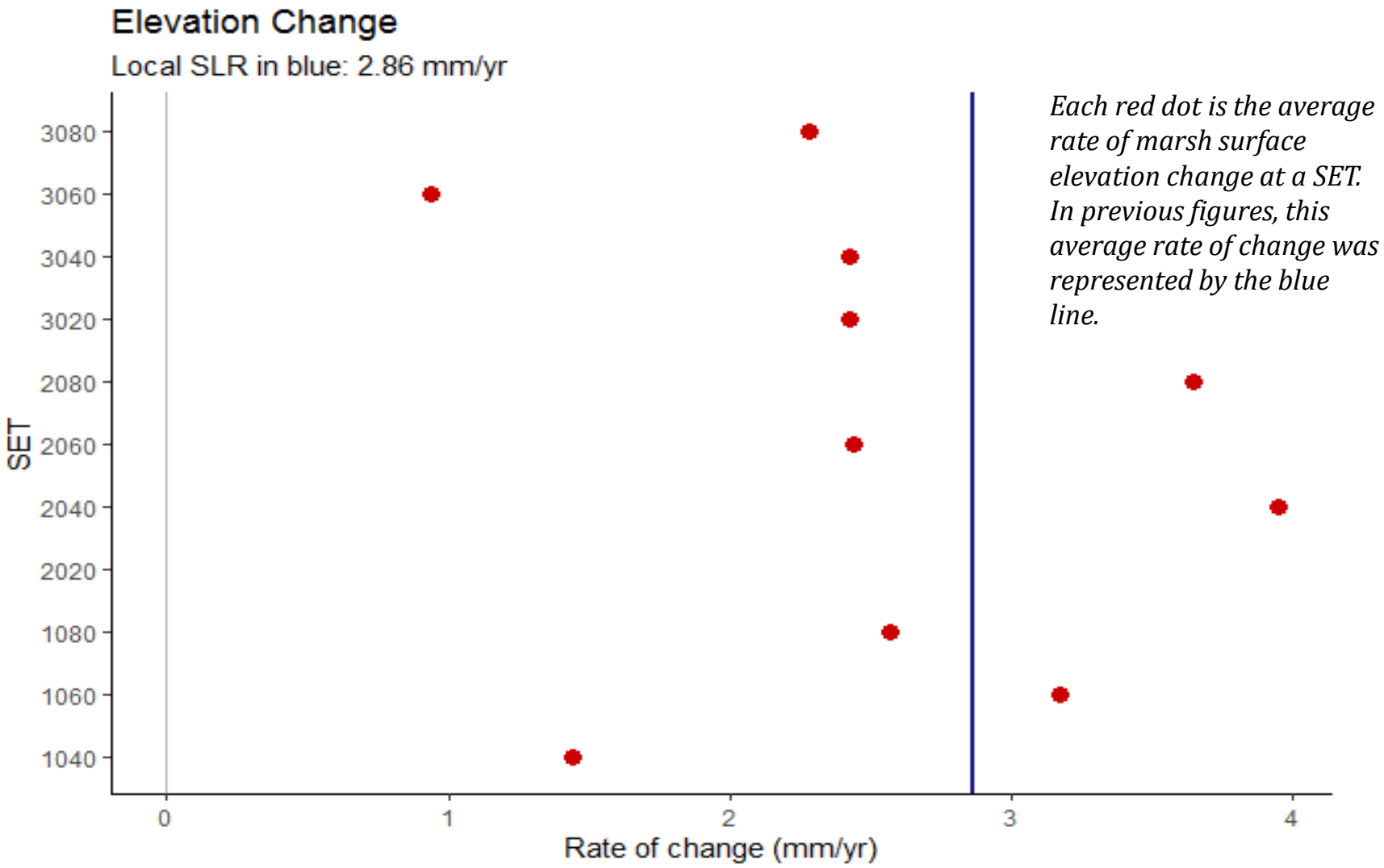

Cumulative Change since first reading
dashed line is linear regression
Dune Upland
1040
Change since first reading (mm)
6
4
2
0
The slope of this line is what we refer to as the rate of change at this SET.
2014
2015
2016
2017
2018
Date


Cumulative Change since first reading
light gray represents data; blue has slope of SET change;
red has slope of long-term sea level rise
Dune
Upland
1040
Change since first reading (mm)
0
2
4
6
2014
2015
2016
2017
2018
Date

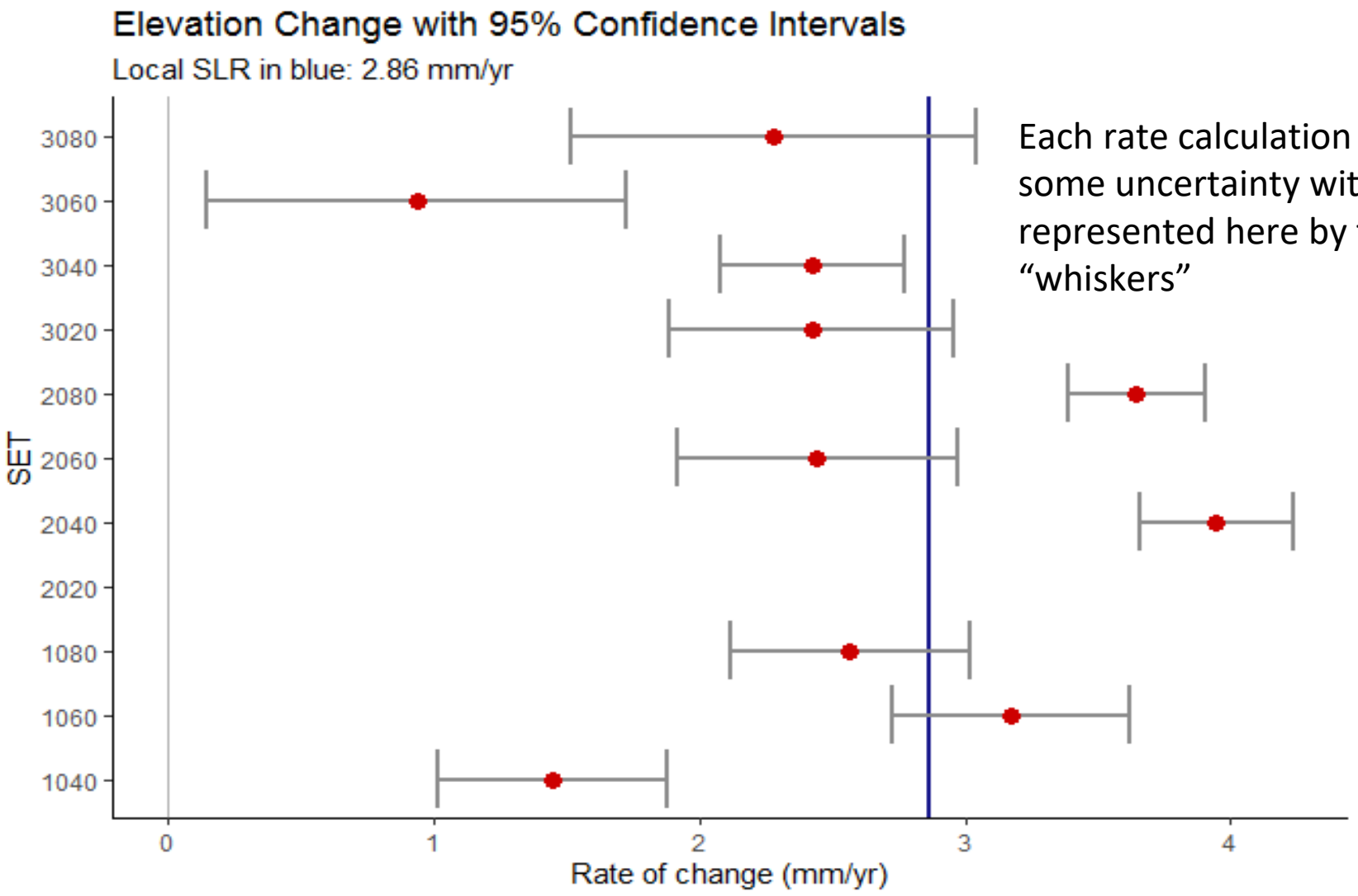


Each panel of this graph is an individual SET at a reserve.

10xx= Dune Upland
20xx= Forested Upland
30xx= Restored Marsh

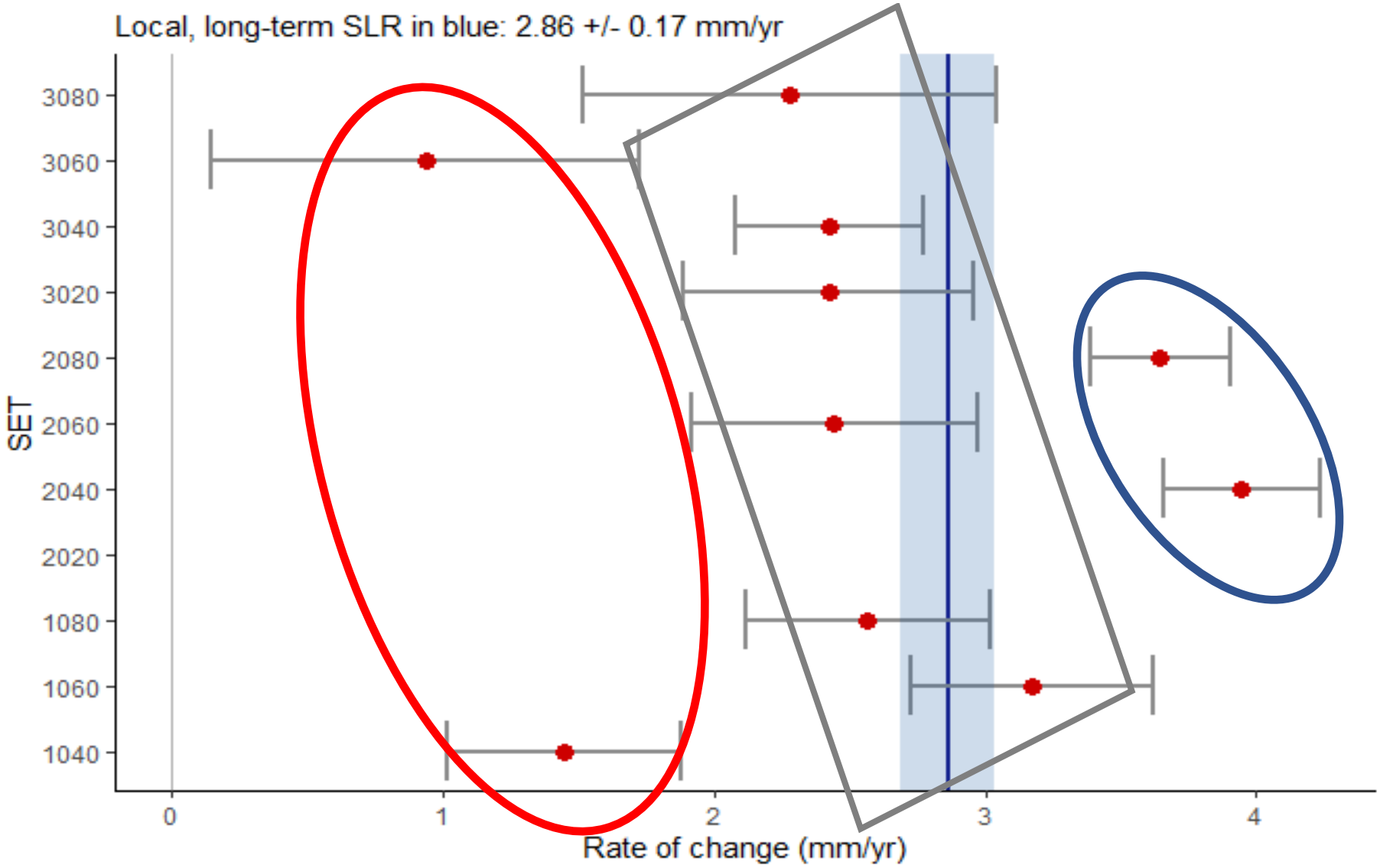


Each red dot is the average rate of marsh surface elevation change at a SET. In previous figures, this average rate of change was represented by the blue line.



Each rate calculation has some uncertainty with it – represented here by the "whiskers"

Assess if there are groupings of SETs with their average and variability overlaid with average SLR and its variability



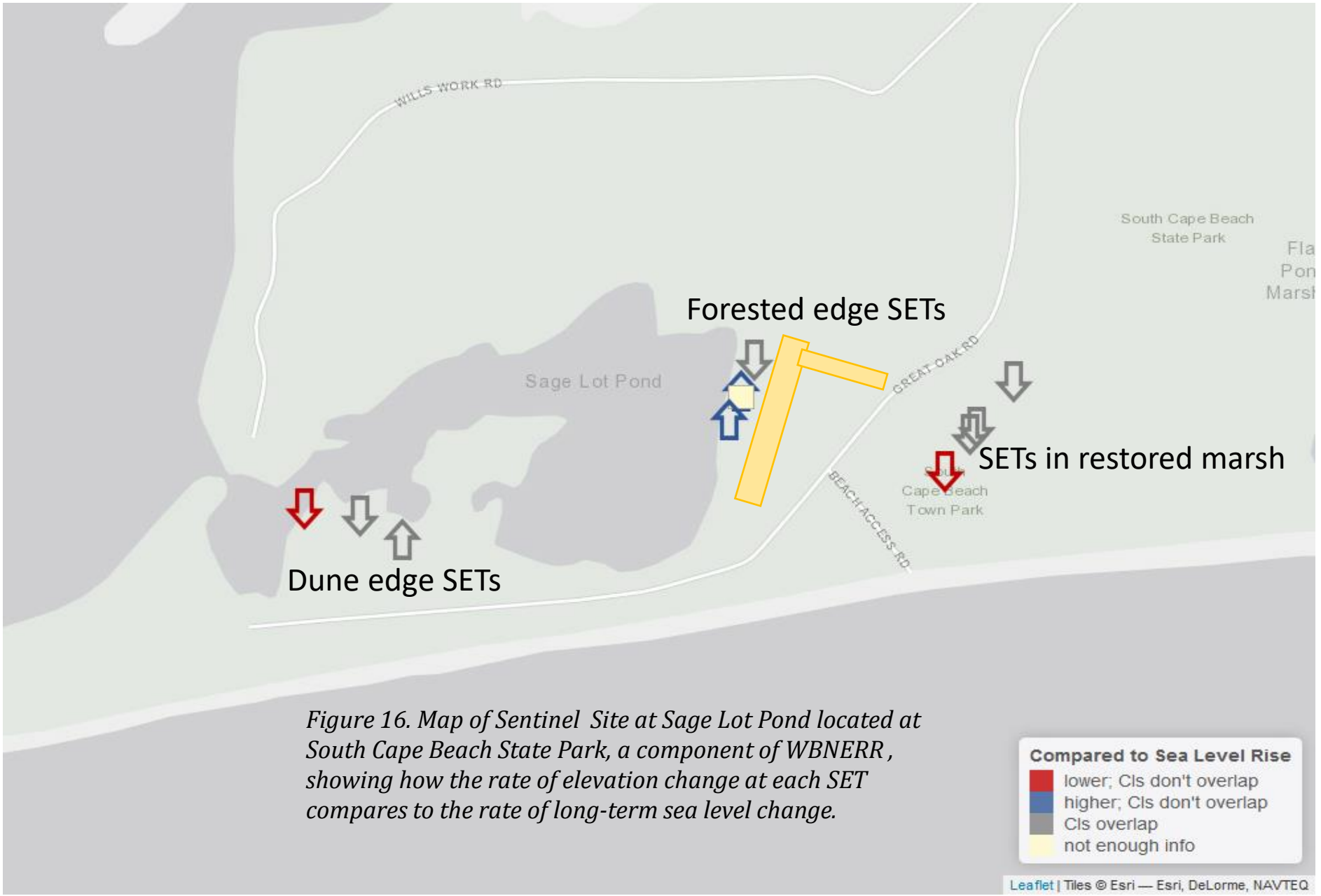


Figure 16. Map of Sentinel Site at Sage Lot Pond located at South Cape Beach State Park, a component of WBNERR , showing how the rate of elevation change at each SET compares to the rate of long-term sea level change.

What can we do to help salt marshes?

Remove tidal restrictions- let the seawater in…..

- Allow marshes to migrate upslope.
- Protect them from development.
- Facilitate migration through selective clearing of trees.

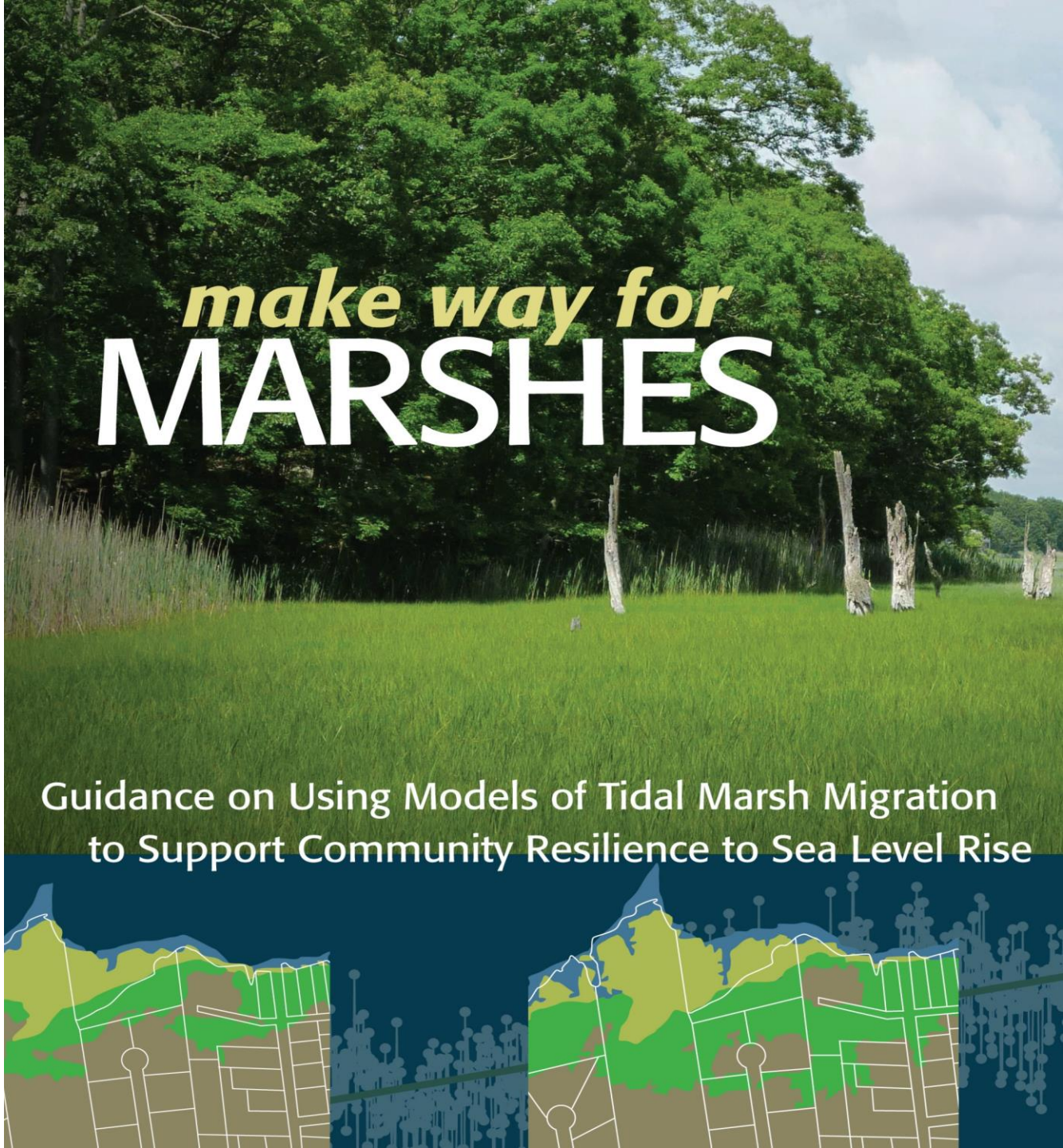


Image credit: Make Way for Marshes/Northeast Regional Ocean Council

Thin Layer Sediment Placement gives an elevation boost to marshes

Thin Layer Placement- sediment addition for elevation boost

Before

Immediately after

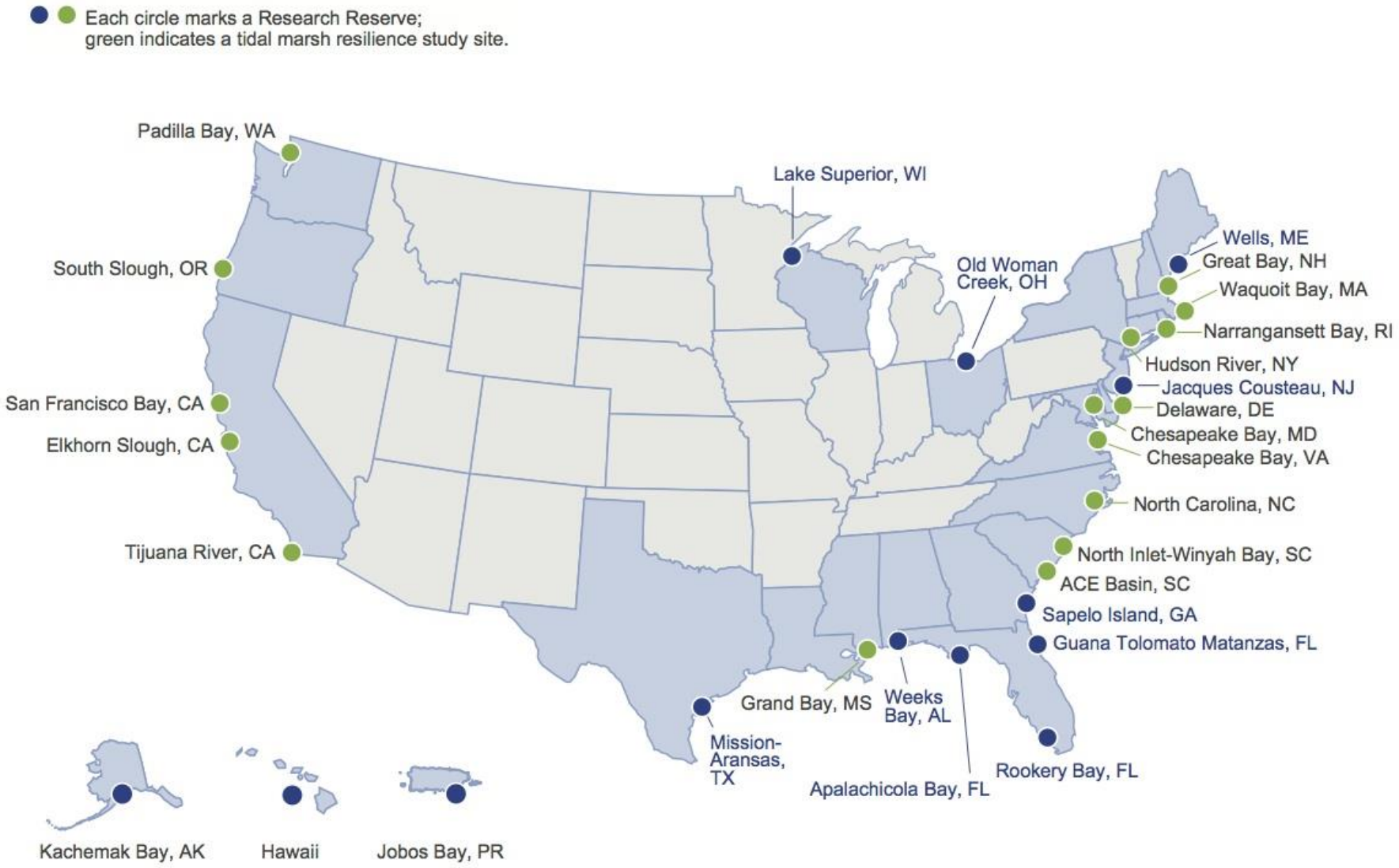
Five months after

One year

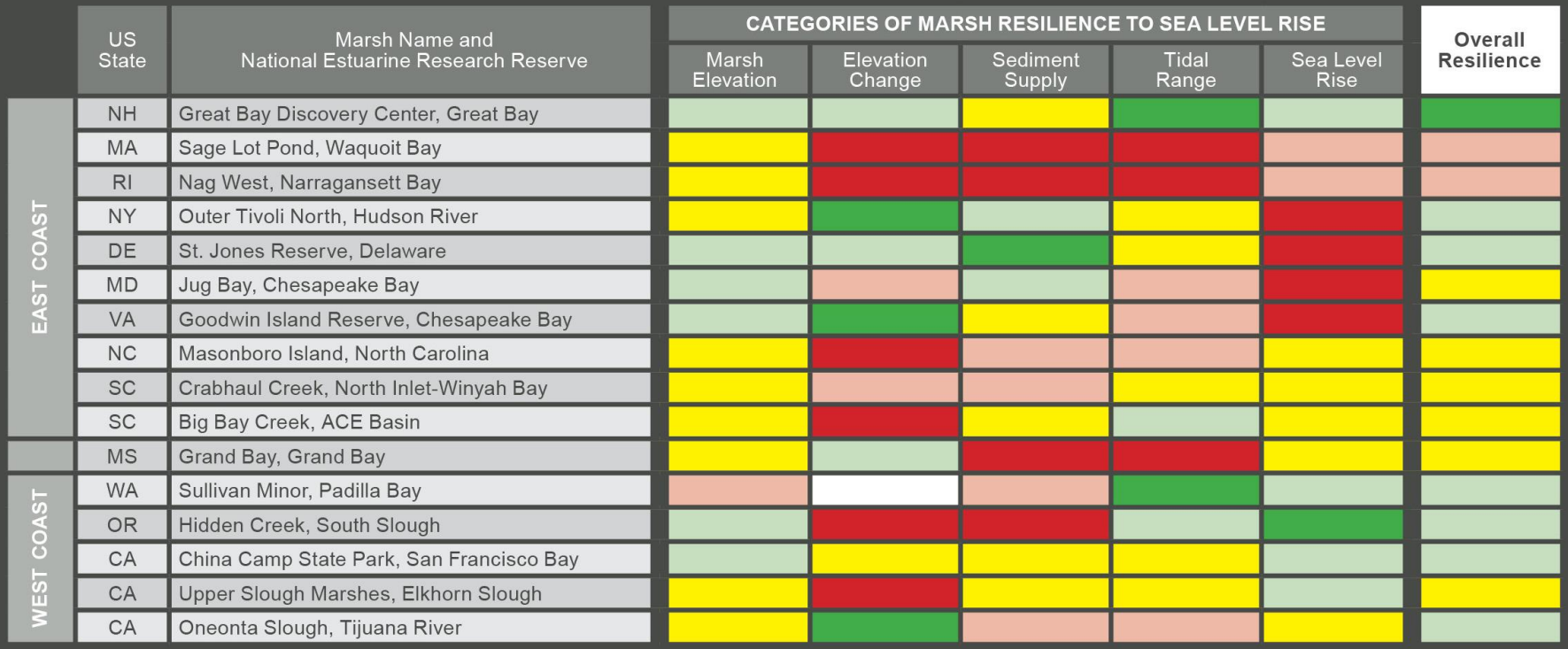
Two years later

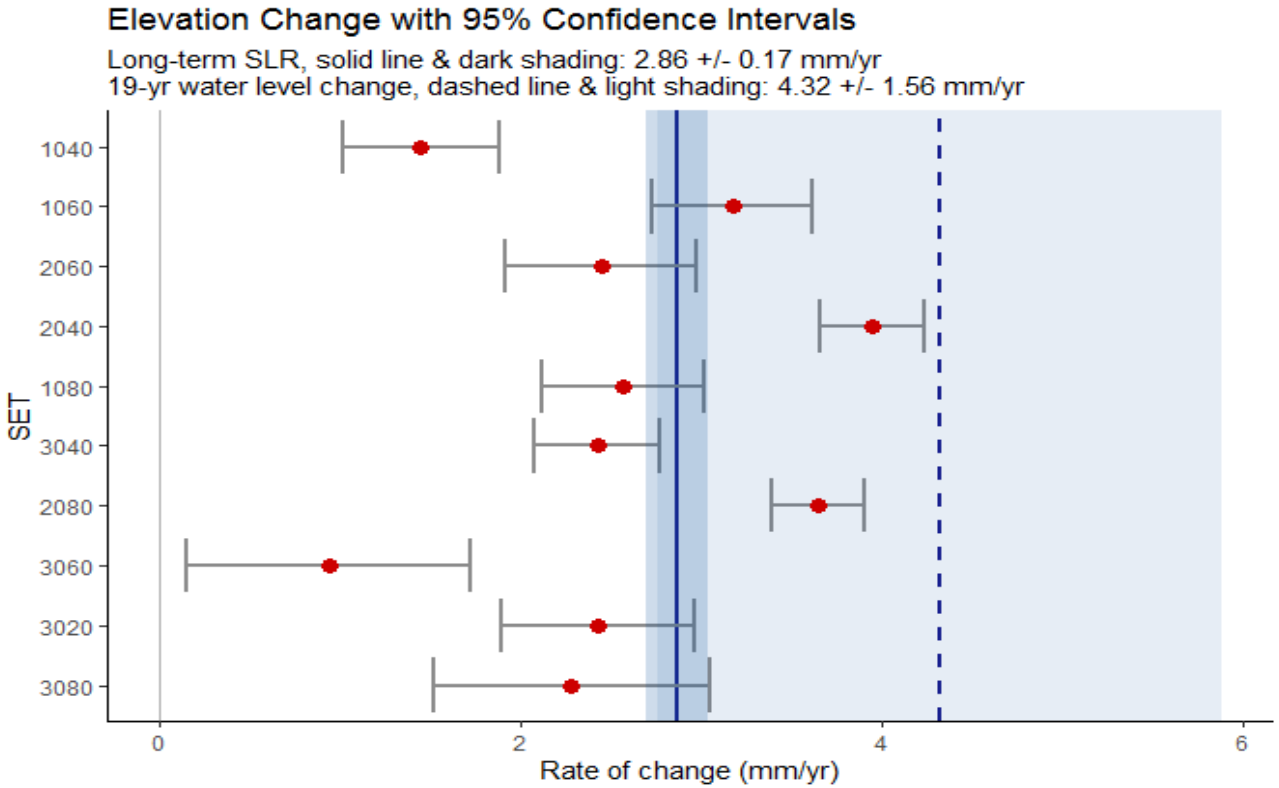
Marsh mats- testing efficacy of coir versus PET mats for seedling survival

Partnership with US Fish and Wildlife Service and 3 National Estuarine Research Reserves


Each circle marks a Research Reserve;
green indicates a tidal marsh resilience study site.
Padilla Bay, WA
South Slough, OR
San Francisco Bay, CA
Elkhorn Slough, CA
Tijuana River, CA
Lake Superior, WI
Old Woman Creek, OH
Wells, ME
Great Bay, NH
Waquoit Bay, MA
Narrangansett Bay, RI
Hudson River, NY
Jacques Cousteau, NJ
Delaware, DE
Chesapeake Bay, MD
Chesapeake Bay, VA
North Carolina, NC
North Inlet-Winyah Bay, SC
ACE Basin, SC
Sapelo Island, GA
Guana Tolomato Matanzas, FL
Grand Bay, MS
Weeks Bay, AL
Mission-Aransas, TX
Apalachicola Bay, FL
Rookery Bay, FL
Kachemak Bay, AK
Hawaii
Jobos Bay, PR

How will tidal marshes fare in the face of sea level rise? A look at 16 marshes in the National Estuarine Research Reserve System indicates they face challenges.





SETs arranged by their elevation in this figure