

# MEASURING MARSH SURFACE ELEVATION CHANGE

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Patterns and Processes, Trends and Timing

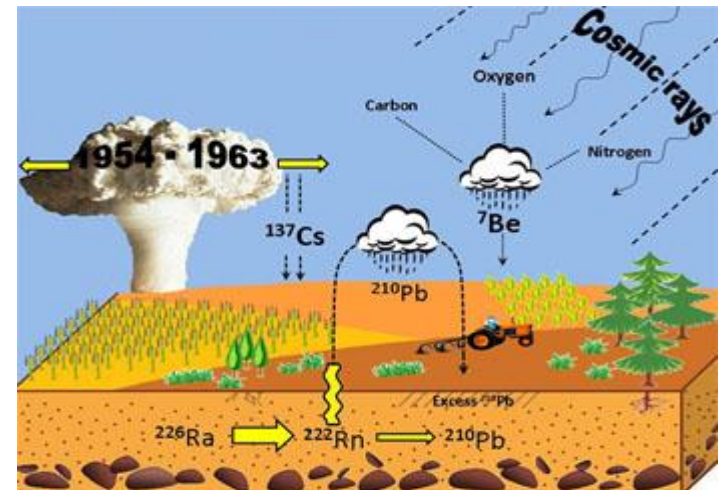
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# Outline

- SET vs. other methods
- Example applications
- Role of Ancillary measurements
  - Hurricane impact example

# Summary of Methods

- Sediment Traps
- Marker Horizons
- Radionuclide
  - $^{210}\text{Pb}$
  - $^{137}\text{Cs}$
- Surface Elevation Table (SET)



<http://www-naweb.iaea.org/nafa/swmn/topic-soil-erosion-control.html>

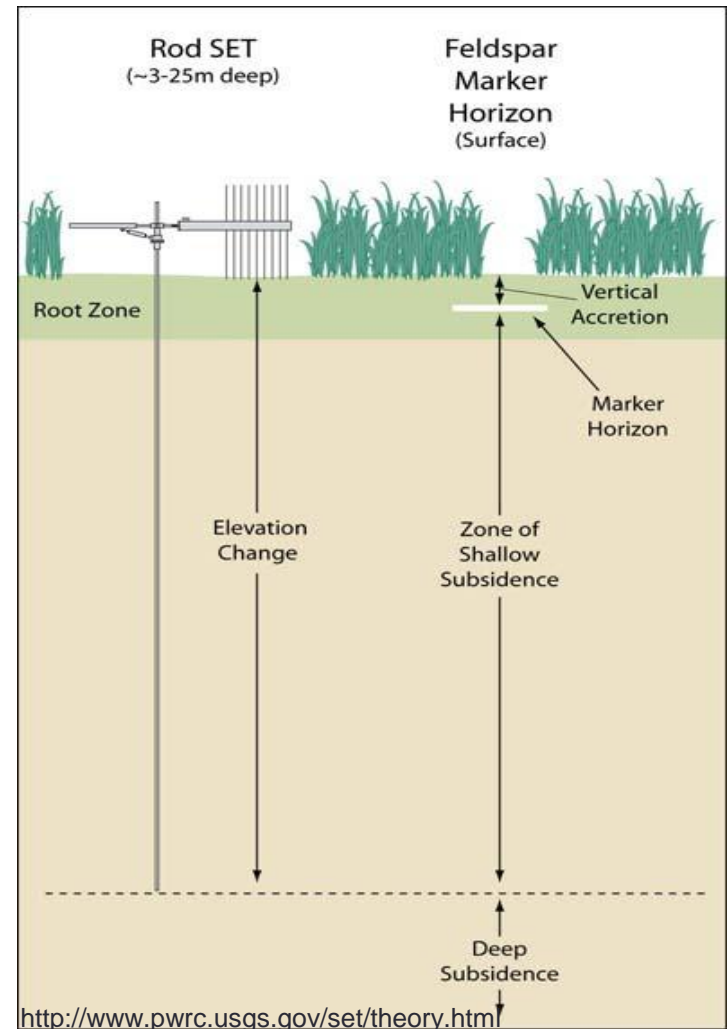
# SET

- Types
  - Original
  - Rod SET (RSET)
- Advantages
  - Represents a fixed point
  - Easy to take subsequent measurements
  - Can be conducted over long periods
  - Measurements can be taken episodically
- Disadvantages
  - Initial deployment can resource intensive
  - Requires periodic ancillary data collection



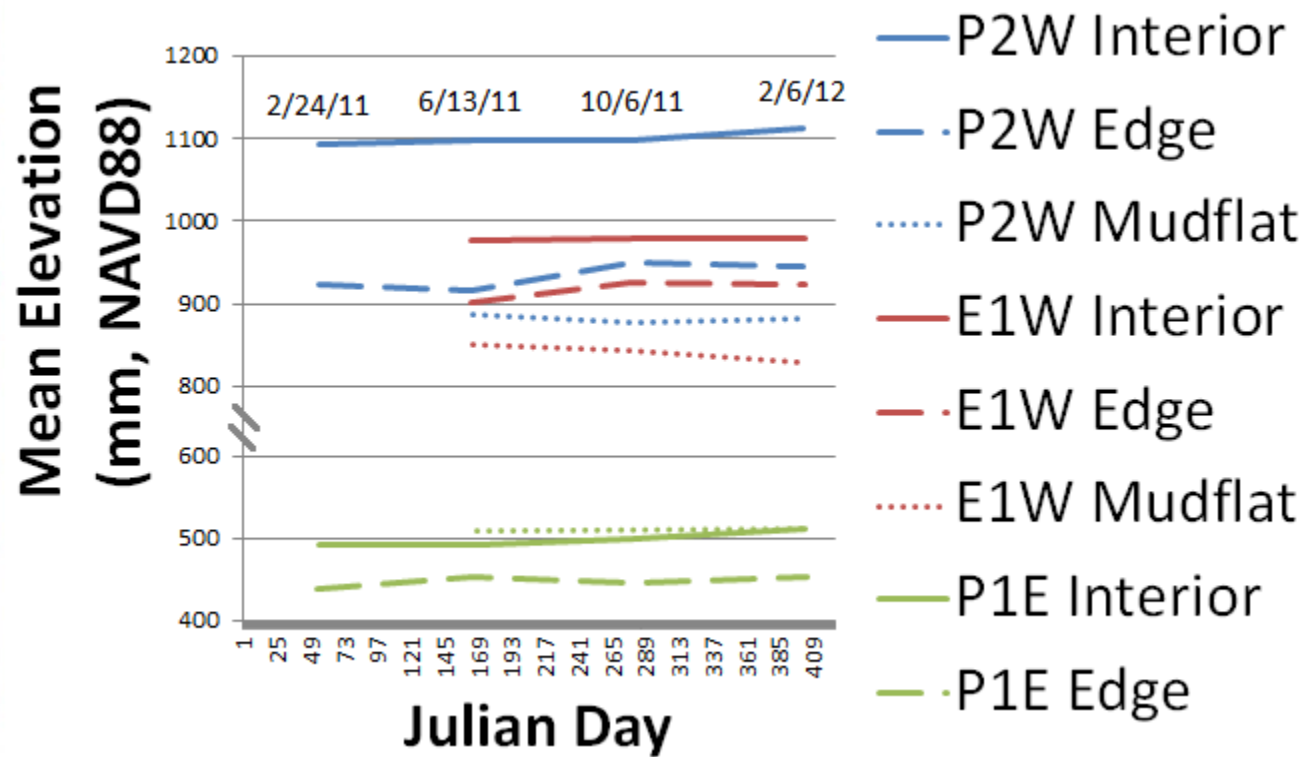
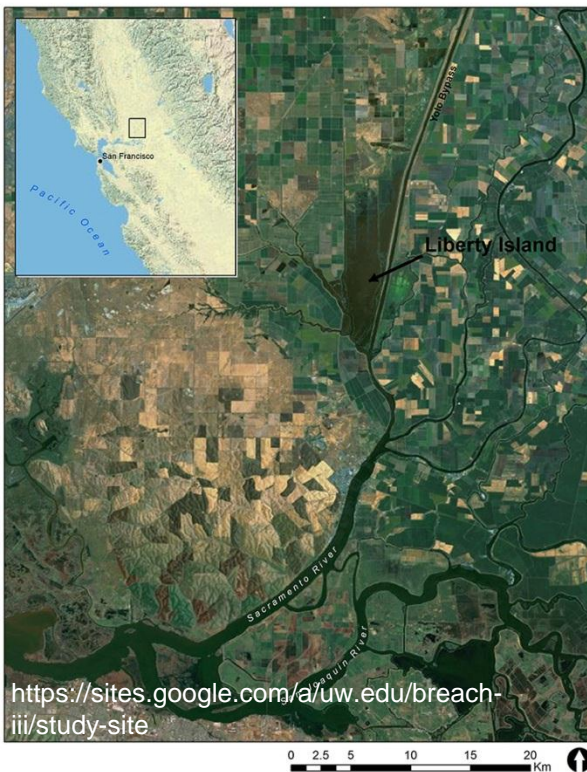
# Fixed Point vs. Moving Targets

- SETs provide measurements relative to a fixed point
- Other field techniques can be influenced by shallow subsurface processes

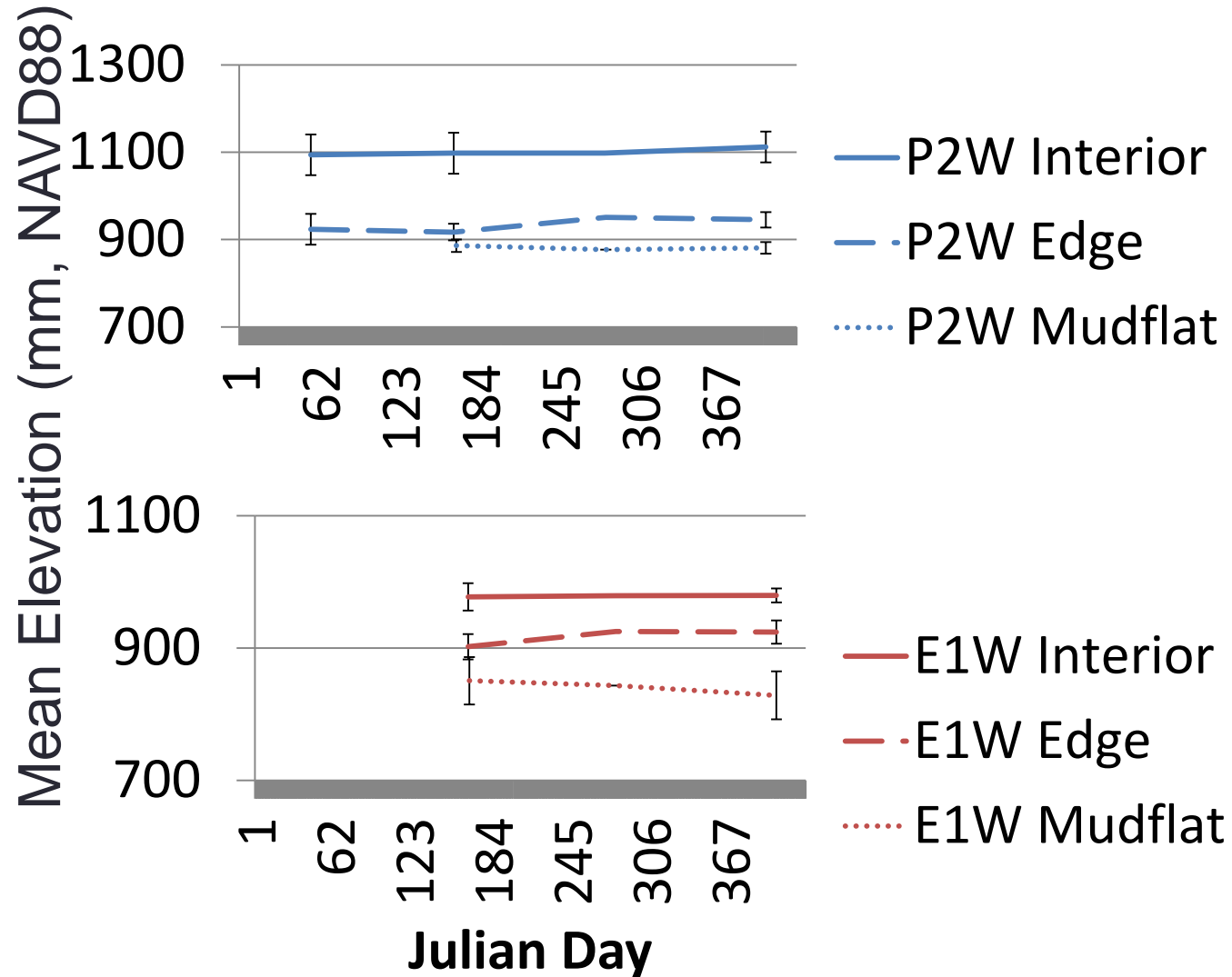
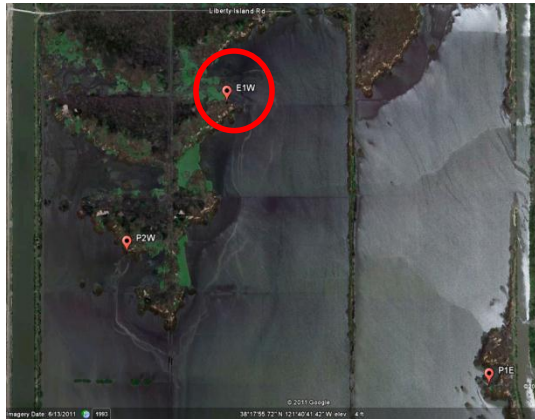


# Regular Repeated Measurements

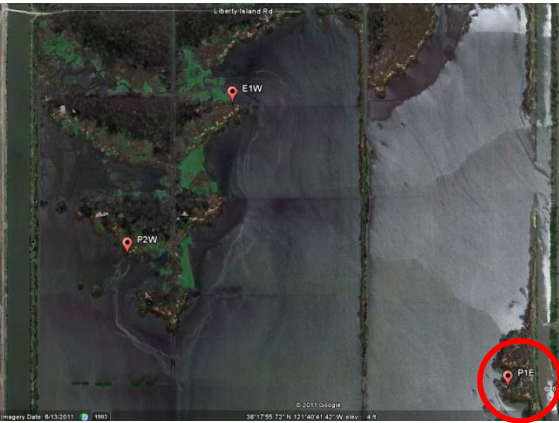
- Preliminary RSET data from and ongoing study on Liberty Island, CA



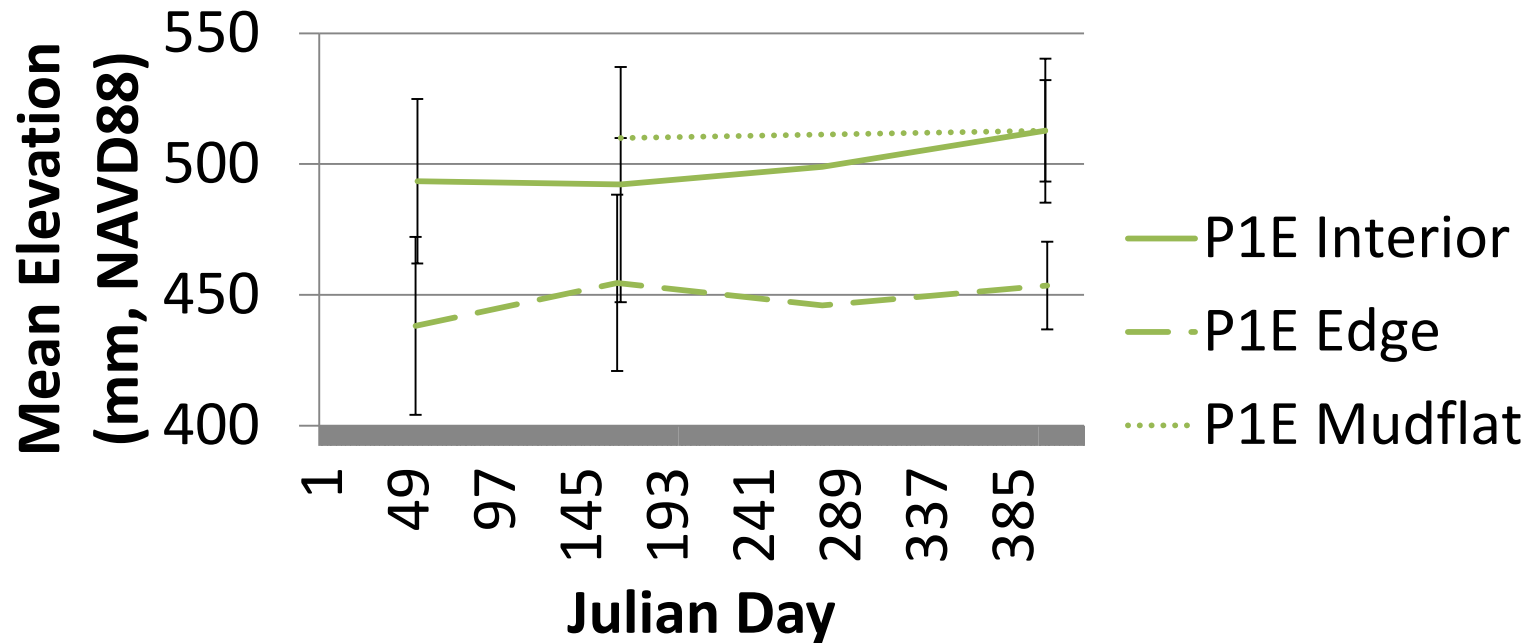
# Regular Repeated Measurements



# Regular Repeated Measurements



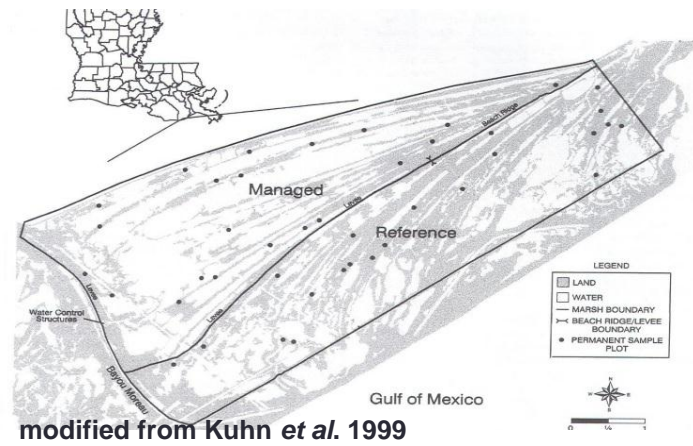
- Lower site shows different elevation pattern



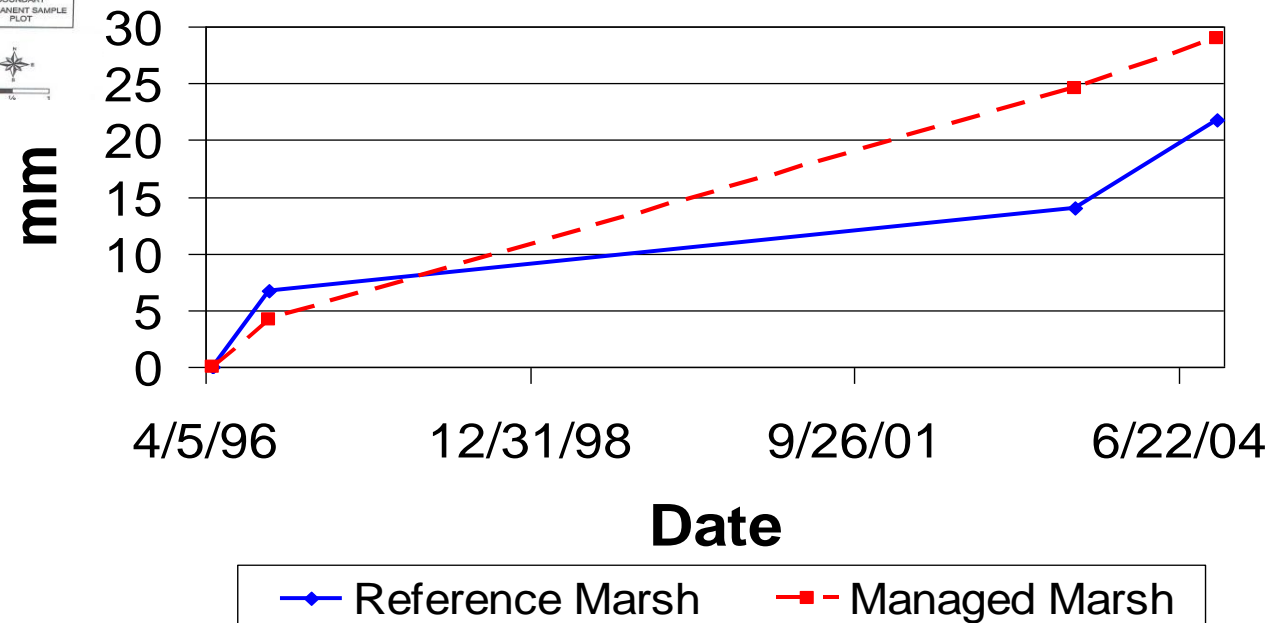


# Episodic Measurements

- Meaningful data can be acquired with infrequent sampling



### Marsh Elevation Change



# Tracking of Storm Events



Vertical accretion and marsh surface elevation change at Otter Bayou Marsh, June-December 1993.

Habitat	<i>n</i>	Accretion (cm)	<i>n</i>	Elevation Change (cm)
Least-impacted marsh <sup>a</sup>	7	2.1 ± 0.5 <sup>b</sup>	2	-1.9 ± 0.6 <sup>e</sup>
Compressed marsh	8	1.0 ± 0.7 <sup>c</sup>	3	-1.5 ± 0.9
Thick-sediment marsh	7	4.2 ± 1.2 <sup>d</sup>	2	-1.4 ± 0.6 <sup>f</sup>

<sup>a</sup>Data are means ±1 SE. <sup>b,c,d,e,f</sup>

Letters within a row designate significant difference.

Data from Guntenspergen et al. 1995

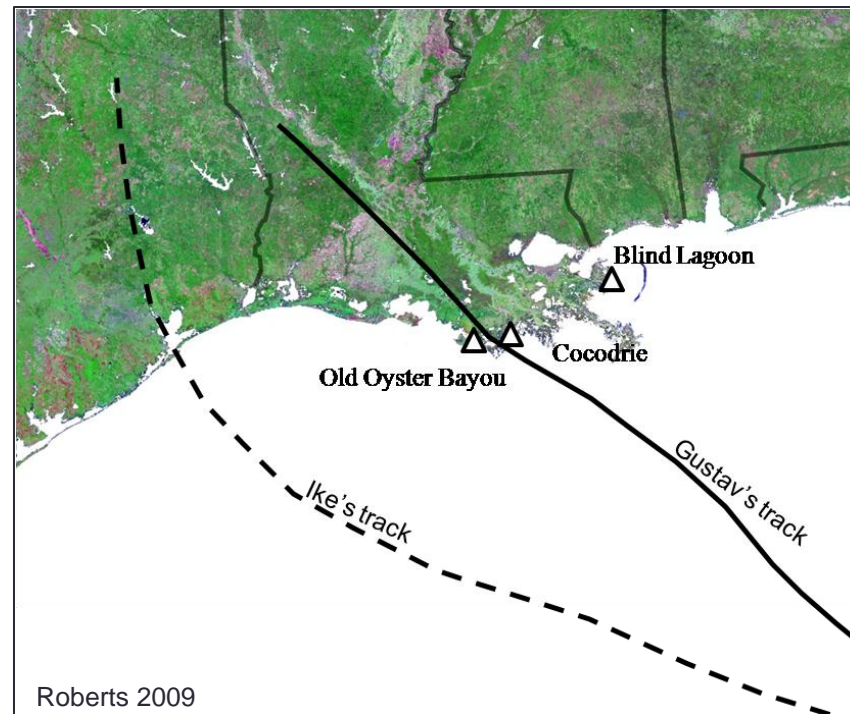
# Ancillary Data Collection

- Places elevation change in a larger context of marsh evolution
- Aboveground Vegetation
- Sediment Cores
  - Bulk Density
  - Organic Matter
  - Specific Gravity
  - Volumetric Analysis
- Marker Horizons
  - Sedimentation



# Vegetative Response to Hurricane Sedimentation

- Hurricane Gustav Landfall: September 1, 2008
- Hurricane Ike Landfall: September 13, 2008



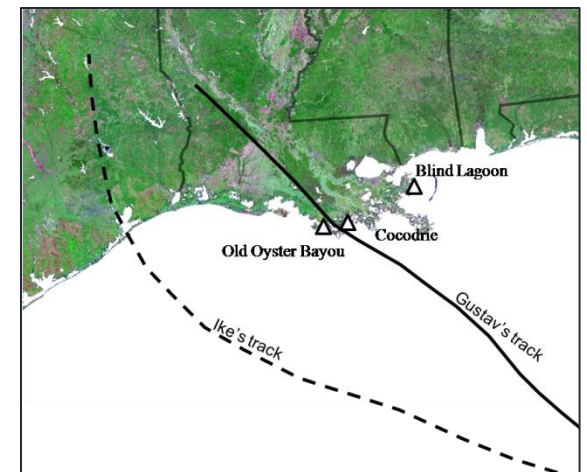
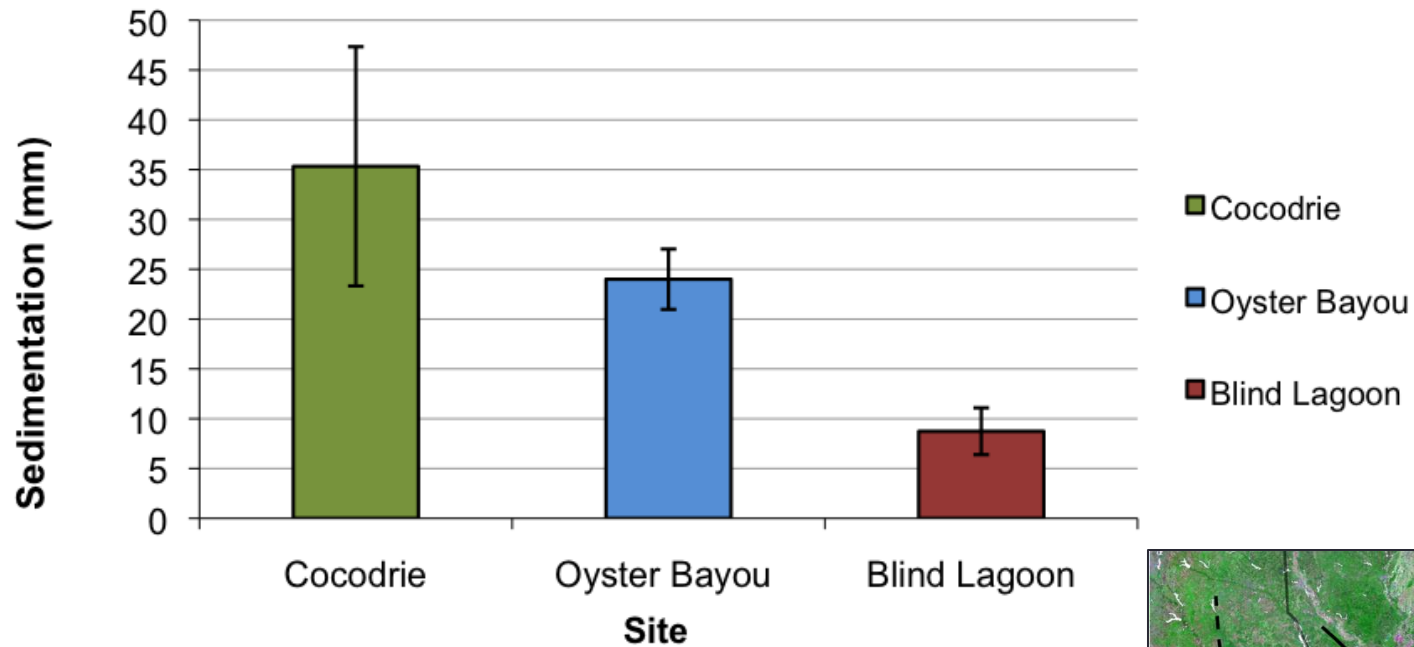
# Methodology

- Marker Horizons
  - Feldspar Plots
- SET
- Aboveground Biomass
  - Stem Clippings
  - Stem Density
  - Stem Height
- Belowground Biomass
  - % Soil Organic Matter
  - Bulk Density
  - Specific Gravity
  - Mineral and Organic Matter Volume



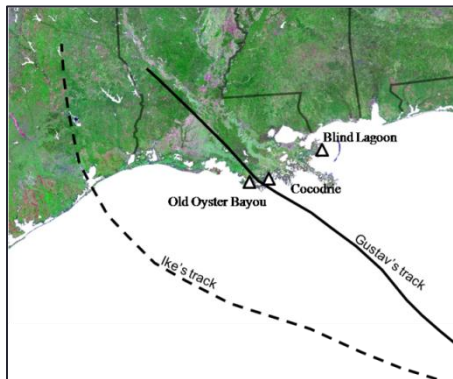
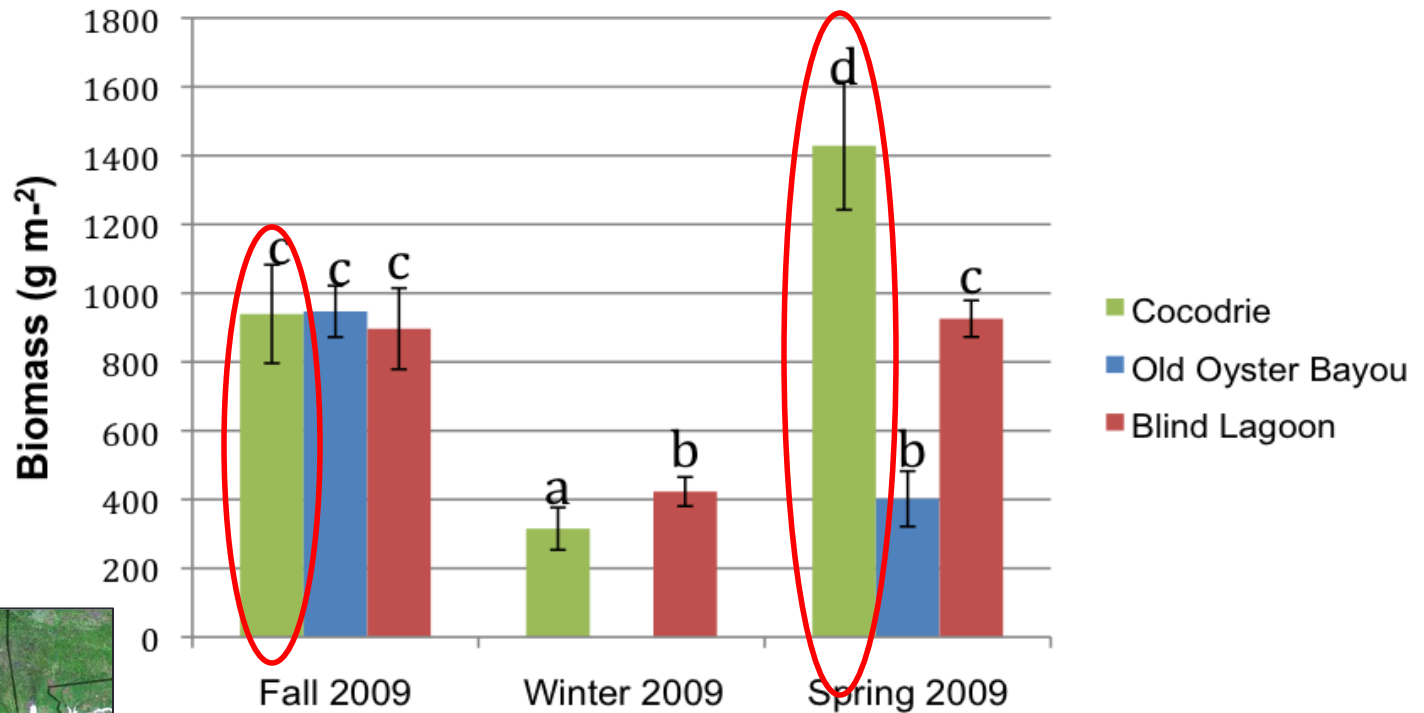
# Sedimentation

From Roberts 2009



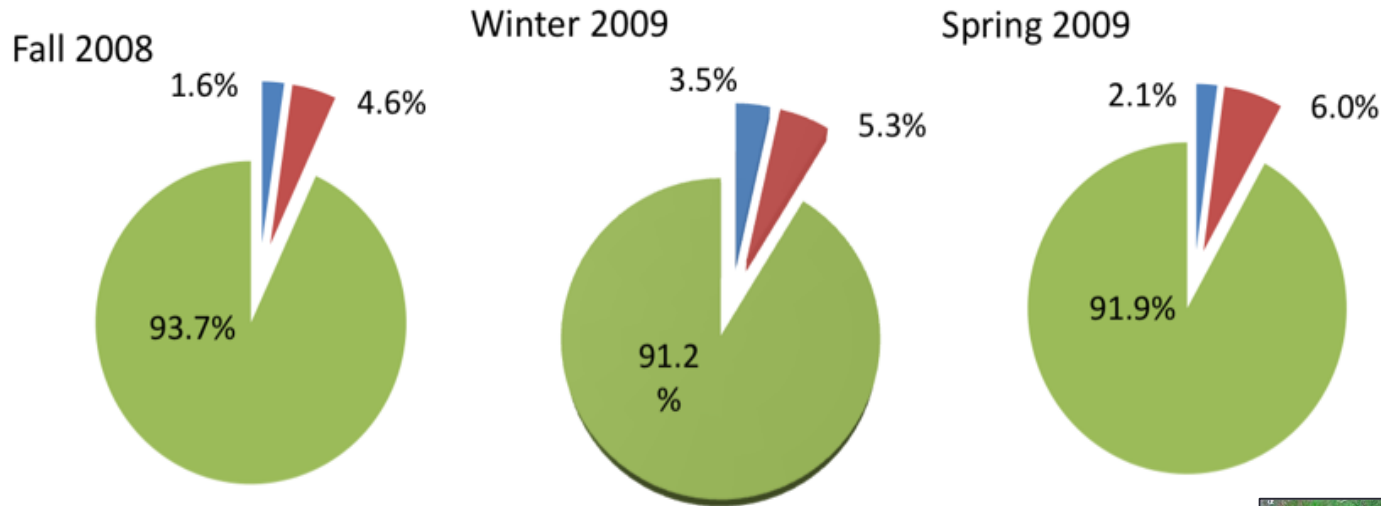
# Vegetative Response

From Roberts 2009

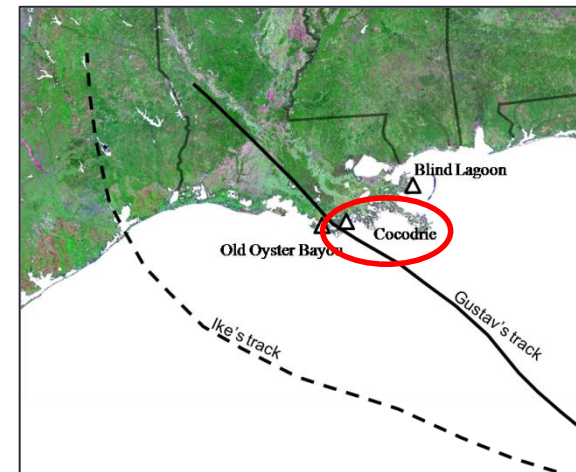


# Soil Volume

From Roberts 2009



■ Organic Matter ■ Mineral Matter ■ Pore space





# Hurricane Effects

- Directly adds sediment to marsh surface
- Stimulates aboveground biomass
- Stimulates positive changes in belowground organic and mineral matter volumes
  
- When elevation measures are used in conjunction with other measures a more complete picture of marsh evolution may be ascertained

# Acknowledgements

- Lindsay Dunaj
- Jennifer Roberts



# Questions

