

Natural and Stabilized Estuarine Shorelines in North Carolina: Research and Policy

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Restoration
Center

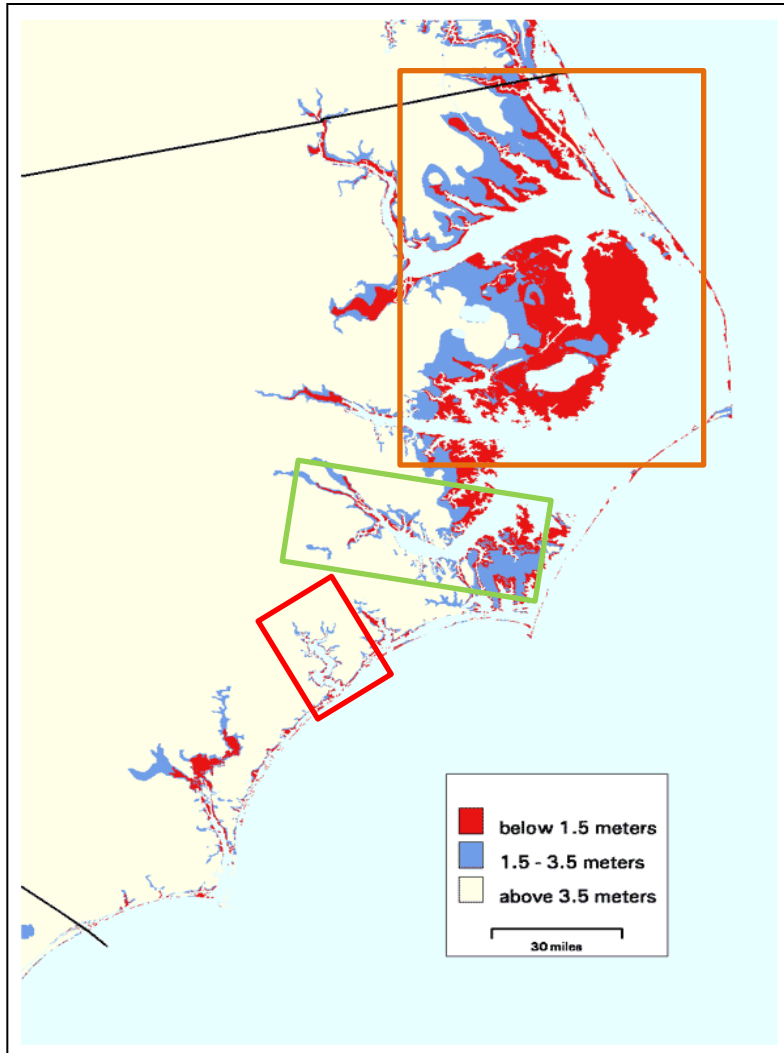


NOAA
Science for Coastal Communities

Center for Coastal Fisheries and Habitat Research
CCFHR

Erosion

- Fetch, prevailing winds, bathymetry, boat wakes
- Geomorphology (slope, elevation, sediments)
- Shoreline type



NC Shoreline Change Rates

-0.8 m yr⁻¹ Albemarle-Pamlico Sound
(Riggs and Ames 2003)

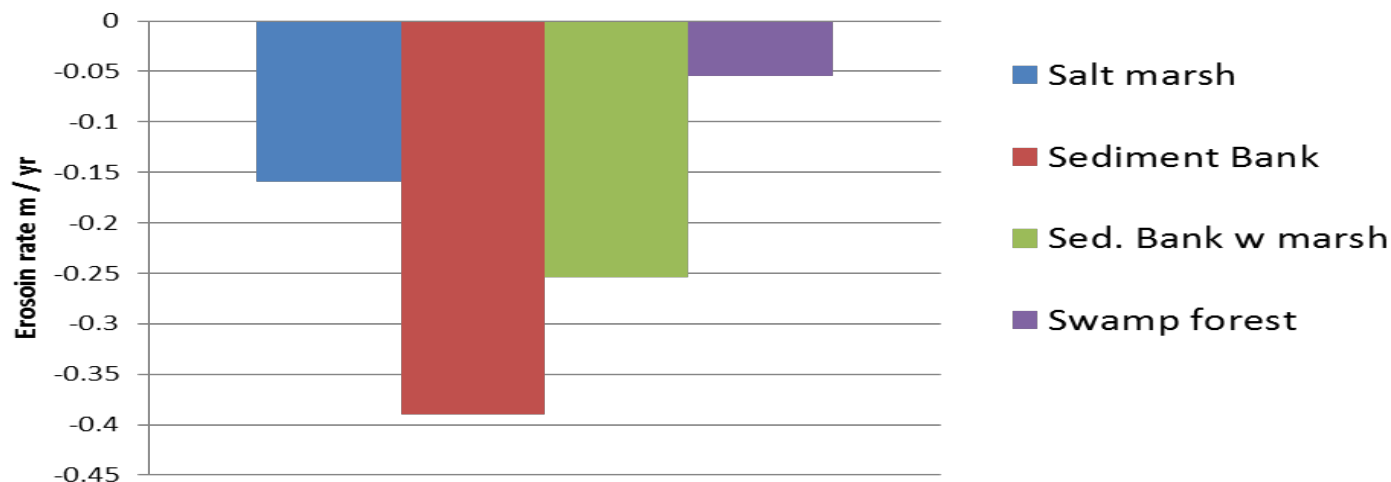
-0.6 m yr⁻¹ Neuse River Estuary
(Cowart et al. 2010)

-0.3 m yr⁻¹ New River Estuary
(Currin et al. In Review)

***But, within a study area, little correlation
between fetch/wave energy and erosion rate***

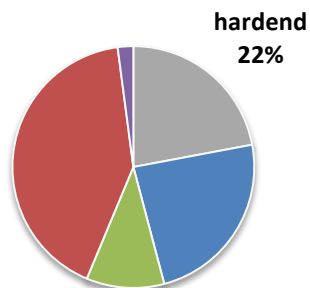
Factors Affecting Estuarine Shoreline Erosion Rates New River Estuary

Shoreline Change Rate by Shoreline Type

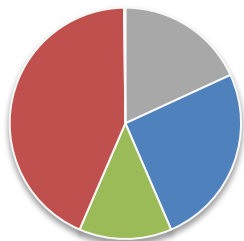


Shoreline Type by Wave Energy Class

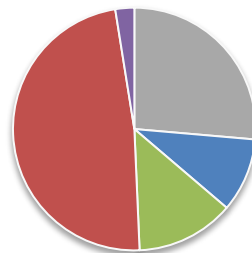
Wave Class 0



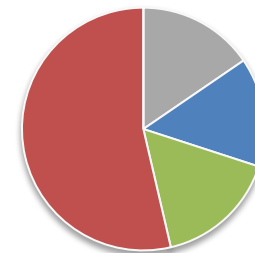
Wave Class 1



Wave Class 2

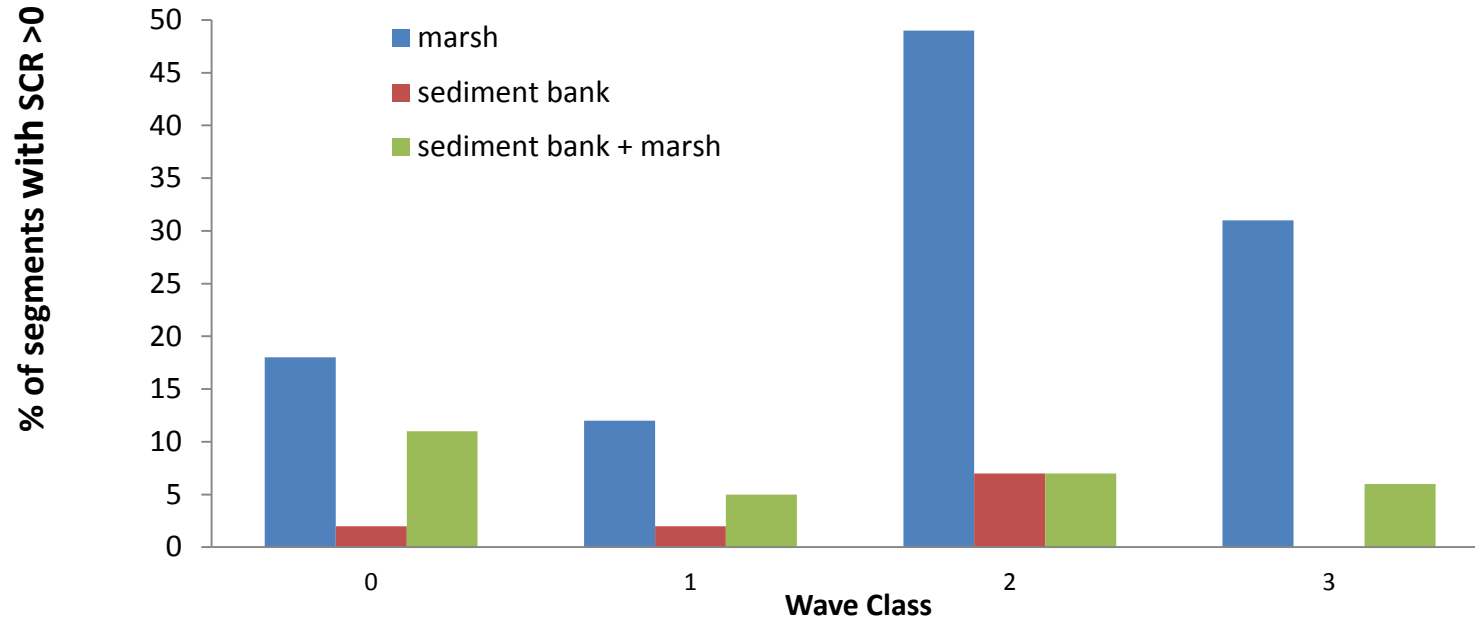


Wave Class 3

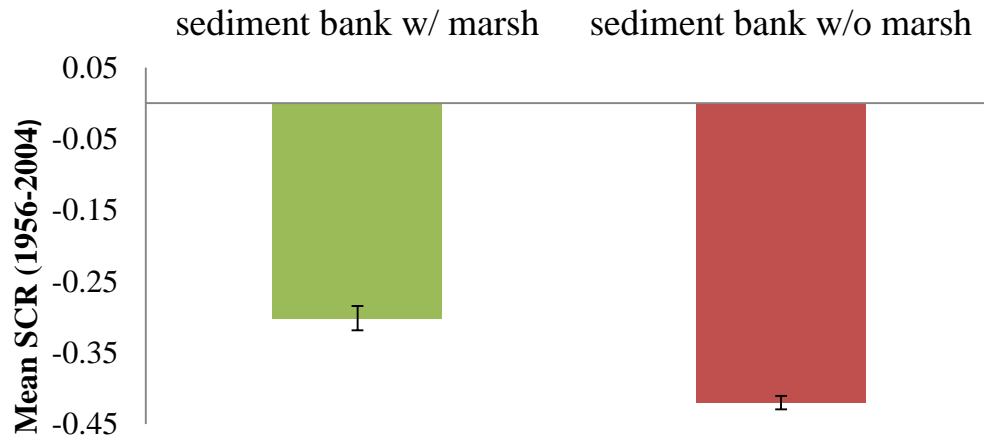


Increasing Wave Energy

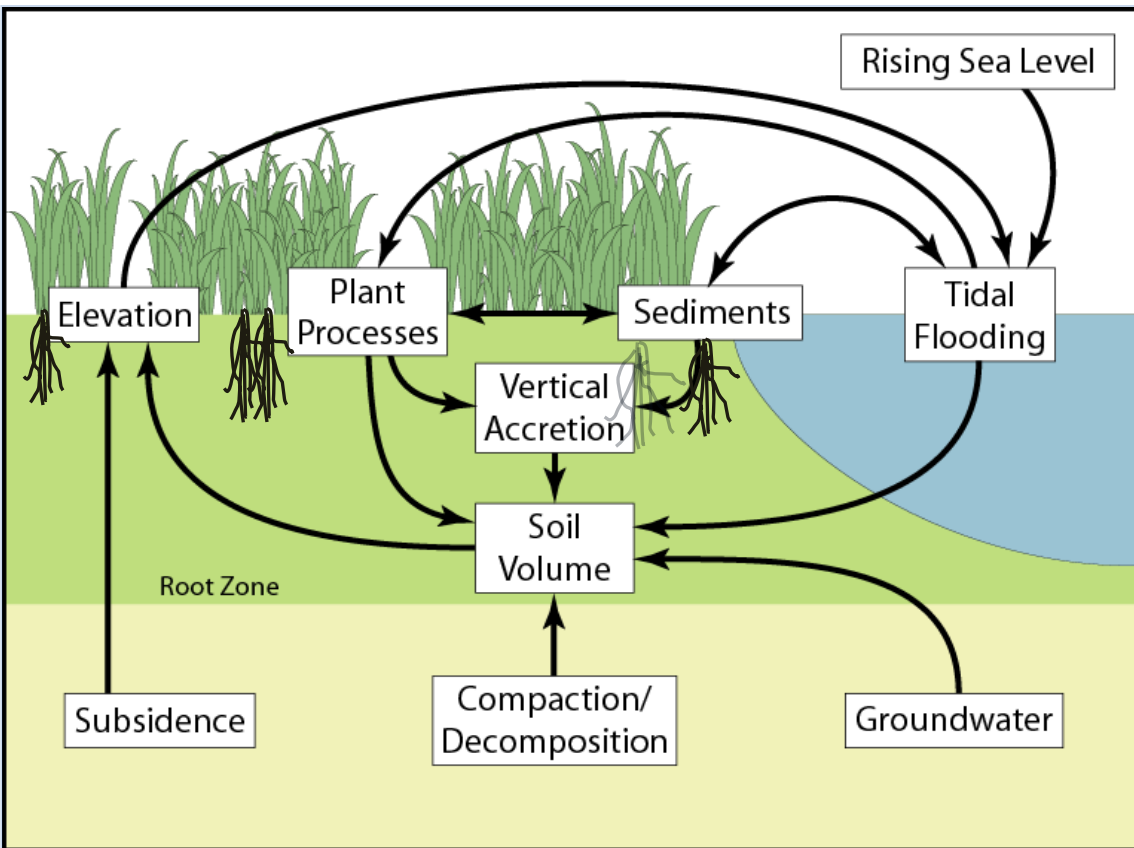
Marsh shorelines show progradation (accretion) more than other shoreline types



Marsh border significantly reduces sediment bank erosion

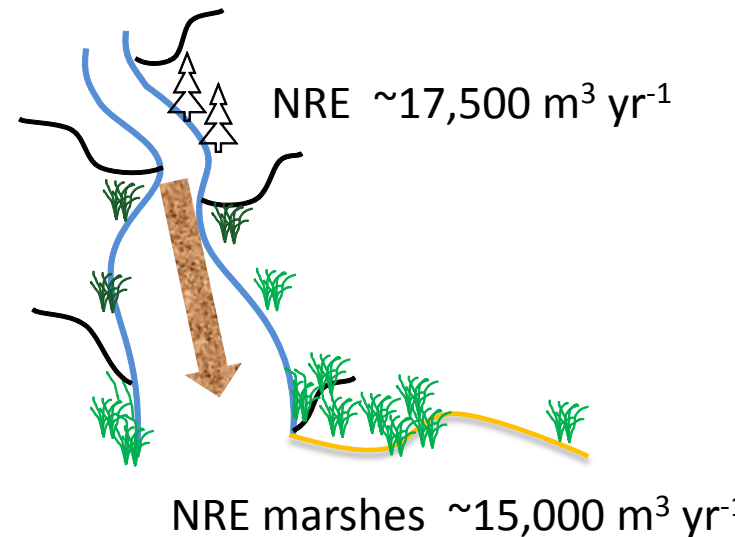


Importance of sediment supply for salt marshes to keep up with SLR



Modified from: Cahoon, DR., J.W. Day, Jr., and D. J. Reed. 1999.

Sediment bank erosion is a SOURCE of sediments

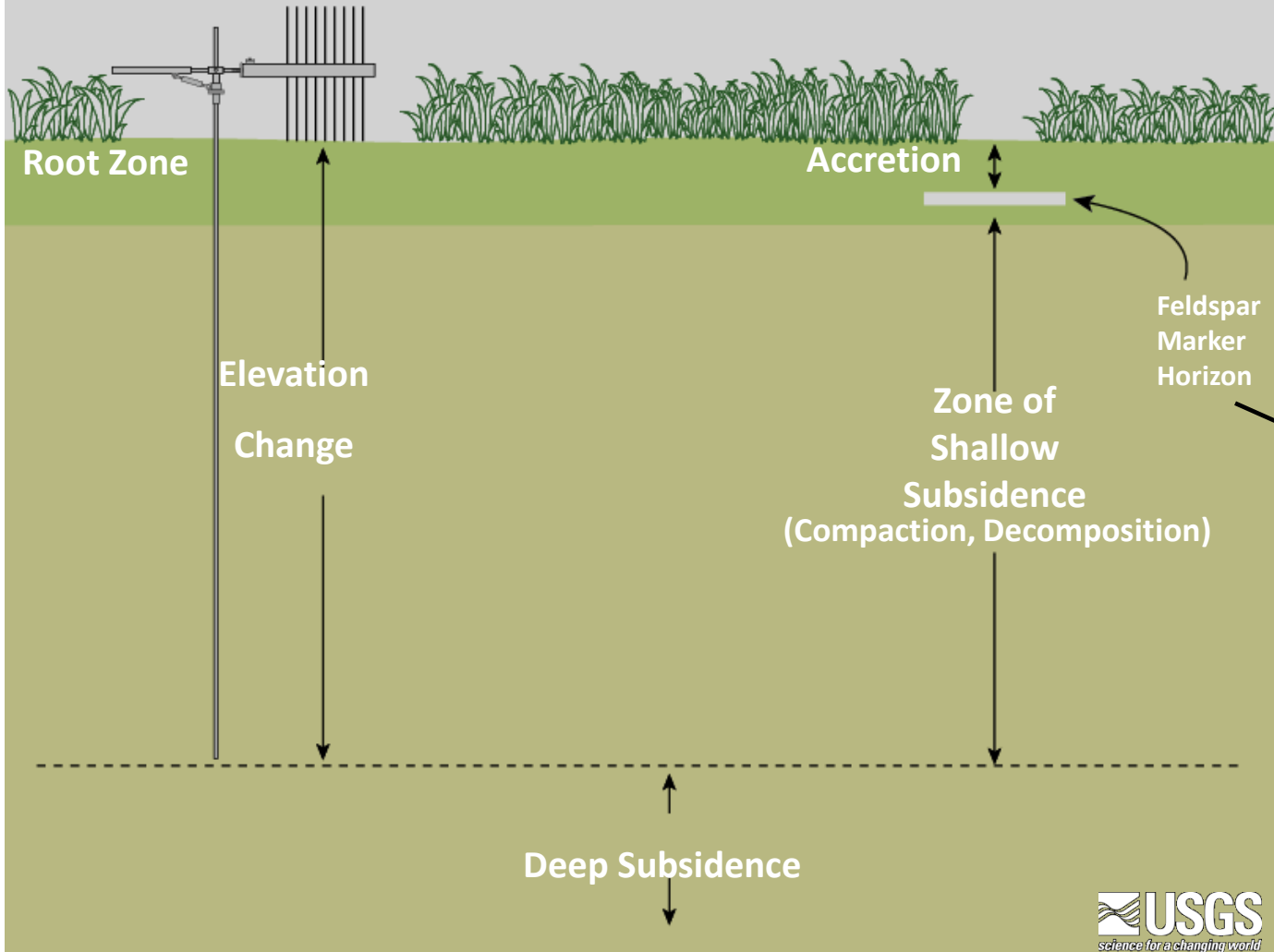


Erosion GIVETH and TAKETH away....

Measuring marsh elevation change in Living Shoreline Sites

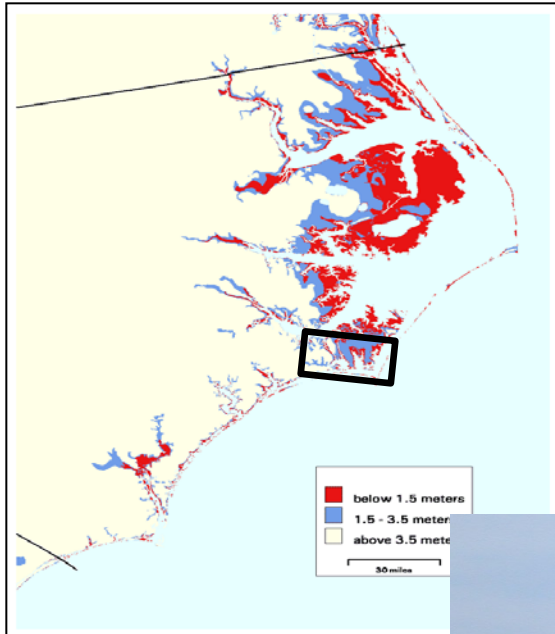
Surface Elevation Table (SET)

Used simultaneously, SETs and Marker horizons can provide information on below ground processes occurring above the base of the SET benchmark that influence elevation change



Carteret County NC

Impact of marsh sills on fringing marsh
surface elevation, sediment accretion and
vegetation



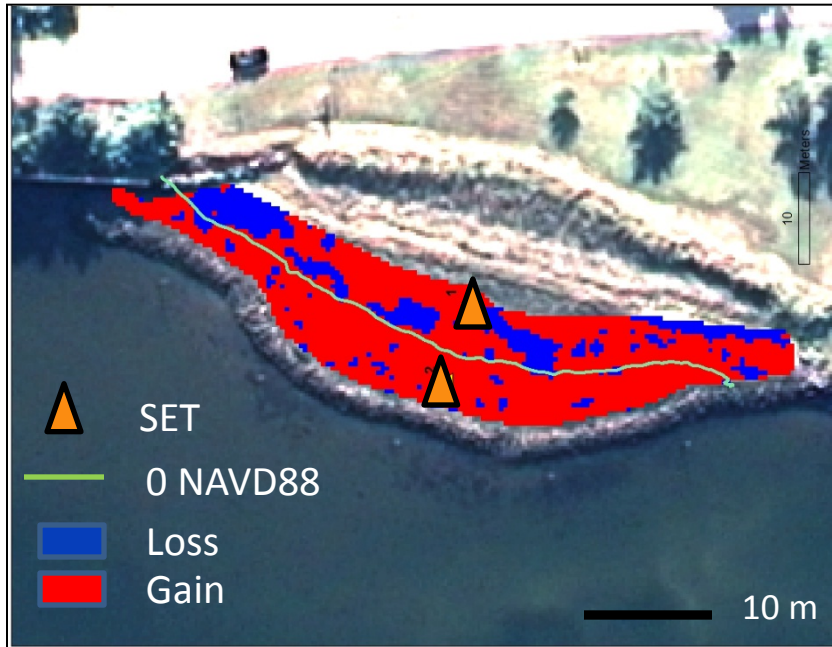
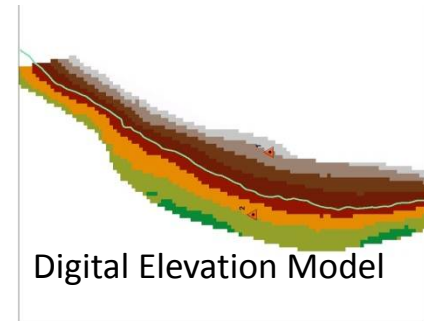
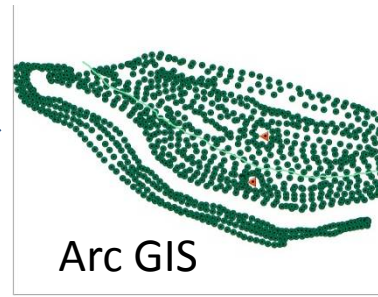
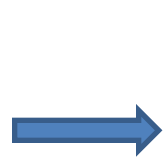
Natural reference marsh



4 paired sites with upper and lower SETs measured twice yearly



RTK GPS pt collection



Compare changes in DEM over time (2007- 2010)

- DEM Change Analysis confirms SET results on impact of sills on surface elevation change
- Upper portions of Sill marshes lost *Spartina alterniflora*, replaced with upper marsh spp.

Pivers Island



Pine Knoll Shores

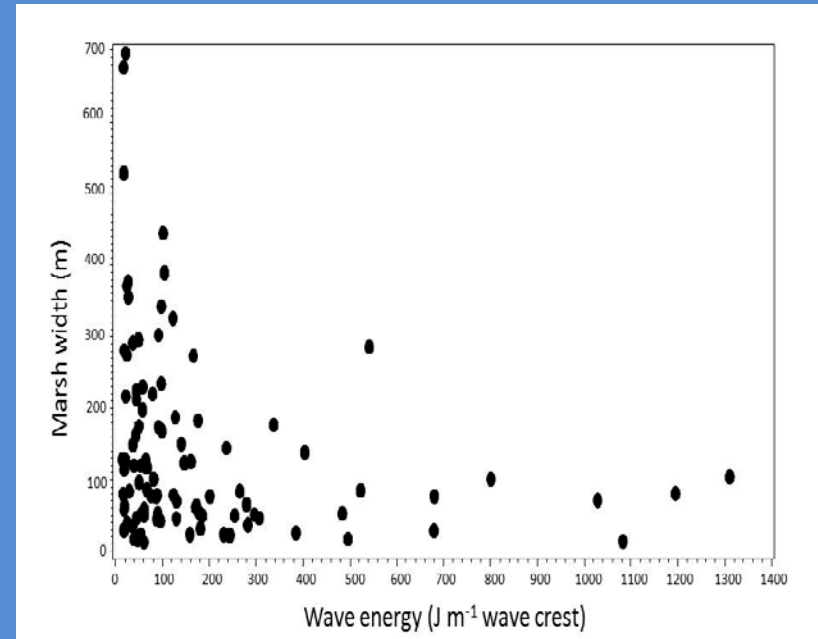
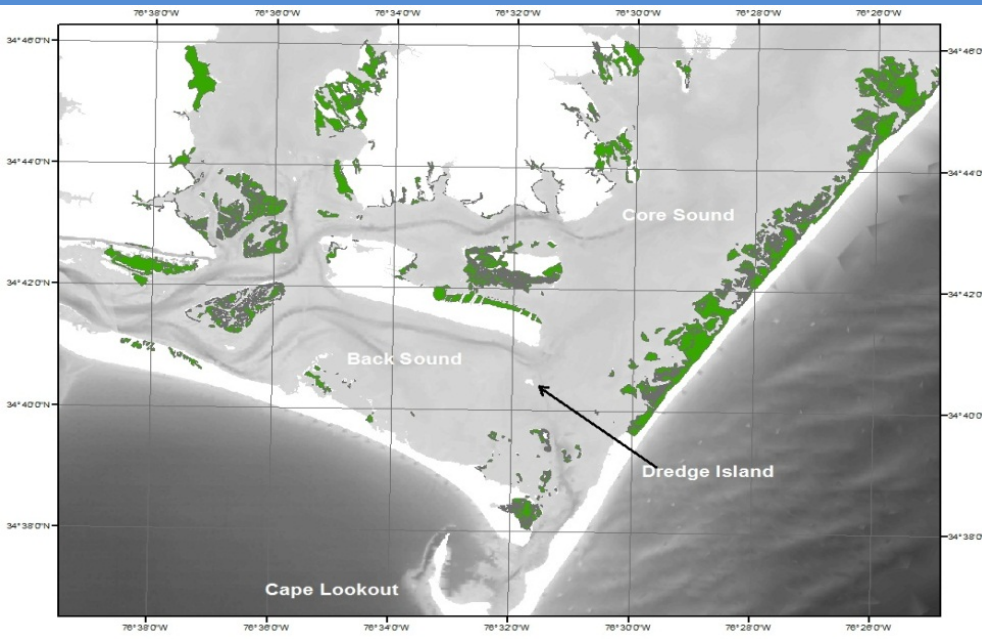


Sills Increase sediment accretion rates
Replace subtidal habitats

Design for site conditions

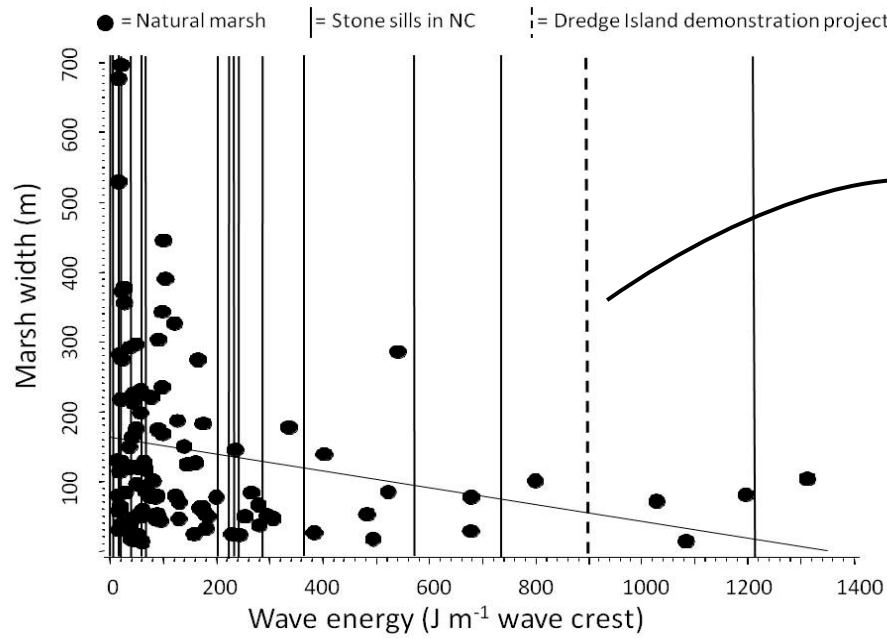
... use oysters instead?

Analysis of Wave Energy setting of salt marsh habitat in Carteret County



M. Fonseca, A. Malhotra
WEMo

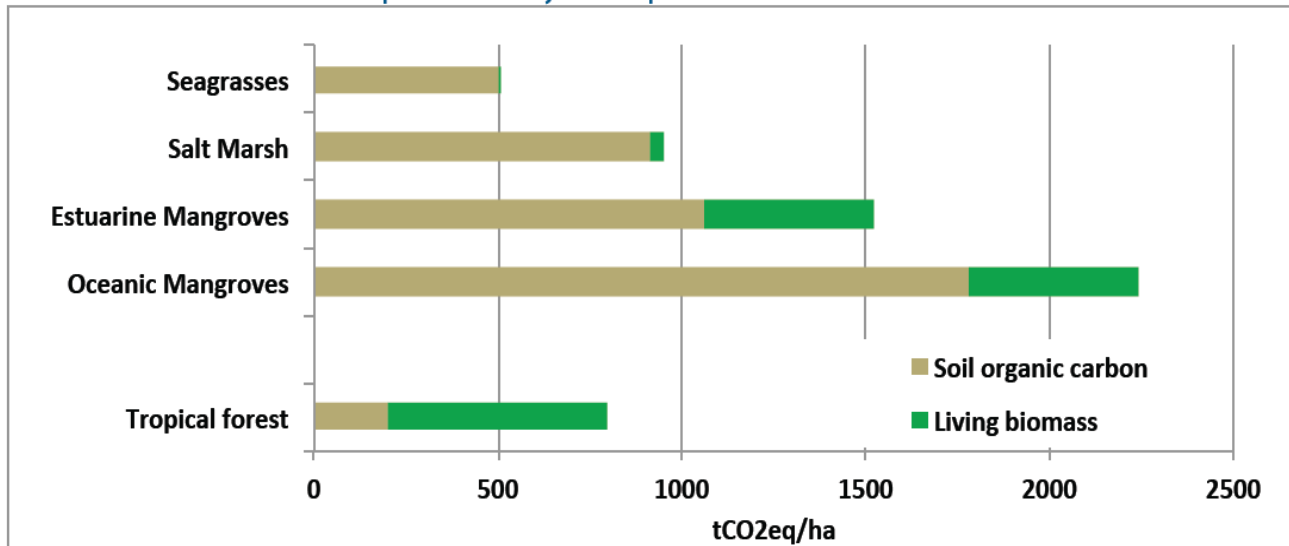
Wave energy setting of
marsh- sill projects



Post-Irene

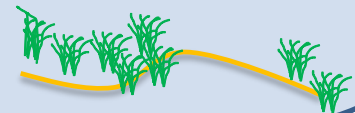
Living Shorelines and **Blue Carbon**

Blue C = C sequestration in marine environments, locking up CO₂ from atmosphere



Summary

- Salt marsh vegetation effective in reducing erosion across a range of wave energy settings
- Marshes are dependent upon sediment supply to maintain surface elevation.
- Stone sills increase sediment accretion and elevation gain in marsh surface elevation. This in turn results in change in marsh vegetation.
- Marsh-sills present tradeoffs in habitat types; loss of subtidal and low marsh, gain in upper marsh. Lack of design standards may contribute to use of hard structures.
- NC 'Living Shorelines', including marshes, oyster reefs, and marsh-sill hybrids, came through Hurricane Irene with no losses, and some sediment accretion. Bulkheads exhibited greater damage (Currin, Fear & Gittman)
- In NC, intertidal oysters are a viable alternative to stone sills in many settings.
- C sequestration another important ecosystem service offered by Living Shoreline approach



Additional Living Shoreline Resources

Weighing Your Options Guide for waterfront property owners
NC DCM, NC NERRS, NOAA CSC NCCOS publications websites

Living Shoreline Approach in NC Currin et al. 2010

http://pubs.usgs.gov/sir/2010/5254/pdf/sir20105254_chap10.pdf

Hurricane Irene Impact on Pivers Island Living Shorelines

<http://www.erh.noaa.gov/mhx/2012HurricaneConference/>



Pivers Island, NC

Impact of hard structures on fringing marsh Mattheus et al. 2010

<http://www.sciencedirect.com/science/article/pii/S0272771410001605>

NC DENR Marsh Sill Evaluation Report

<http://portal.ncdenr.org/web/cm/marsh-sill-evaluation-project>

Natural and stabilized salt marshes in NC Currin et al. 2008

coastalscience.noaa.gov/about/docs/Currinetal.WME.vol2.pdf

Considering 'Coastal C' in Federal Statutes & Policies Pendleton et al. 2013

<http://nicholasinstitute.duke.edu/sites/default/files/publications/>