

Tracking Marsh Elevation and Water Levels in Elkhorn Slough

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1931

Google earth

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2015

Google earth

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- Are the marshes in Elkhorn Slough drowning?

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- What are the tools used to observe a drowning marsh?

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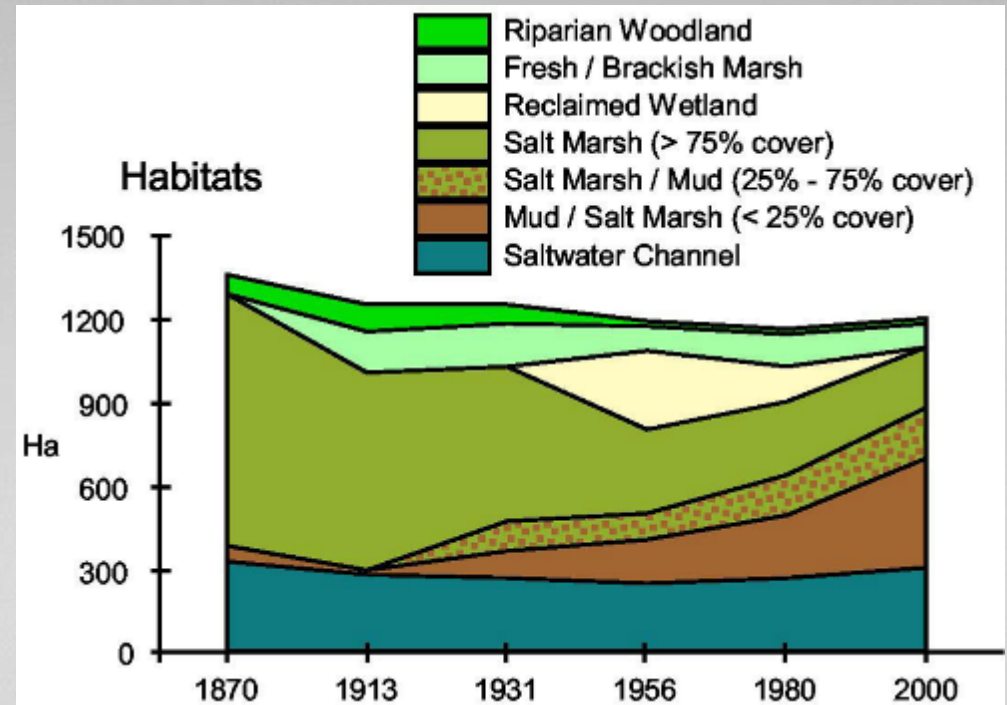
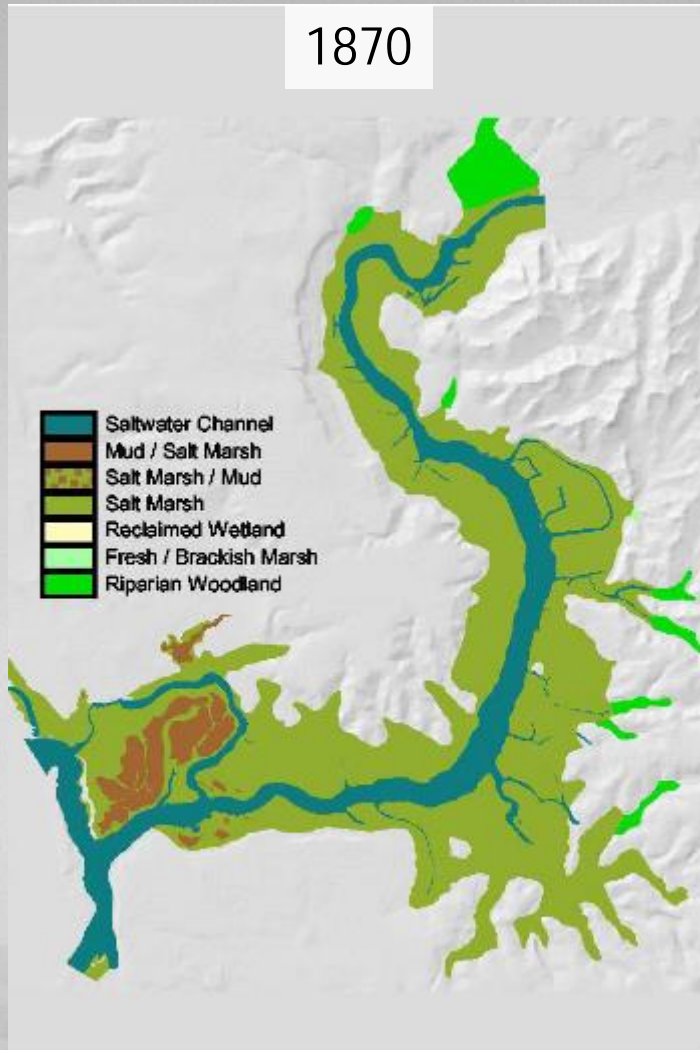
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- What does the data show?

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- What are the tools used to observe a drowning marsh?
- What does the data show?
- What are the potential drivers?

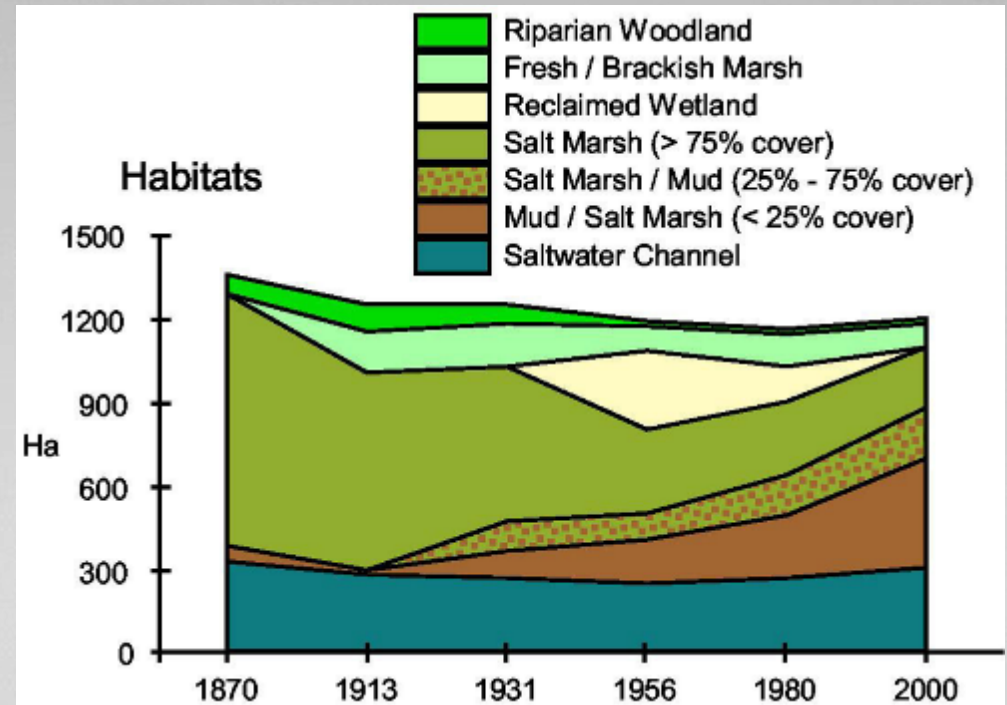
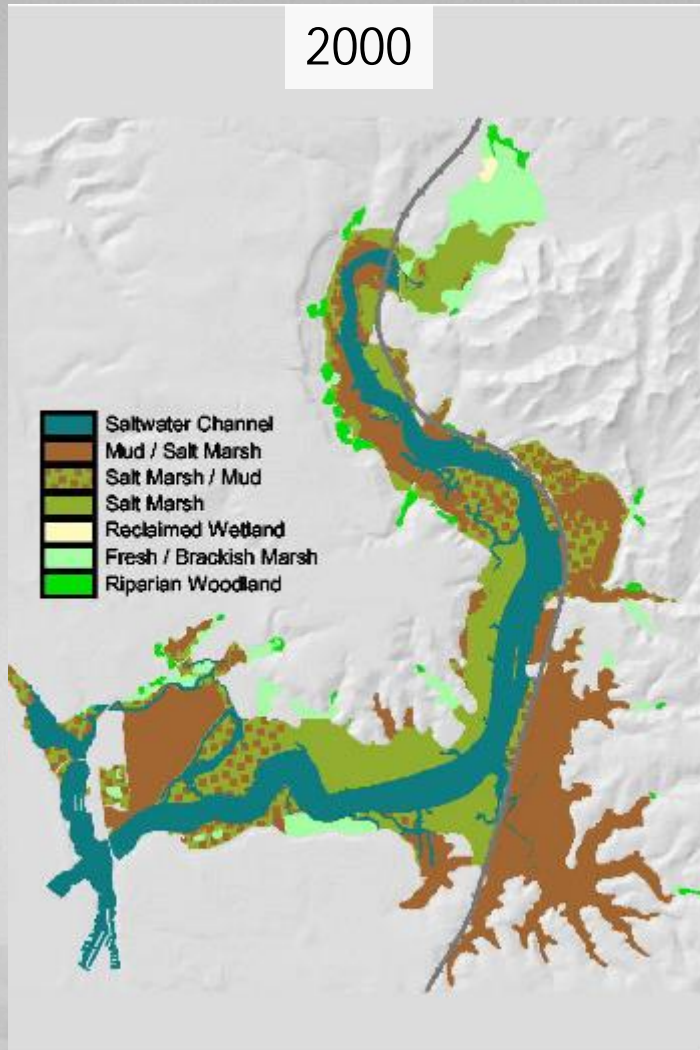
Questions

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Observation Tools

- What are the tools used to observe a drowning marsh?
 - *Photographs*



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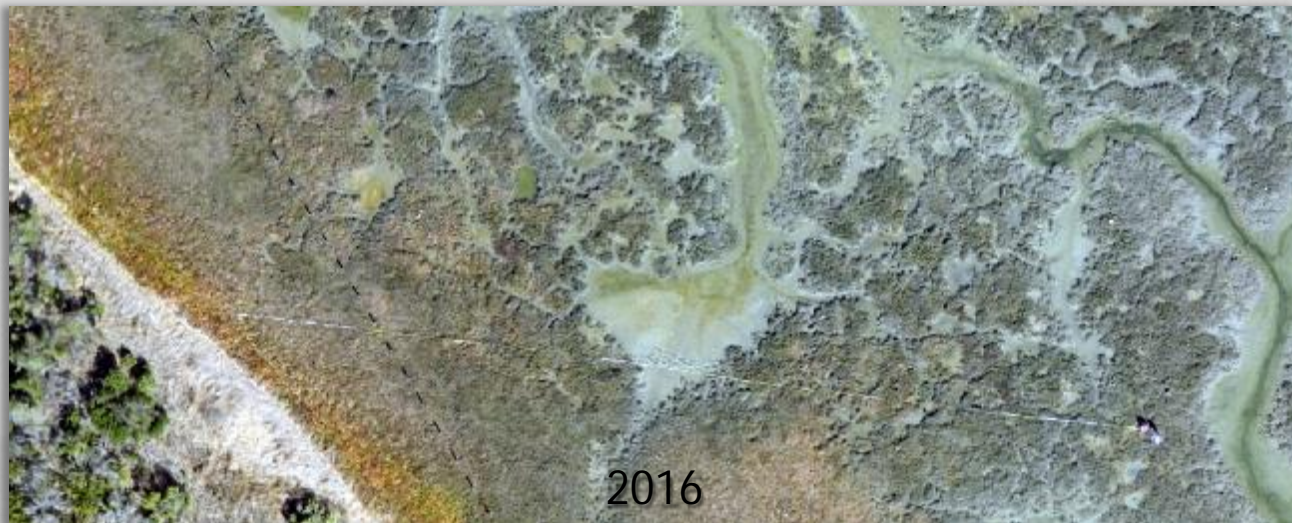
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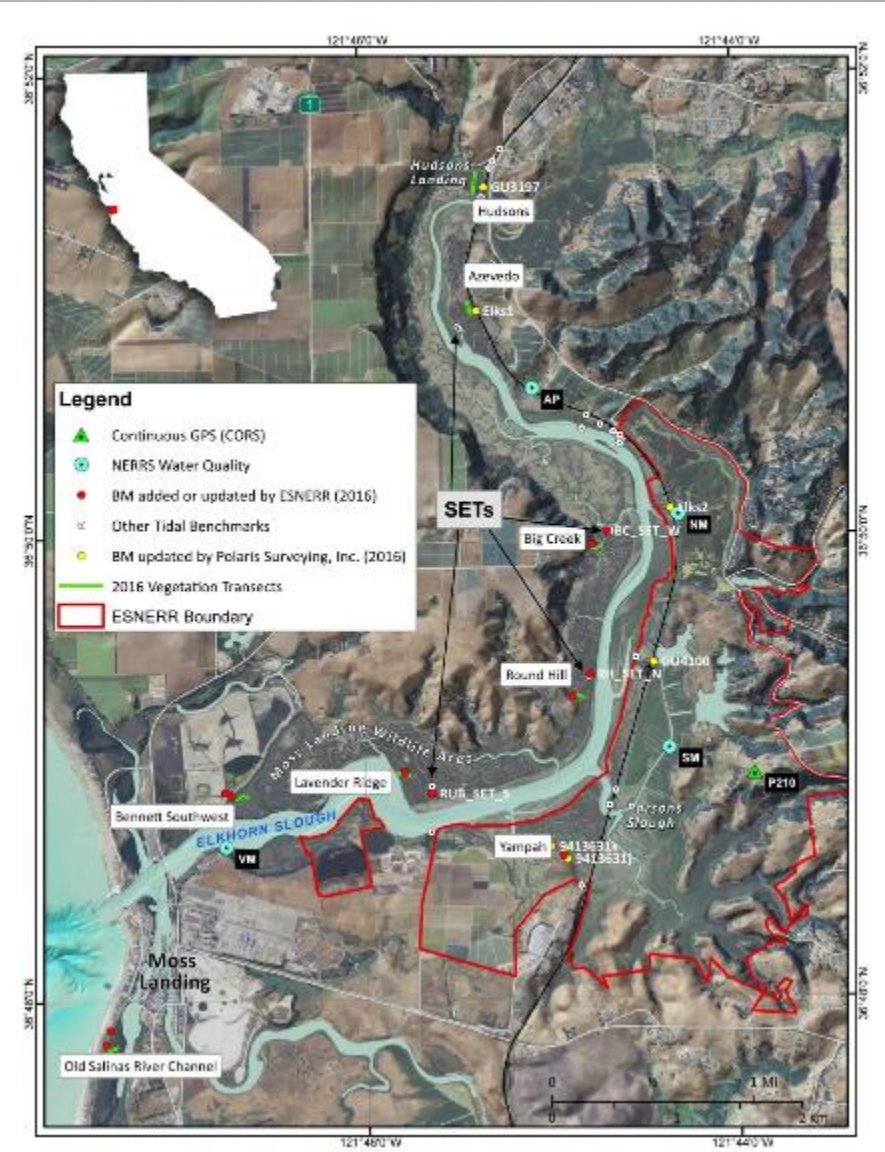
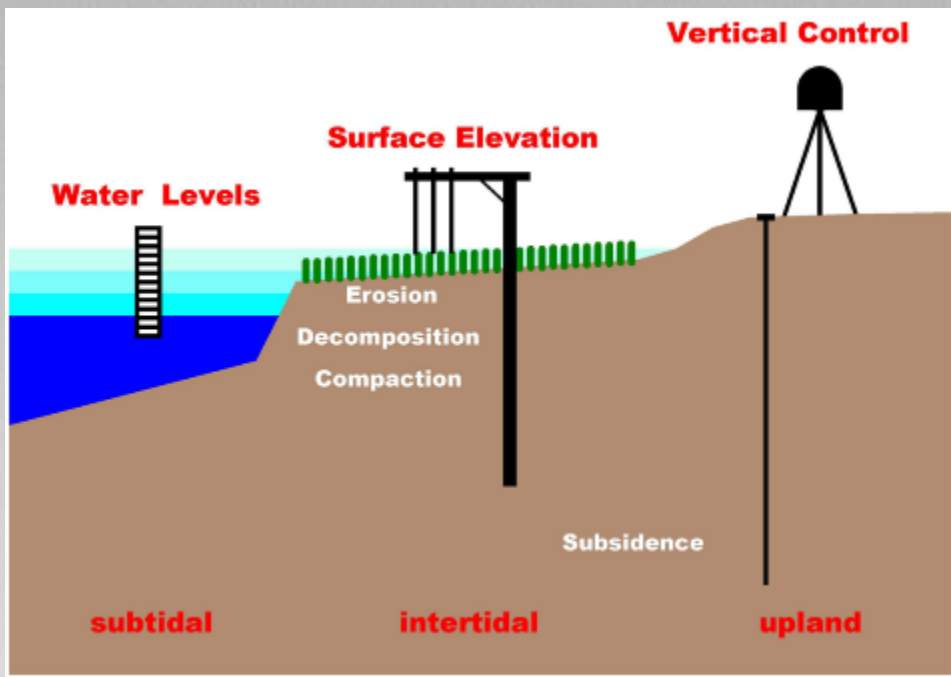
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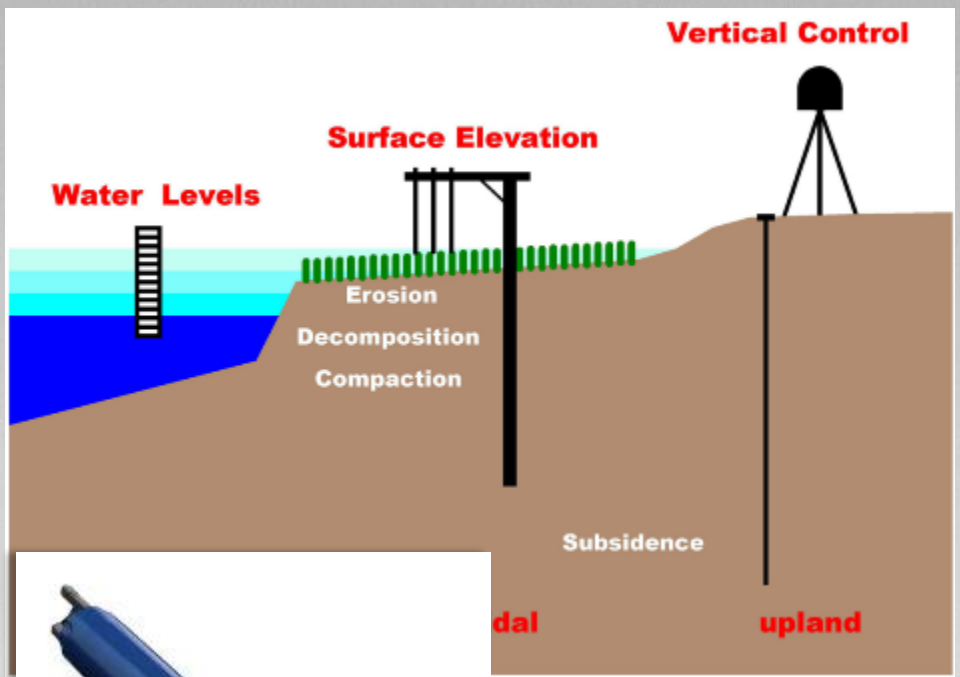
Observation Tools

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 - *Water level sensors, SETs, and CORS*

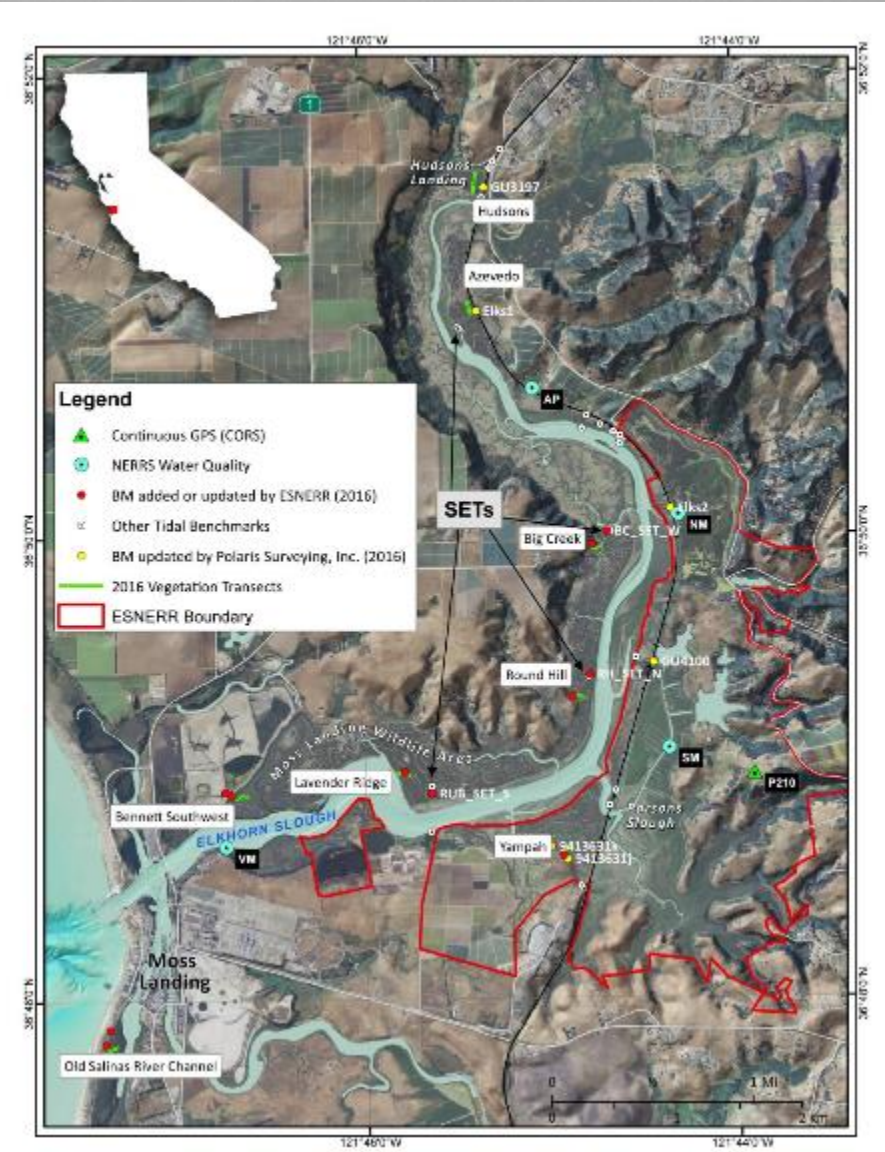


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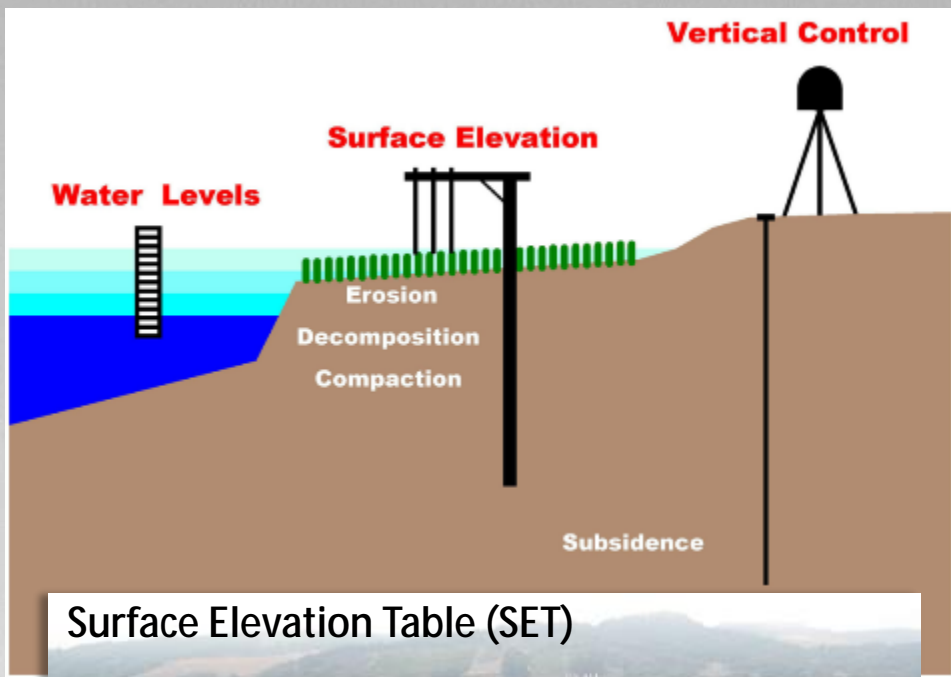


www.ysi.com

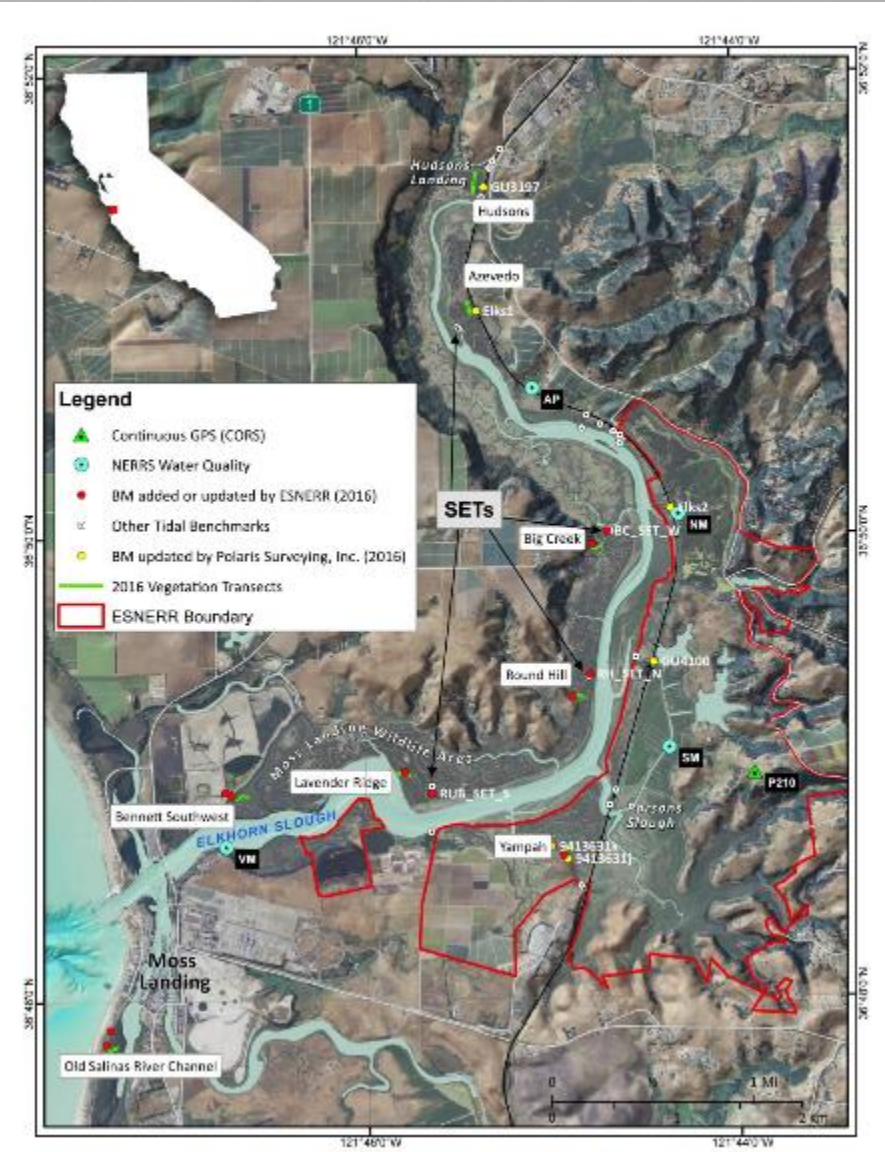


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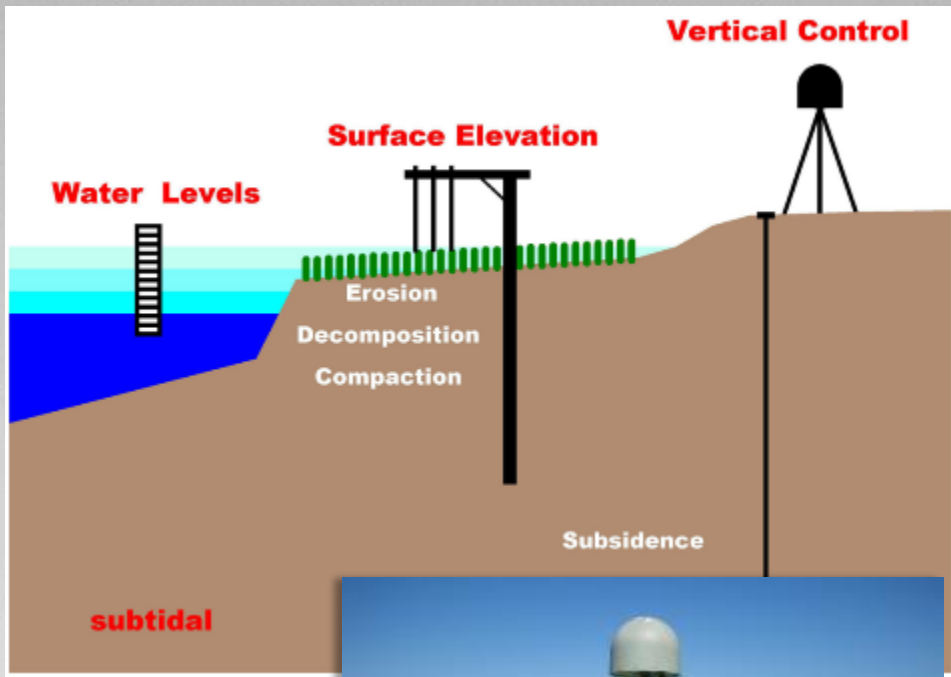


Surface Elevation Table (SET)

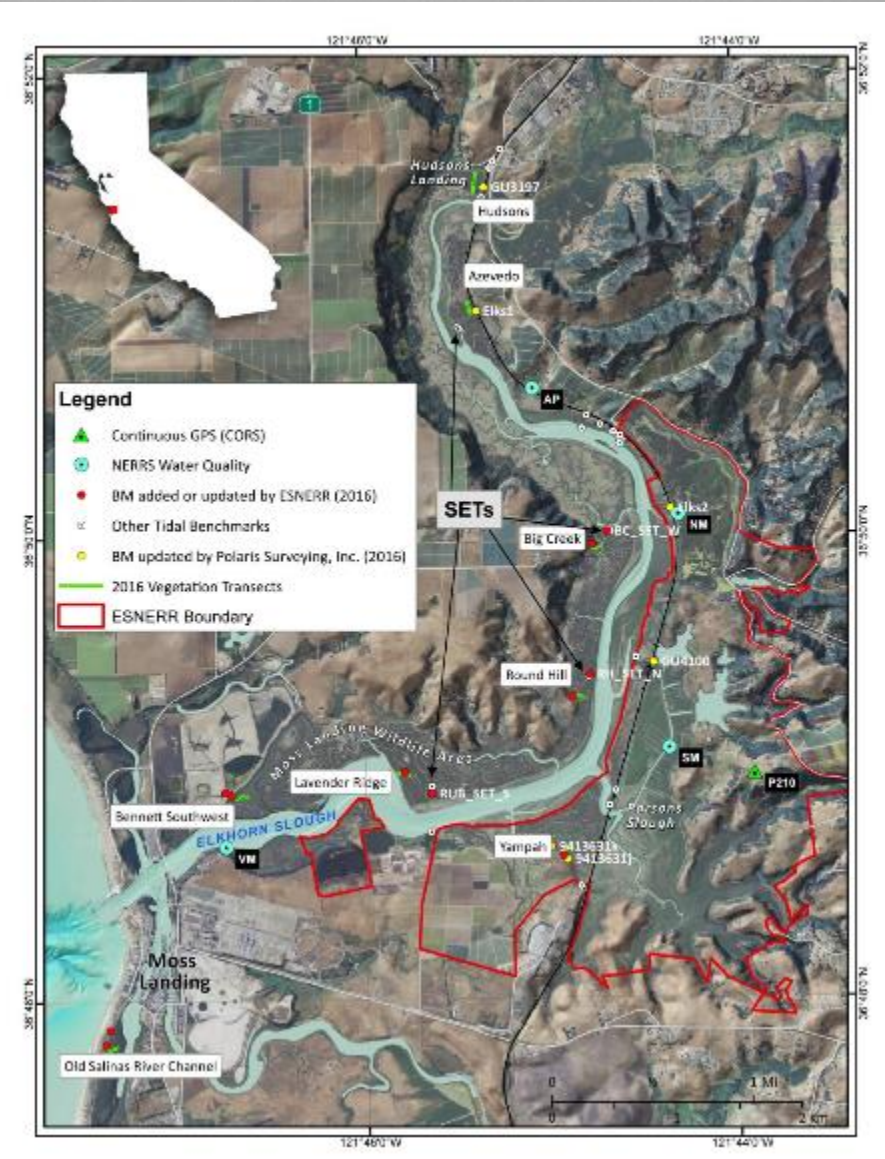


Observation Tools

- What are the tools used to observe a drowning marsh?
 - *Water level sensors, SETs, and CORS*
 - *Vertical Control Network*



<https://www.unavco.org/>



Observation Tools

- What are the tools used to observe a drowning marsh?
 - *GPS, Differential Leveling, TLS, and Remote Sensing*

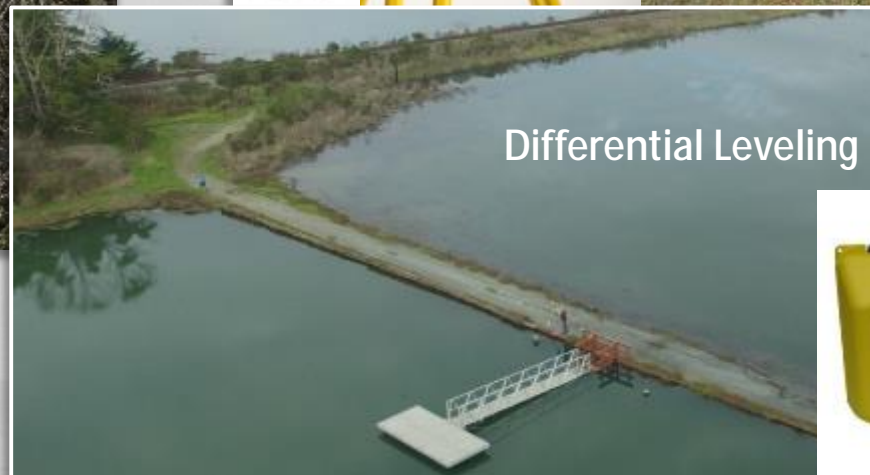
Static GPS (+2 hr)



Terrestrial LiDAR aka "TLS" (terrestrial laser scanning)



Differential Leveling



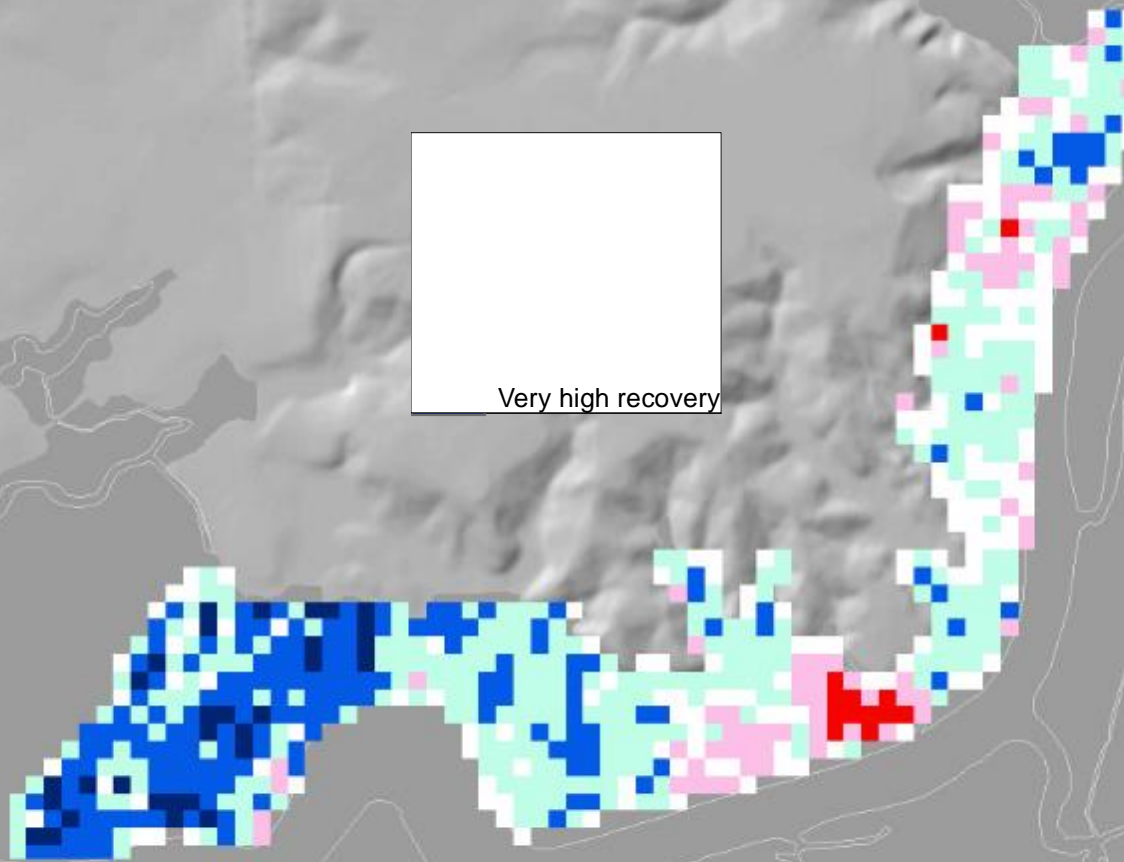
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Data Results

Remote sensing: *Marsh Classification*

2004 - 2012



Very high recovery

Data Results

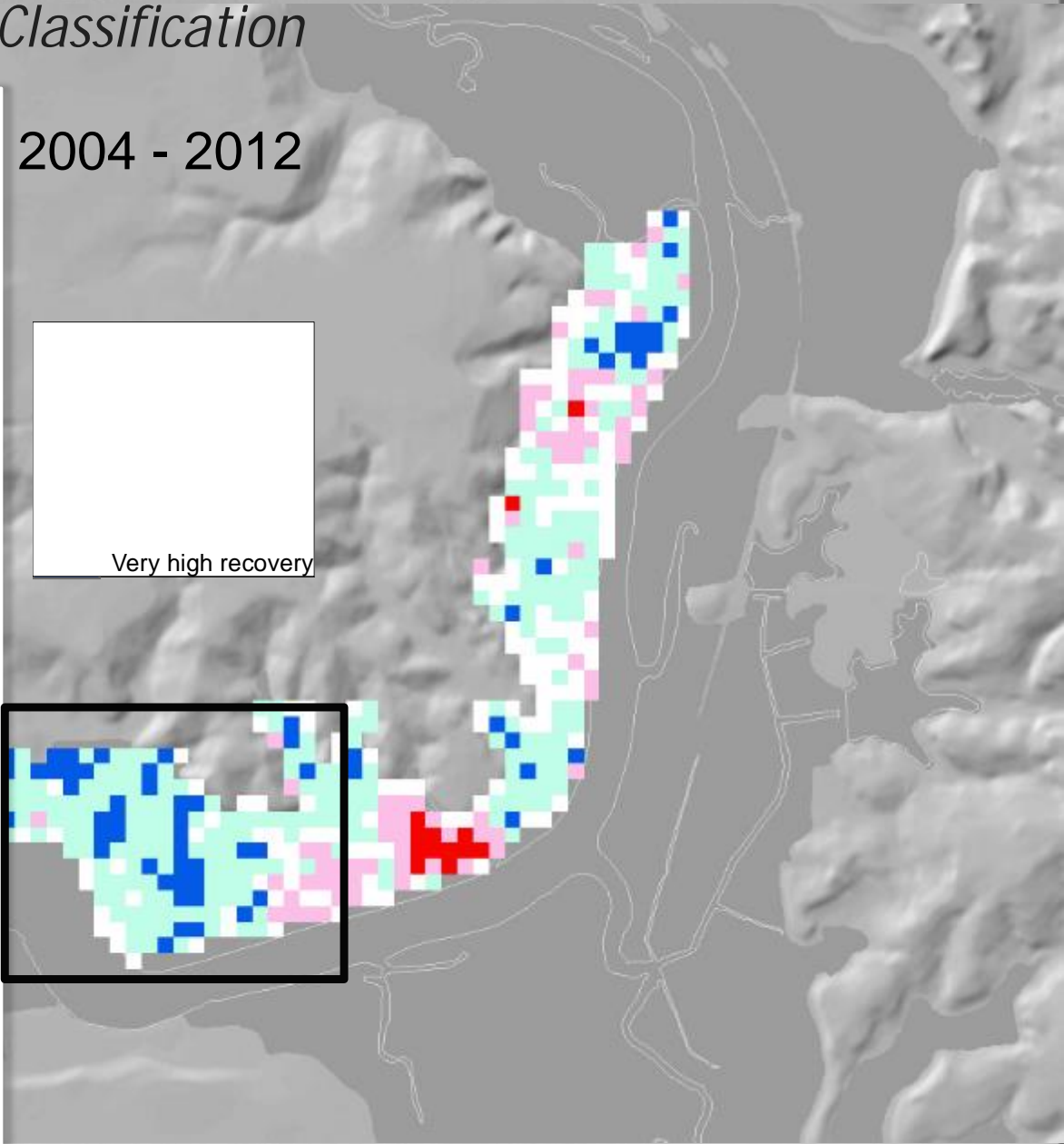
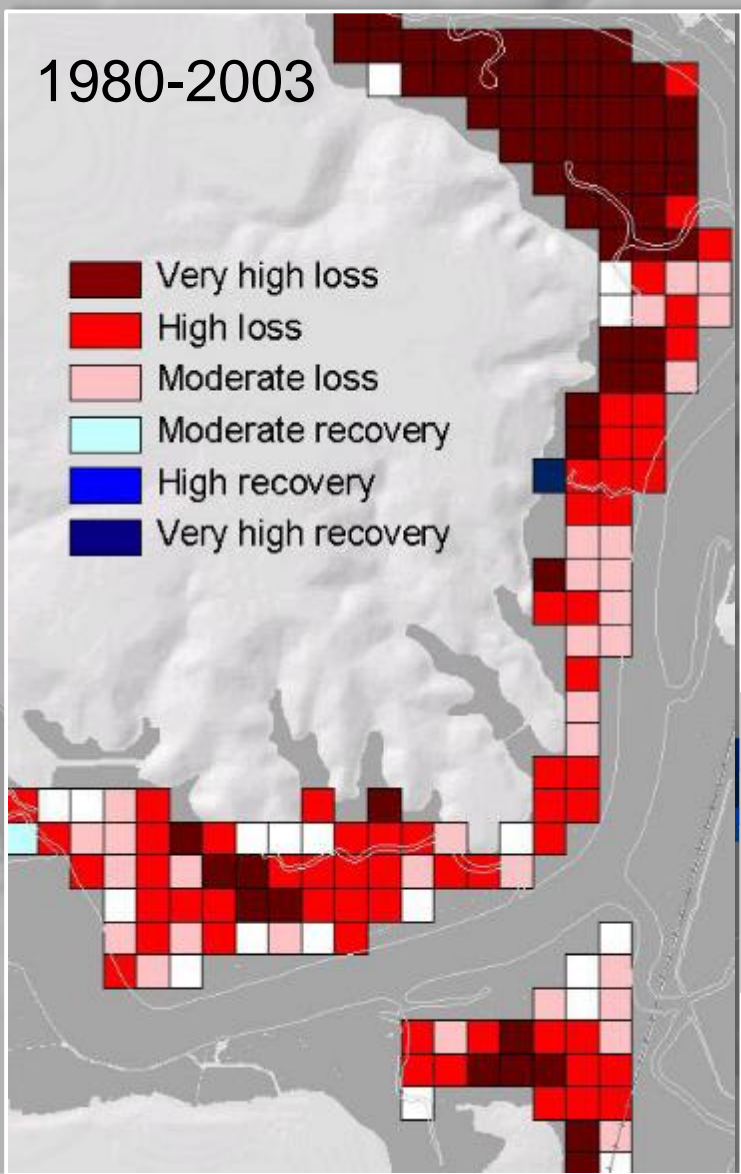
Remote sensing: *Marsh Classification*

1980-2003

2004 - 2012

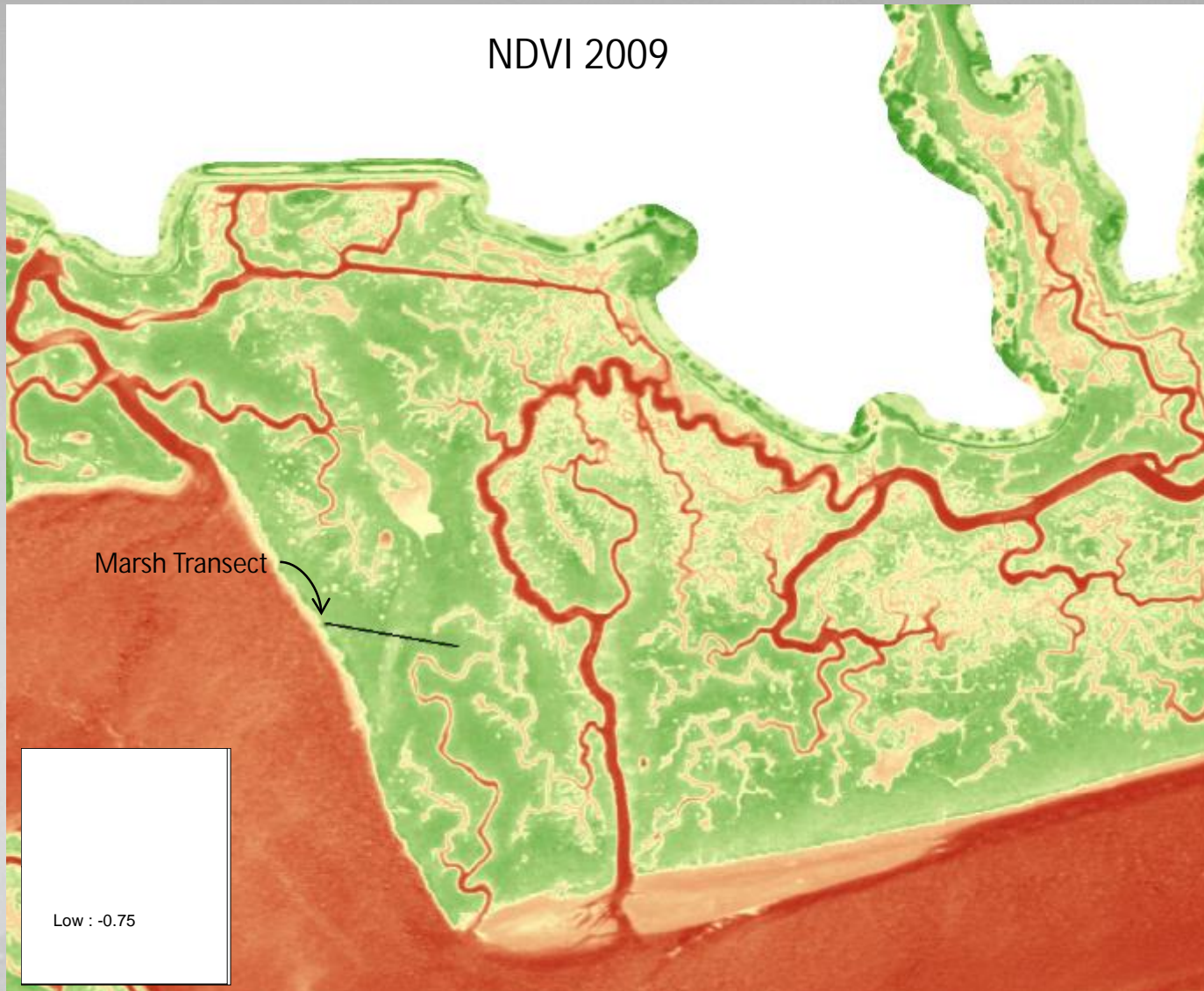
- Very high loss
- High loss
- Moderate loss
- Moderate recovery
- High recovery
- Very high recovery

Very high recovery



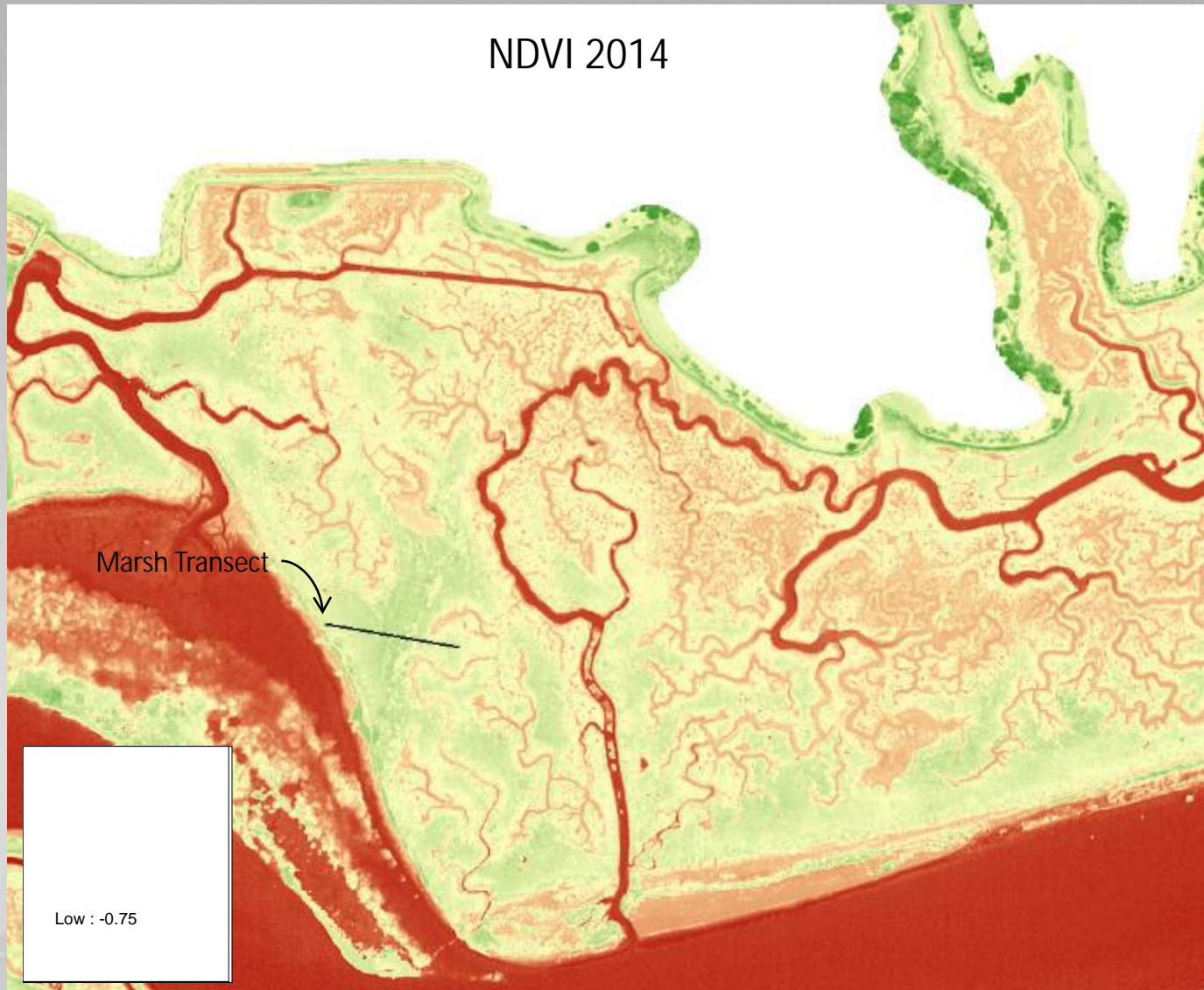
Data Results

TLS and remote sensing: *NDVI* (normalized difference vegetation index)



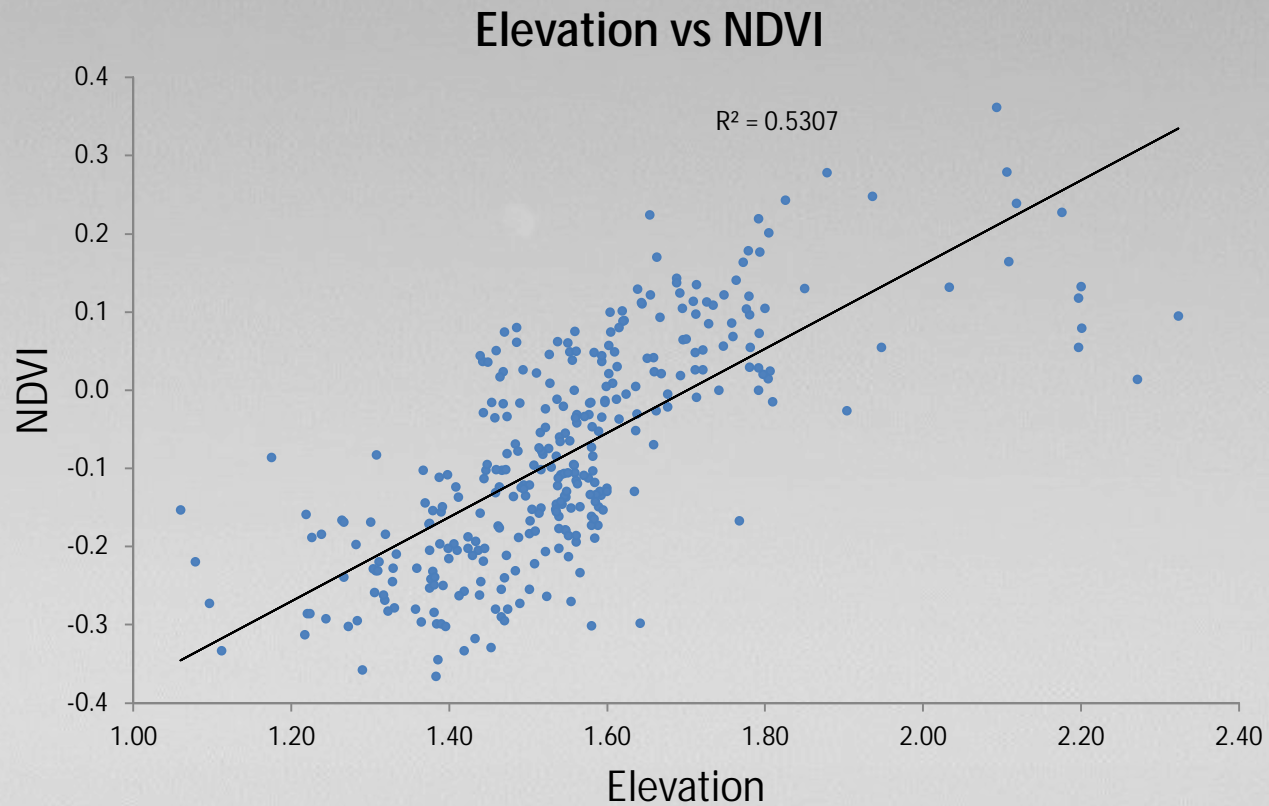
Data Results

TLS and remote sensing: *NDVI* (normalized difference vegetation index)



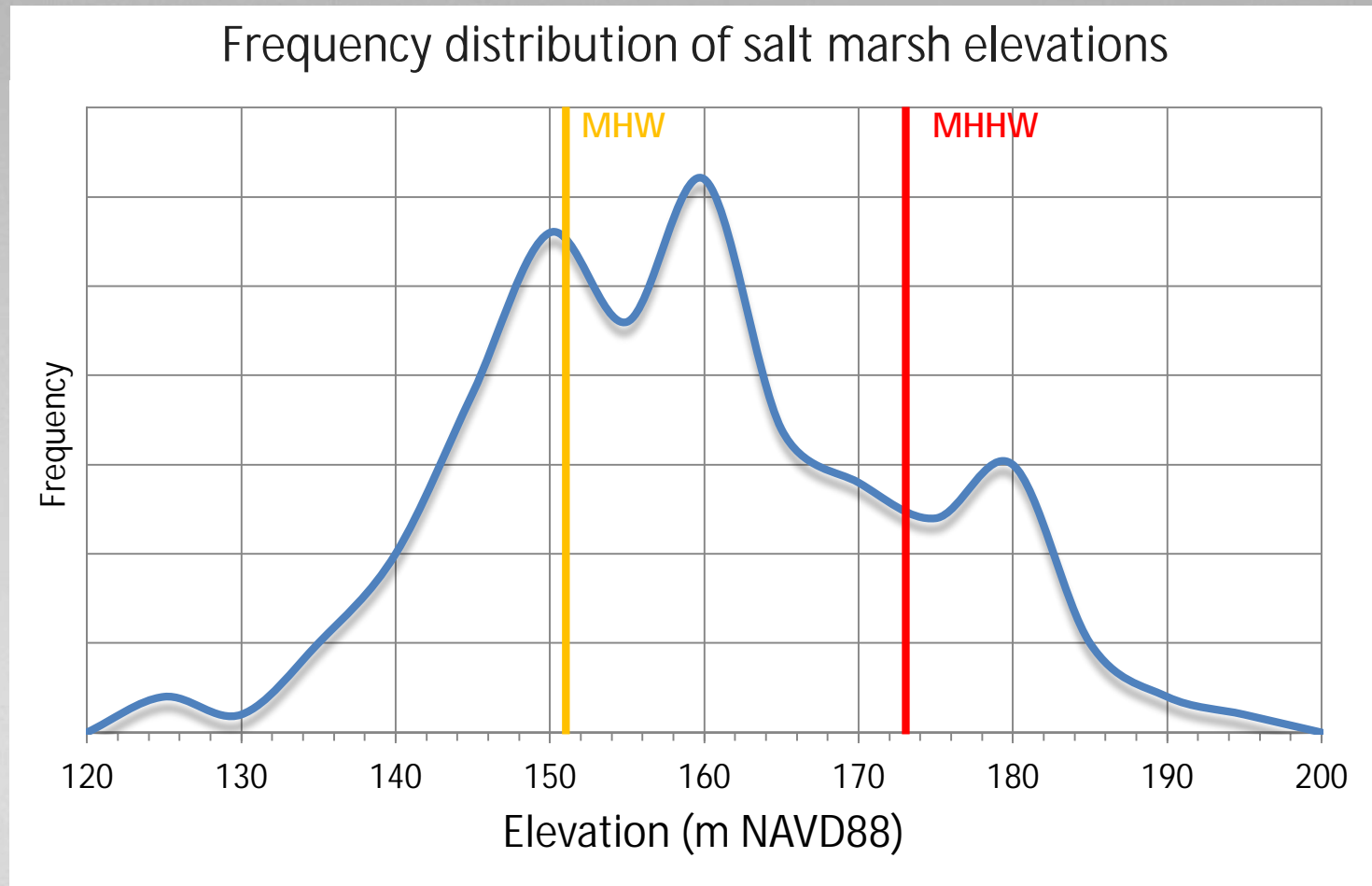
Data Results

TLS and remote sensing: *Elevation correlates with NDVI*



Data Results

TLS and marsh transect data: *marshes are low in the tidal frame*



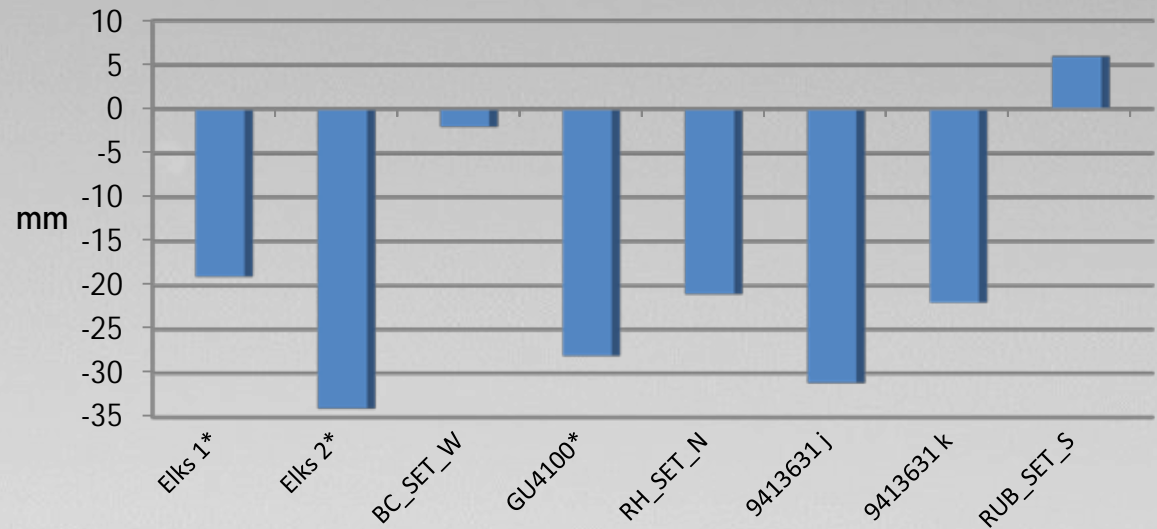
Data Results

Benchmark Surveys: *Subsidence = 2.75 mm/yr*



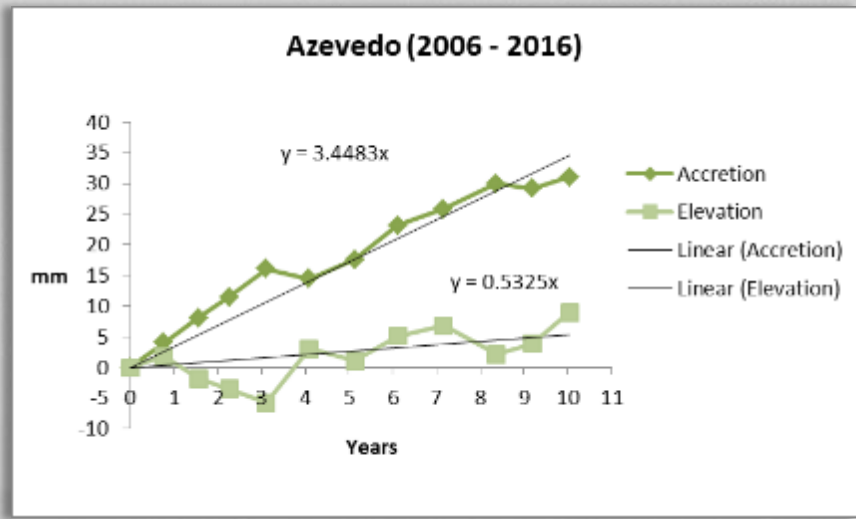
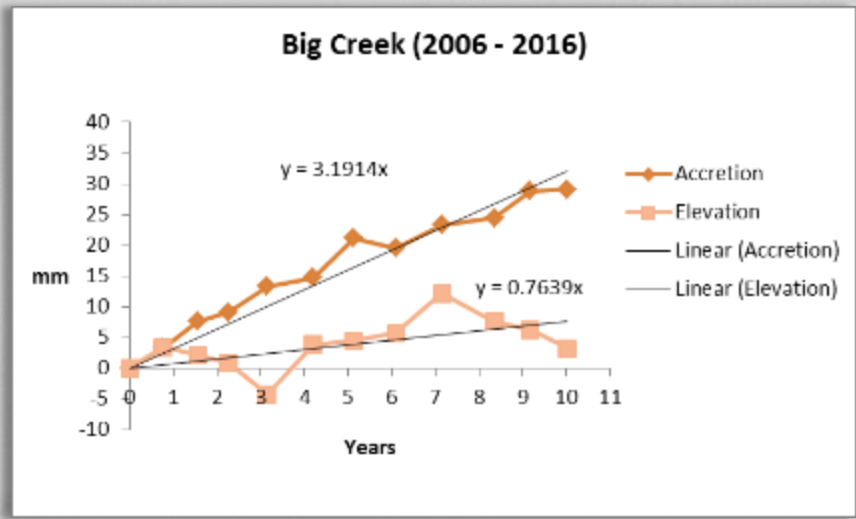
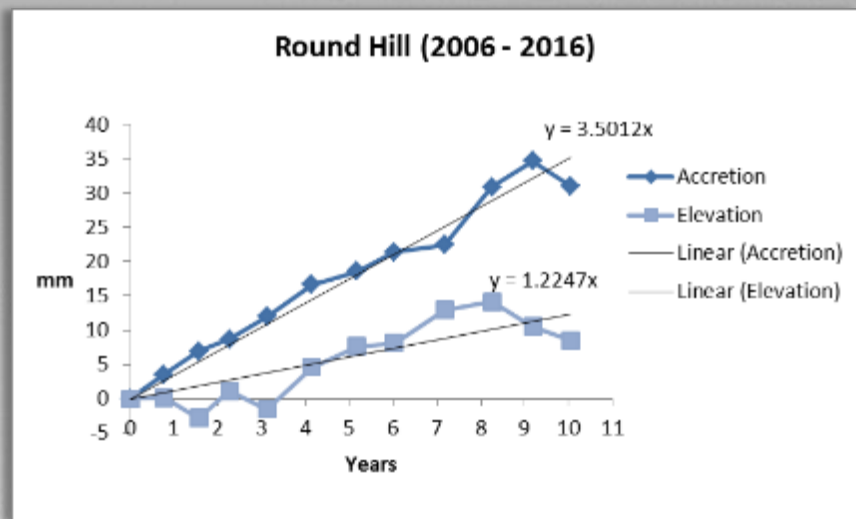
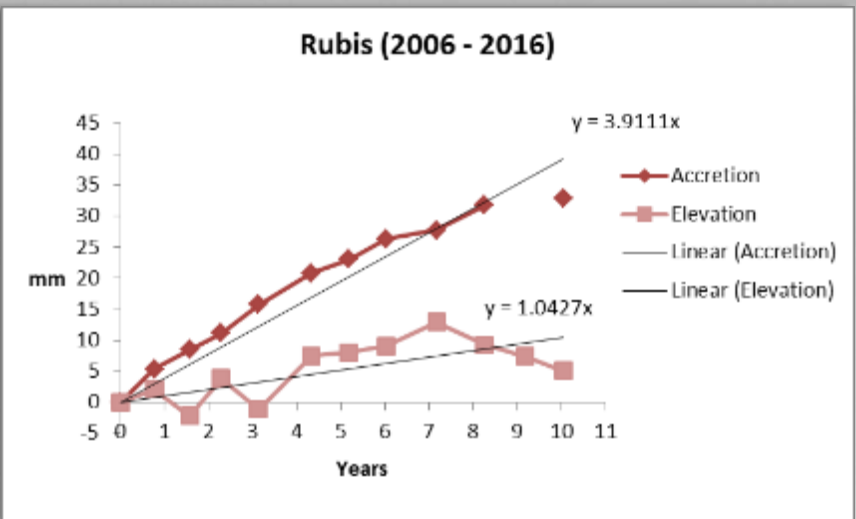
Laser Leveling

Elevation Change at Benchmarks (2008 to 2016)



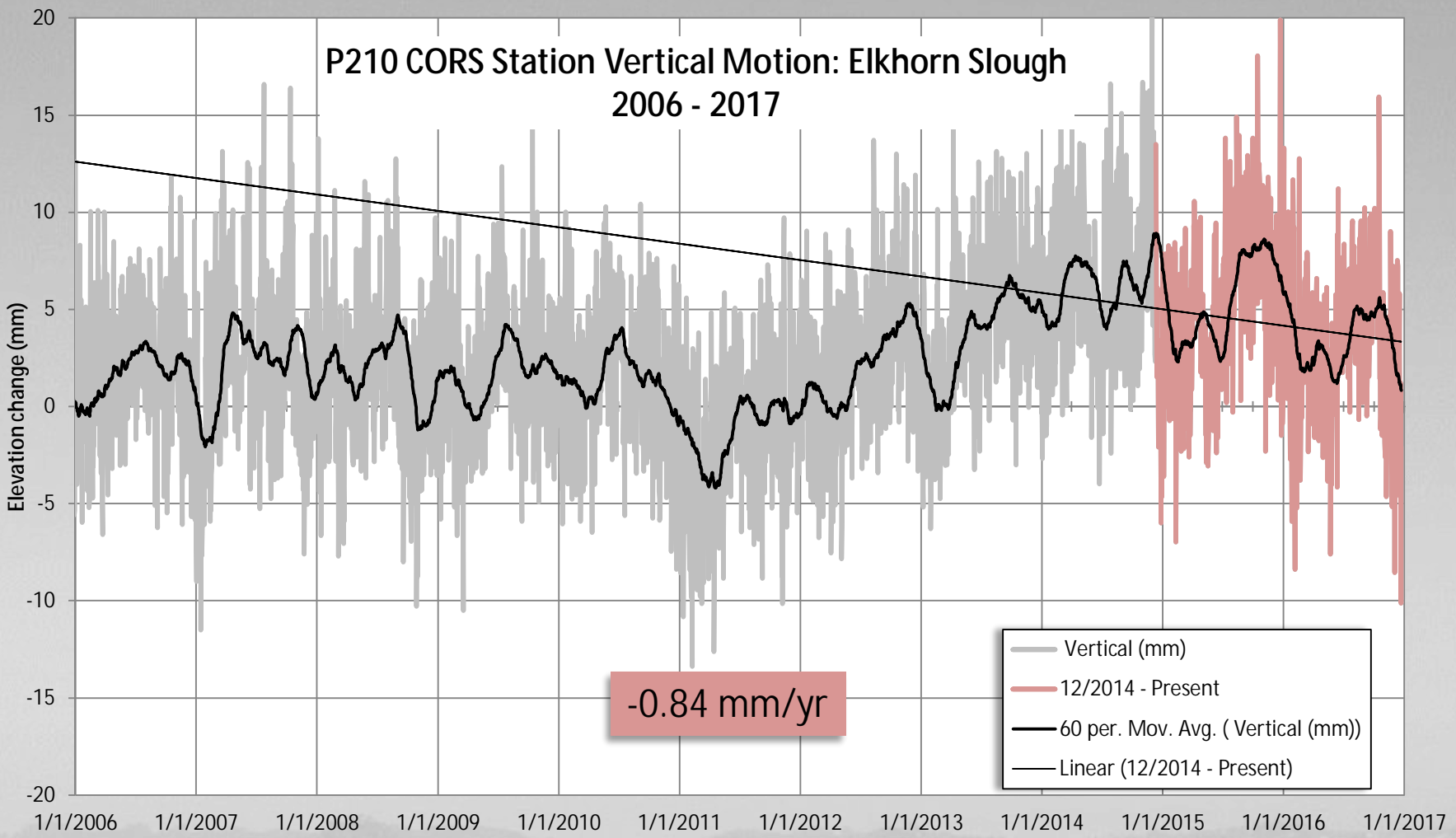
Data Results

SET data: Accretion outpacing elevation; *Subsidence = 2.6 mm/yr*



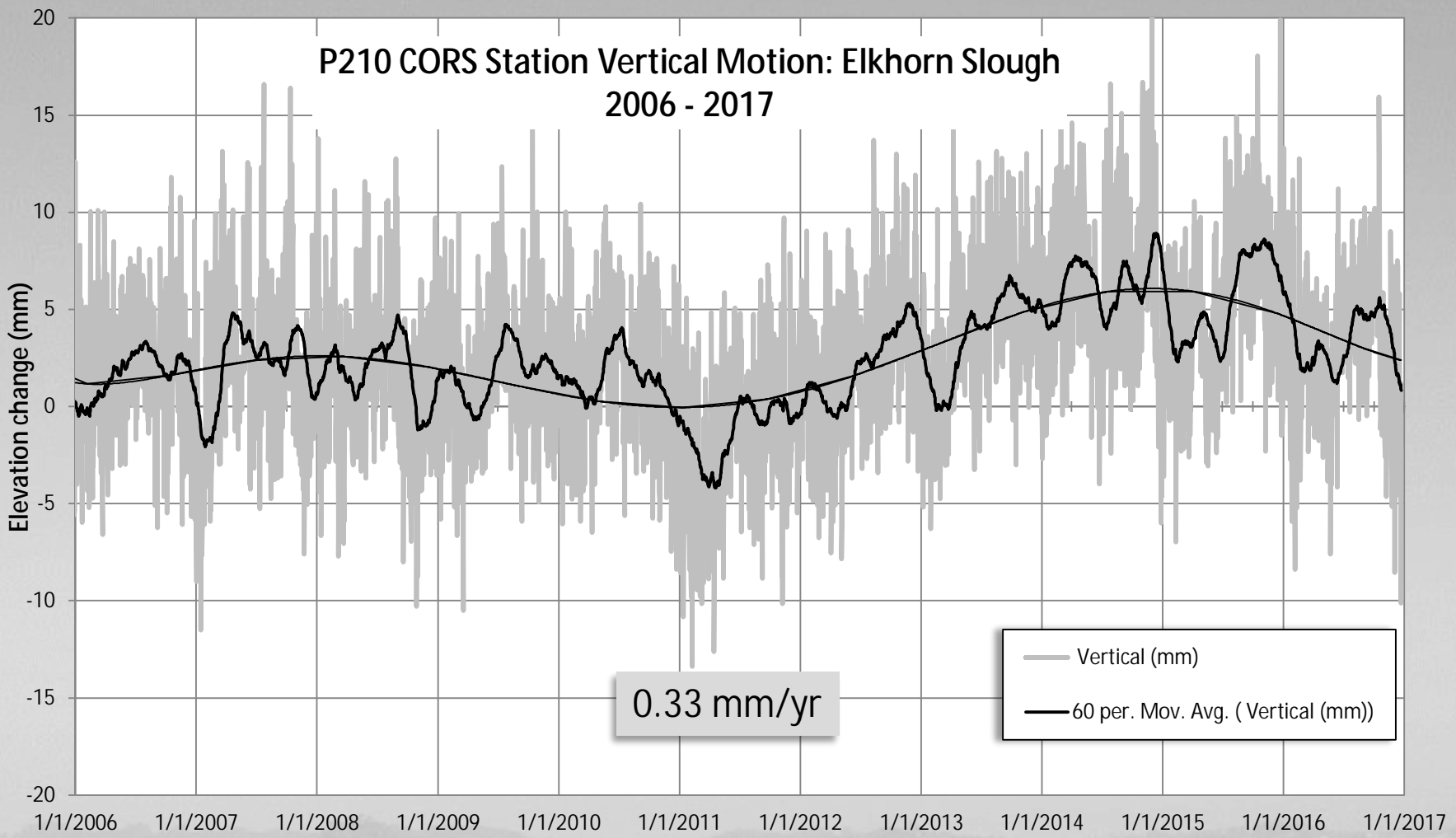
Data Results

CORS (P210) data: Vertical plate motion



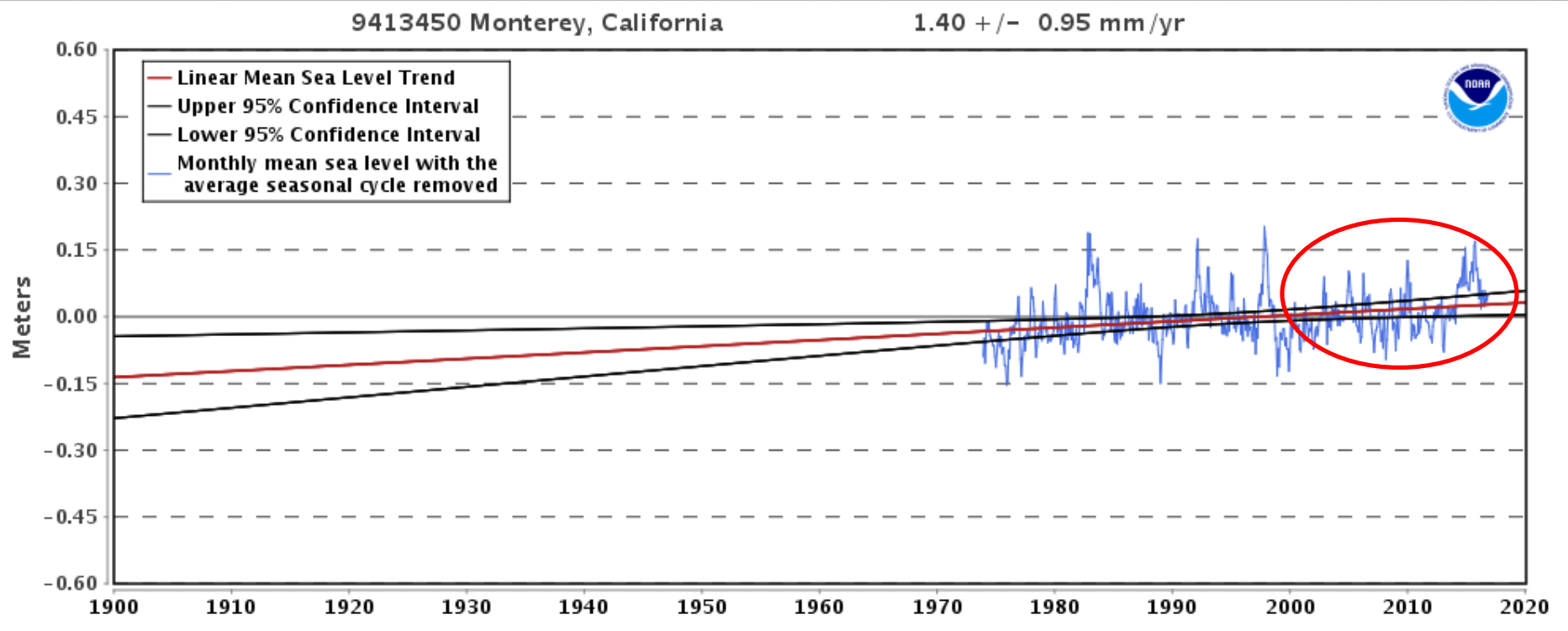
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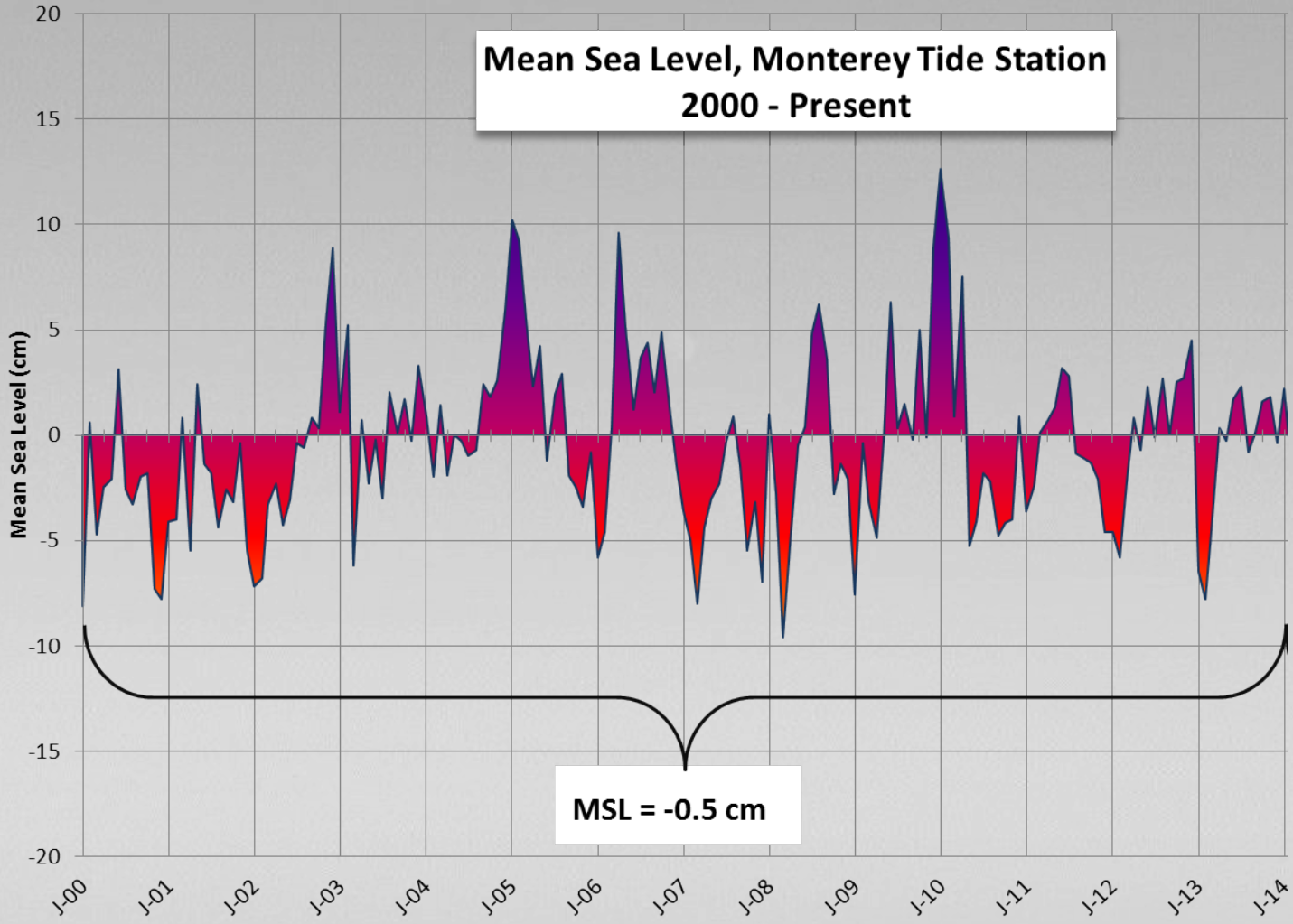
Water Level data: Monterey Tide Station



<https://tidesandcurrents.noaa.gov/>

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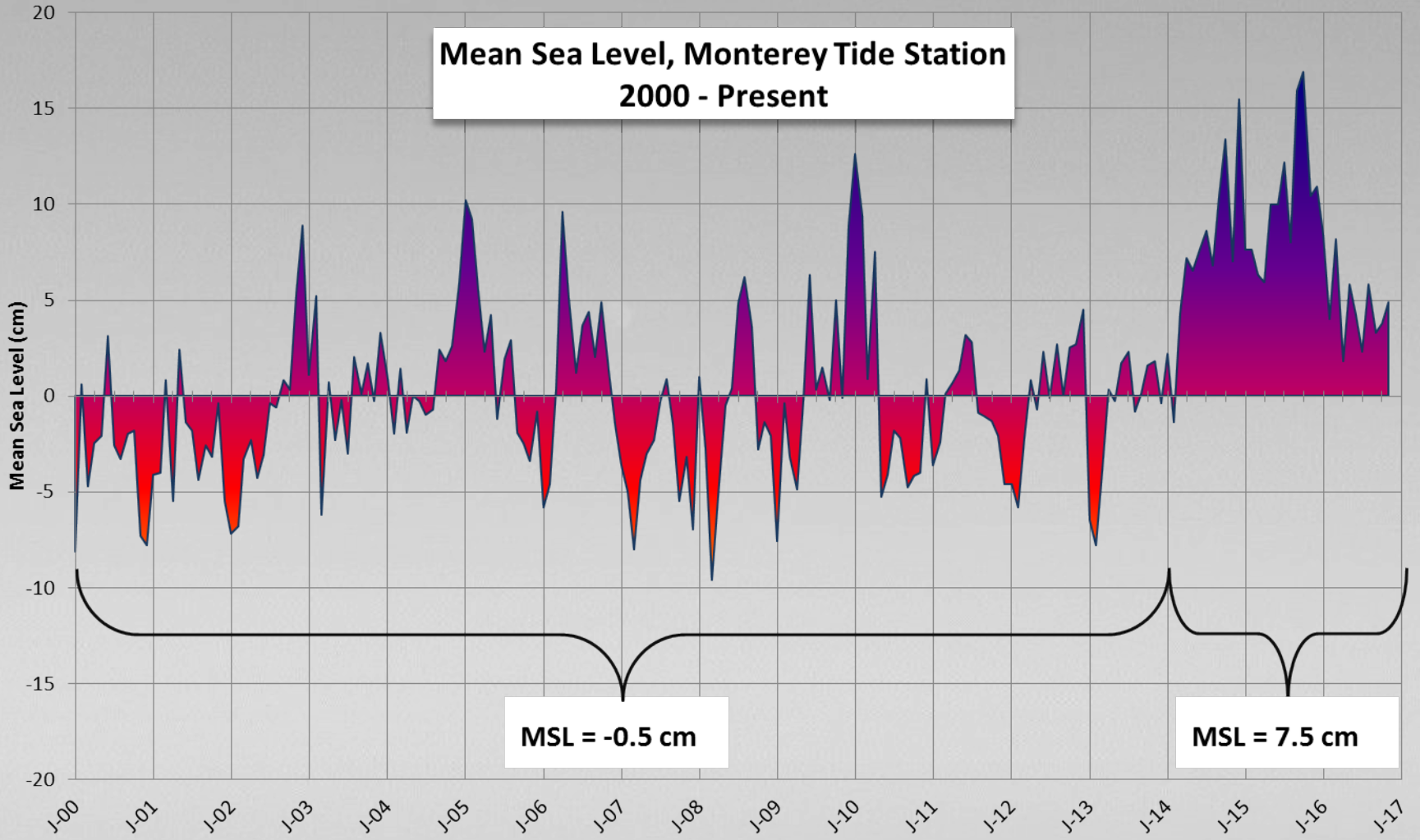
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Source: tidesandcurrents.noaa.gov/

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Summary

- Historical and recent data suggests Elkhorn Slough's marshes are drowning
- Rate of local subsidence of 3 mm/yr has been fairly consistent
- Rate of sea level rise has dramatically increased since 2014
- With sustained high water levels, significant die-off of pickleweed in Elkhorn Slough is likely
- Marsh restoration efforts are imperative

Questions?

