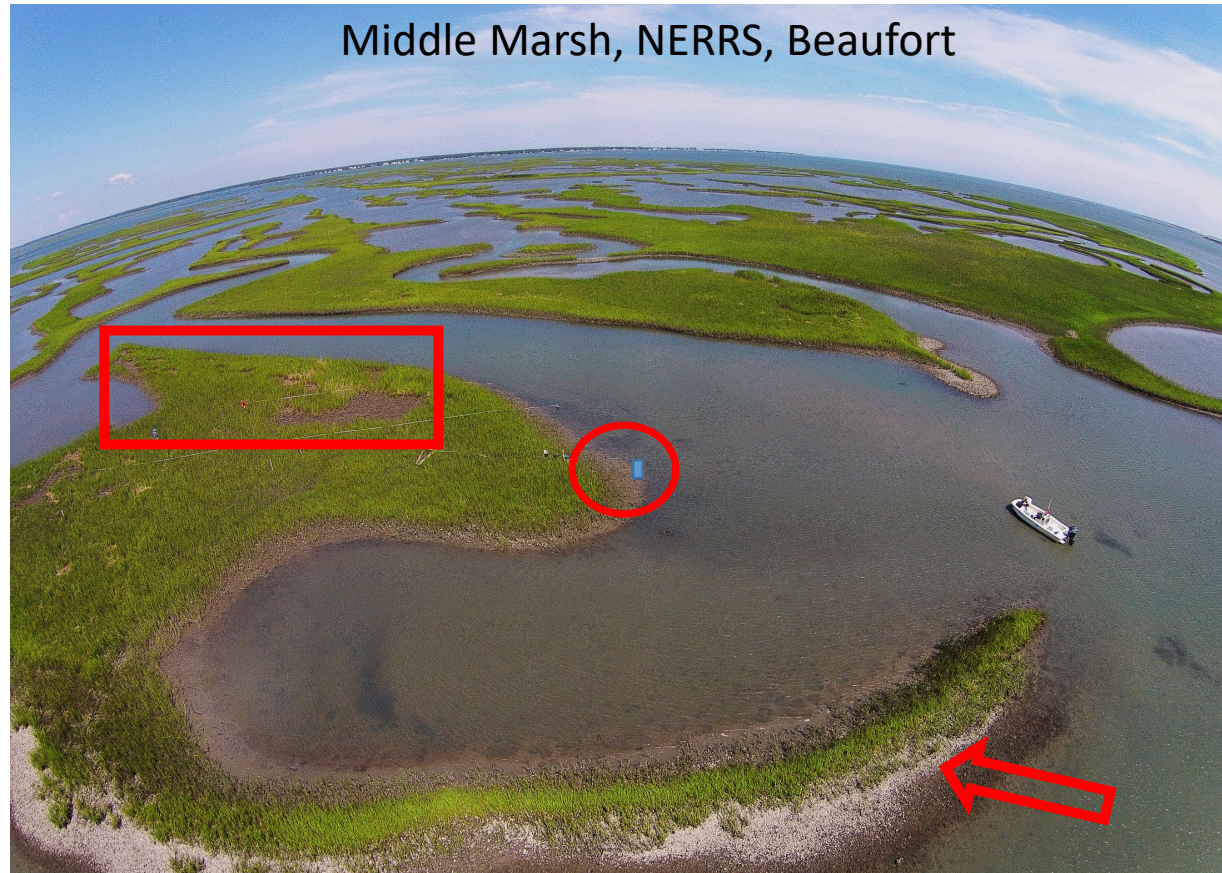


# NC Salt Marshes: Threats and Conservation Opportunities

Carolyn Currin  
NOAA NCCOS, Beaufort, NC



Drought

SLR

Erosion

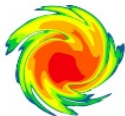


Barriers to Landward Migration

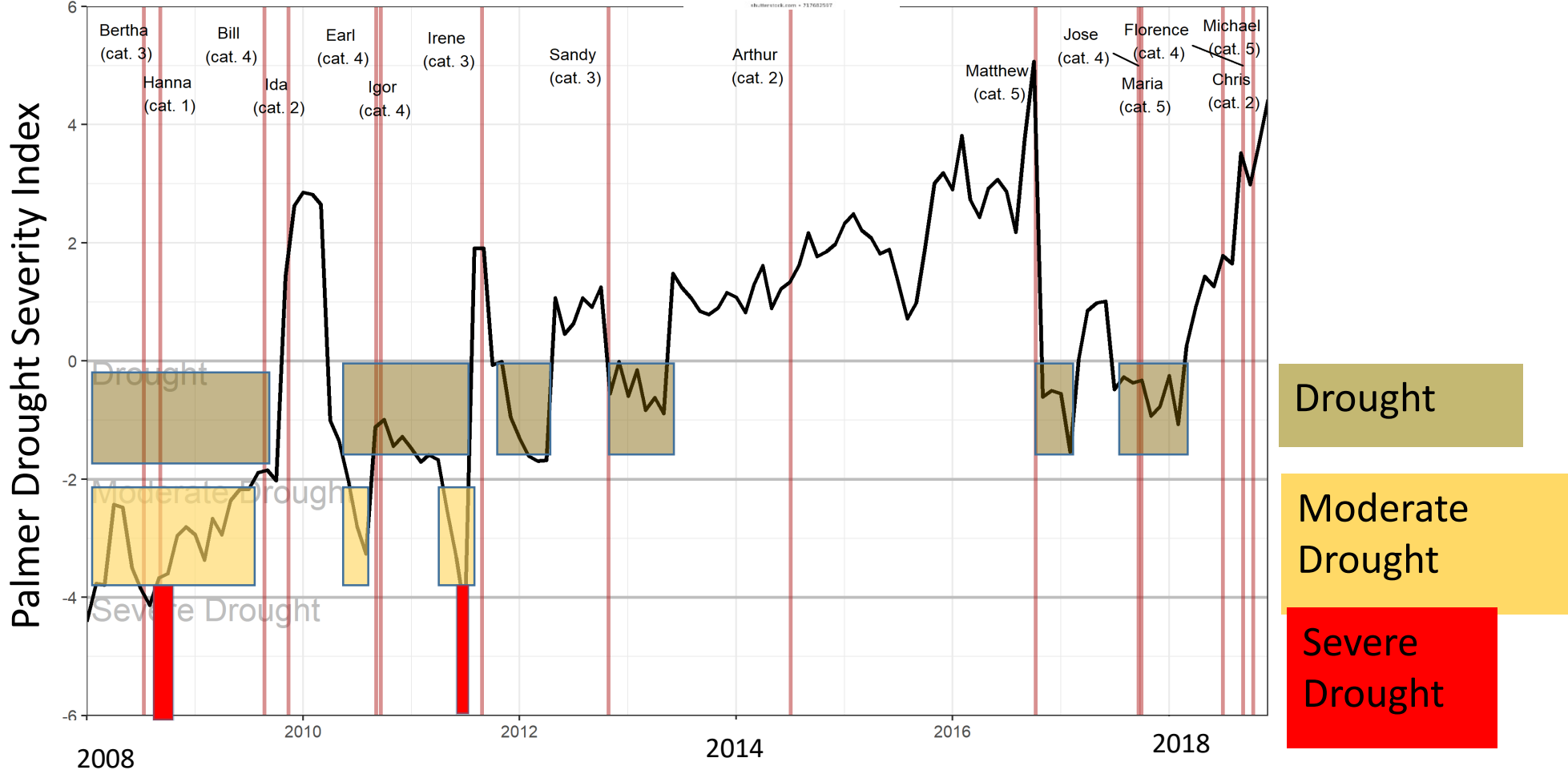


# Eastern North Carolina Drought and Hurricanes

2008 – 2019



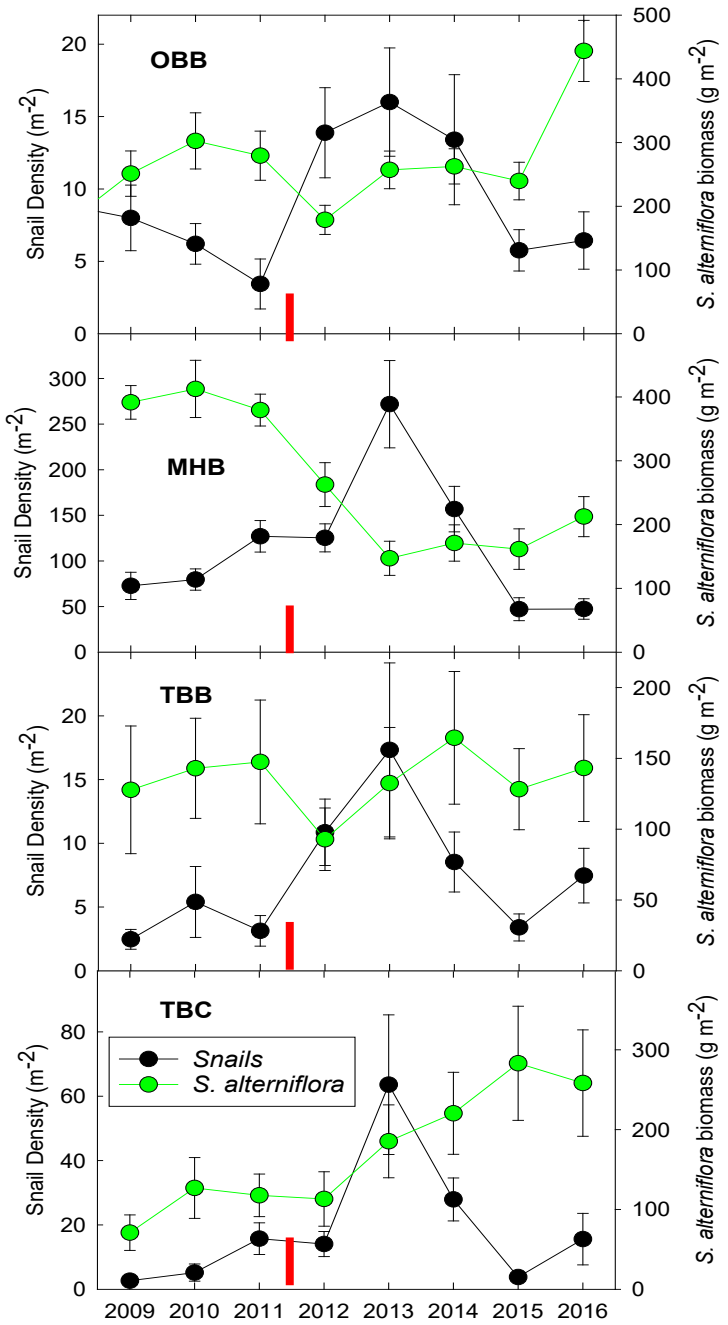
Hurricanes and Drought Index  
Central Coastal Plain NC 2008 - 2018





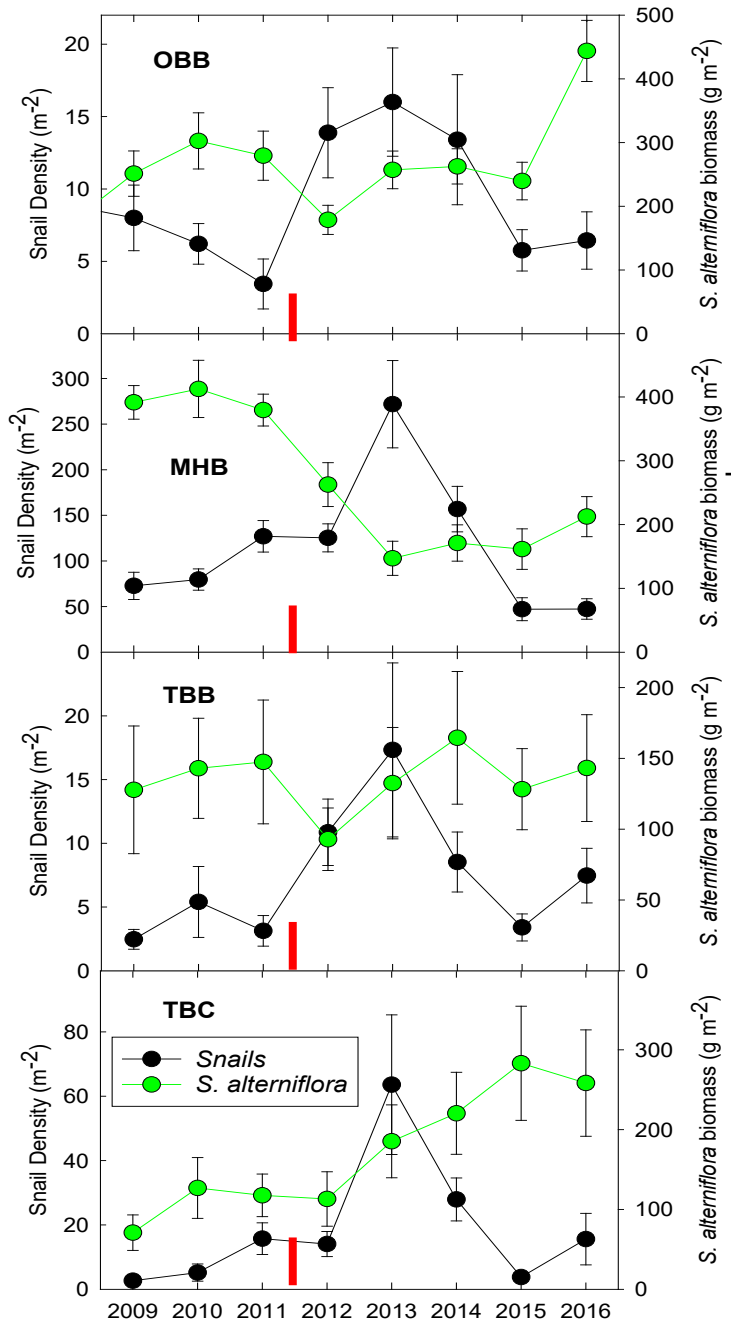
# Drought impact on salt marsh biomass

- Significant decline in *Spartina alterniflora* biomass in 2011-12 in MCB Camp Lejeune marshes and Carteret County fringing marshes
- Marsh plant decline followed by *Littoraria* snail increase



# Drought impact on salt marsh biomass

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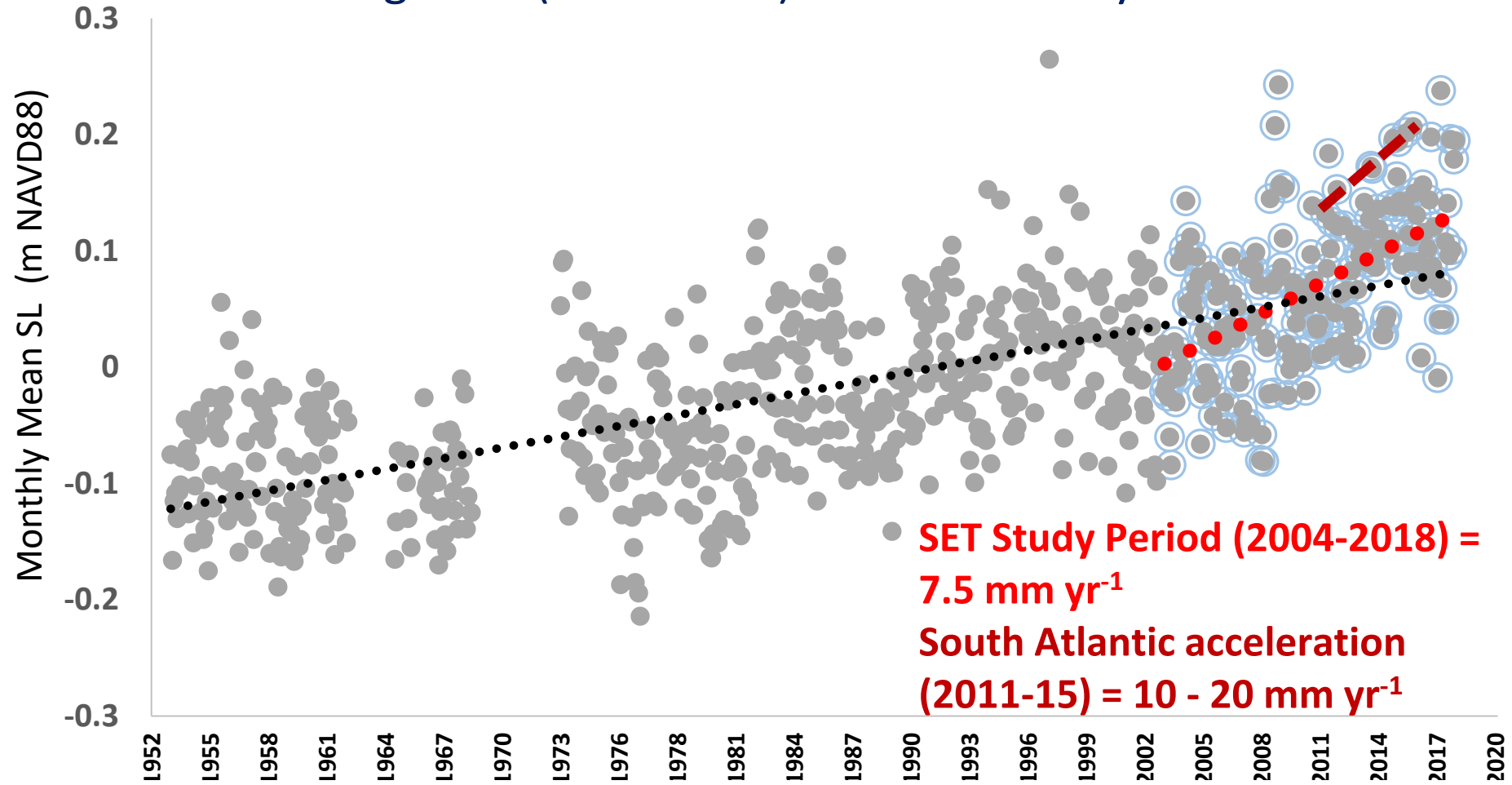
High marshes subject to longterm dieoff from drought events



# Relative Sea Level Rise

Beaufort NC tide gauge

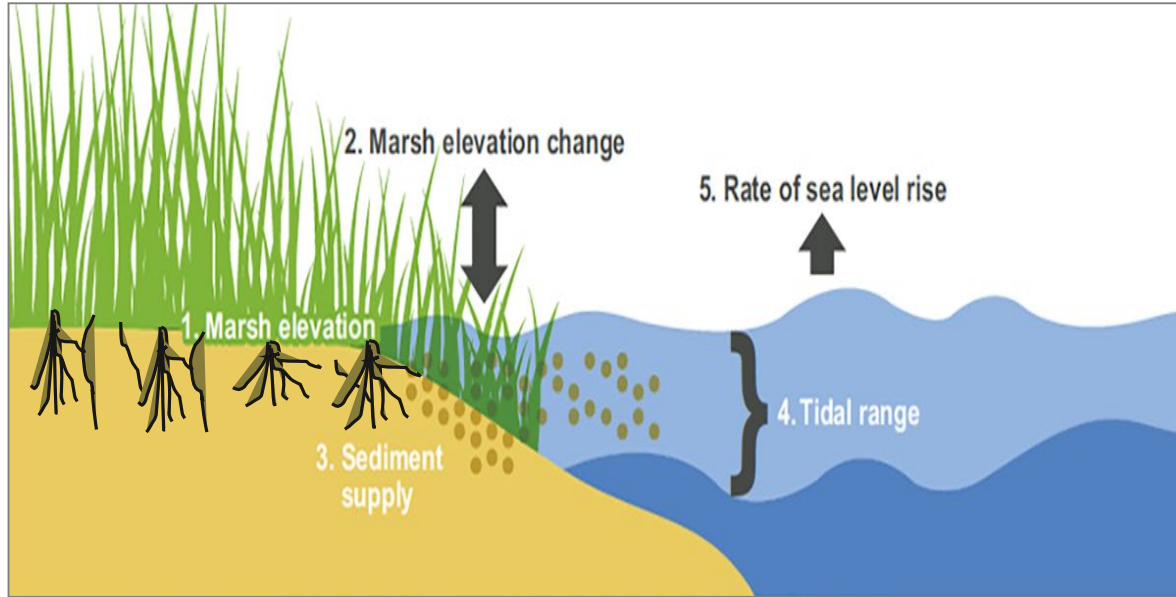
Long term (1953-2018) SLR = 3.1 mm yr<sup>-1</sup>





# Marsh Response to Sea Level Rise

## Keep Up (accretion)

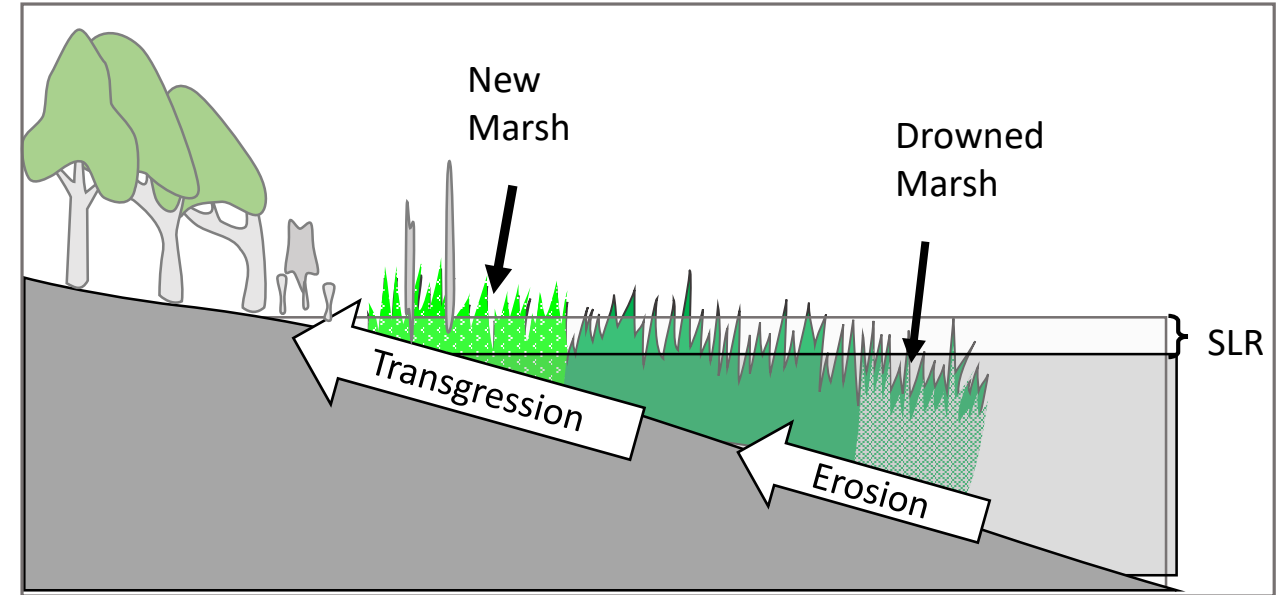


- Requires Adequate Sediment Supply and Plant Biomass

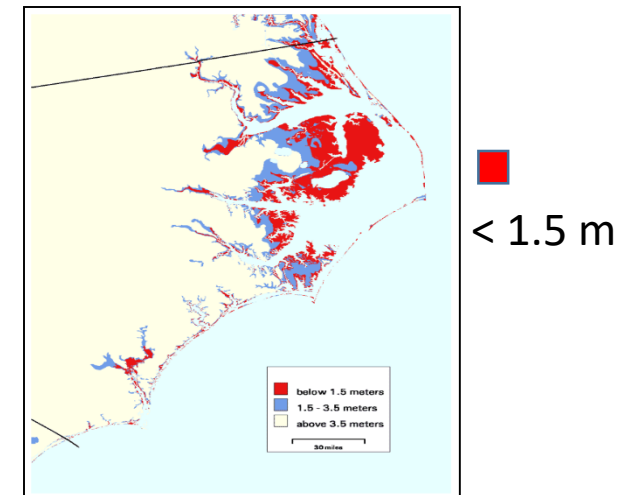
### NC salt marshes

- microtidal
- <20 mg/l SSC
- Low end of *Spartina* primary production

## Move Up (transgression)

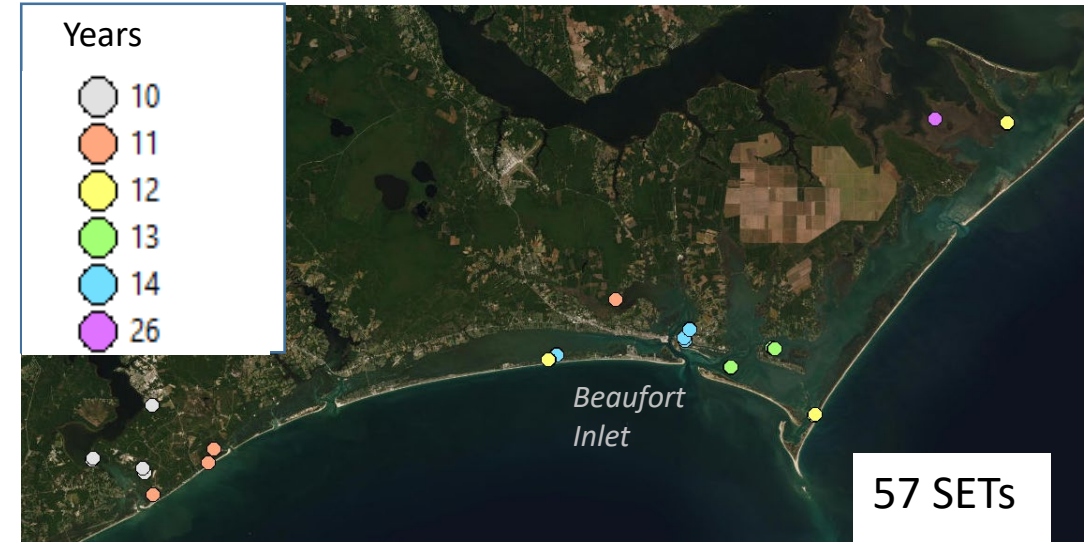
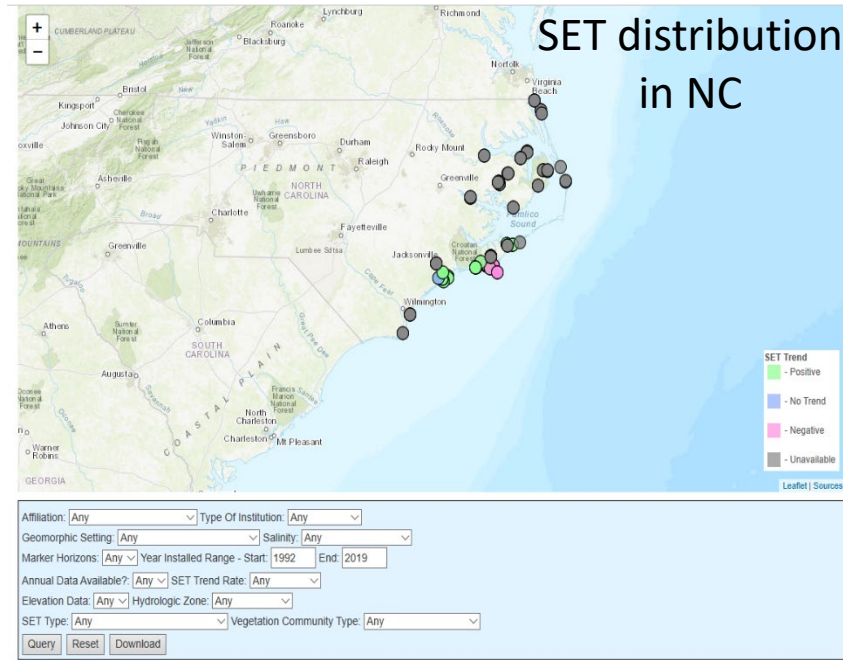
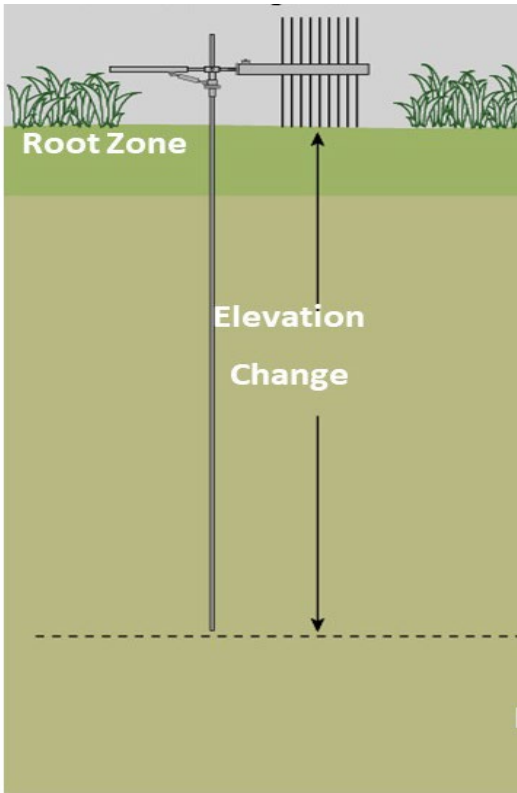


- Requires undeveloped space to move into and no topographical barriers



# NC Salt Marsh Elevation Change

## Surface Elevation Table

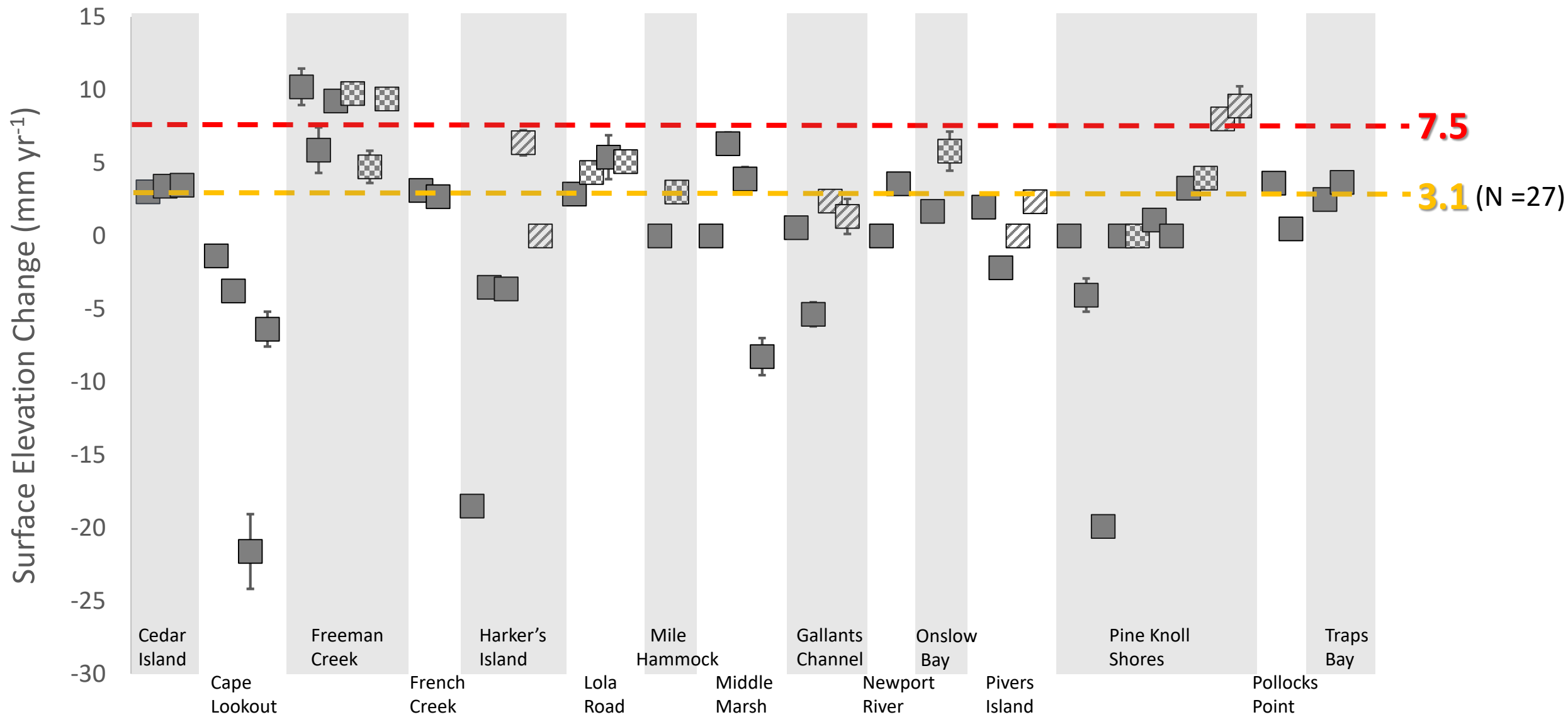


<https://ncseagrant.ncsu.edu/program-areas/sustainable-communities/north-carolina-sentinel-site-cooperative/nc-set-community-of-practice/>

# Are NC marshes keeping up with SLR?

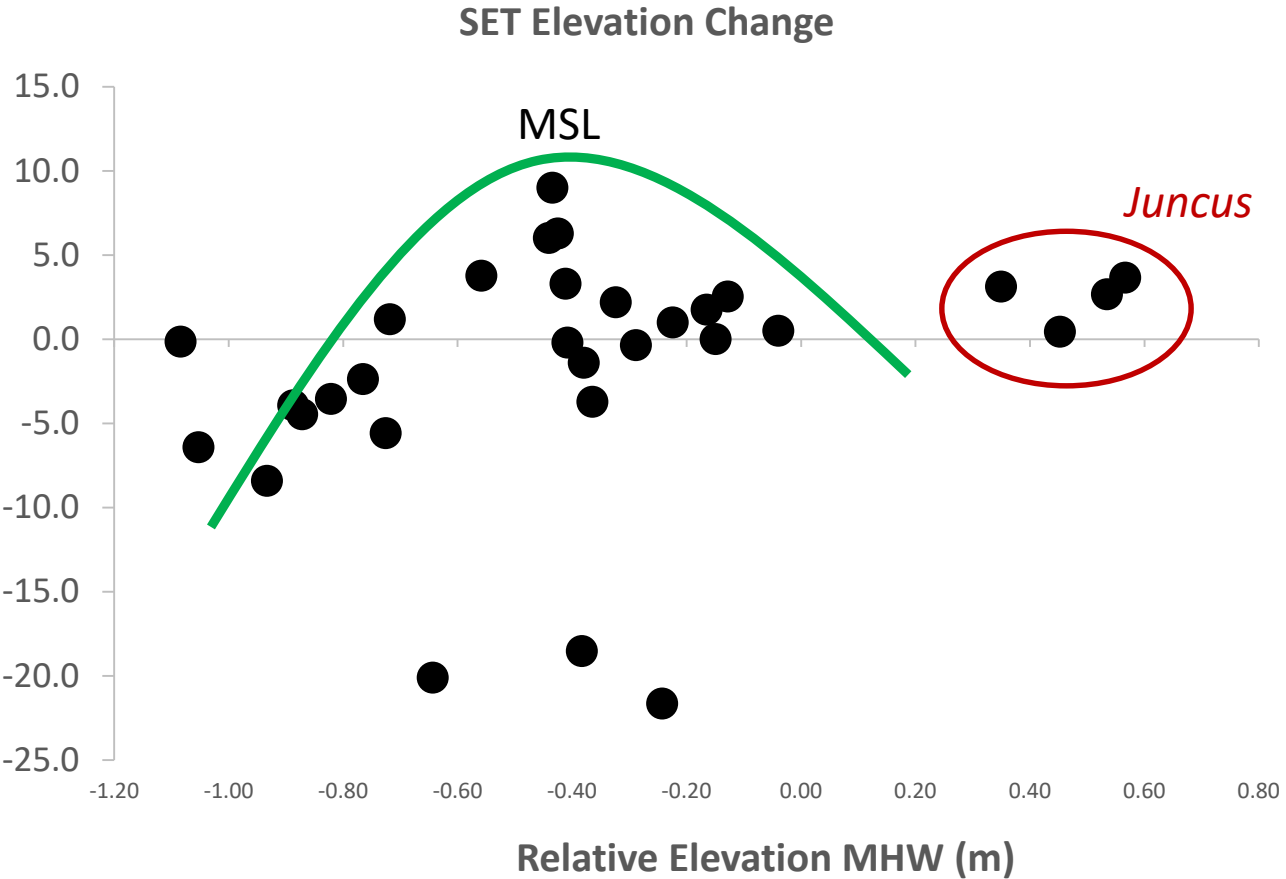
(no)

- No treatment
- Sill
- Fertilizer





# Importance of Elevation Capital for Marsh Sustainability



- *Spartina* marshes below MSL are drowning
- Peak plant biomass at MSL correlates with peak sediment accretion

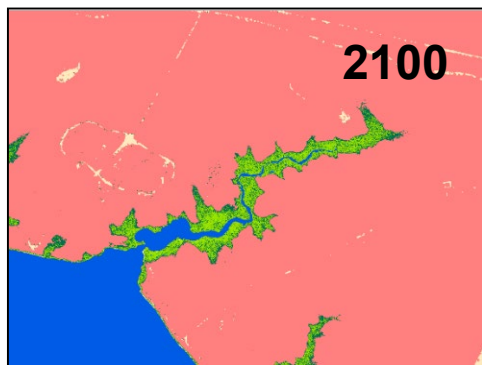
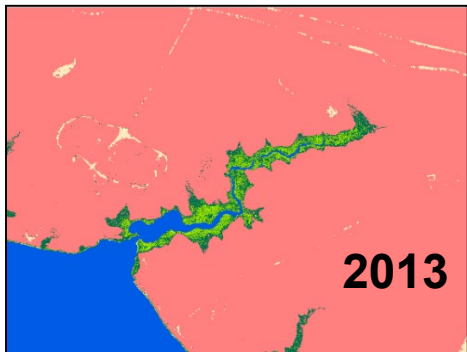


# Predicted Marsh Migration varies by slope and SLR rate

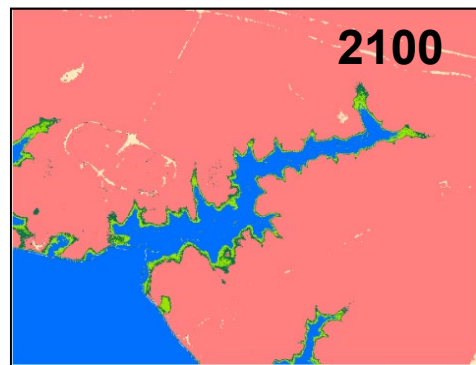
*MCB Camp Lejeune marshes*

- No built infrastructure barriers at these sites
- Species change and marsh expansion at coastal sites

Traps Bay

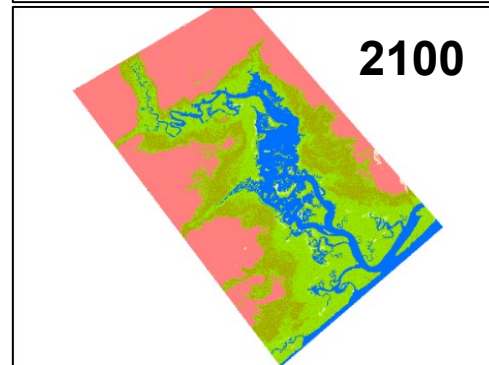
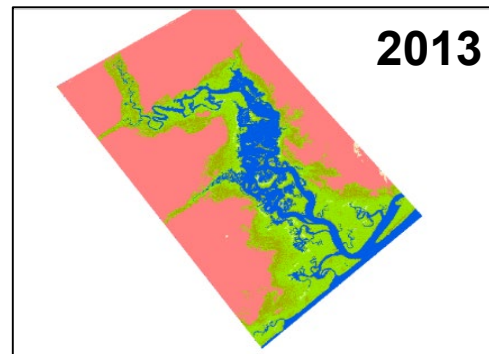


Lowest (0.3m)

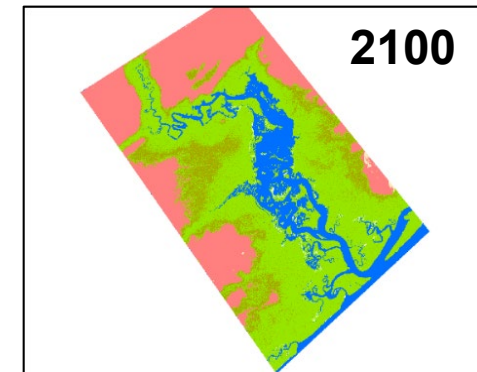


Medium (1.3m)

Freeman Creek



Lowest (0.3m)

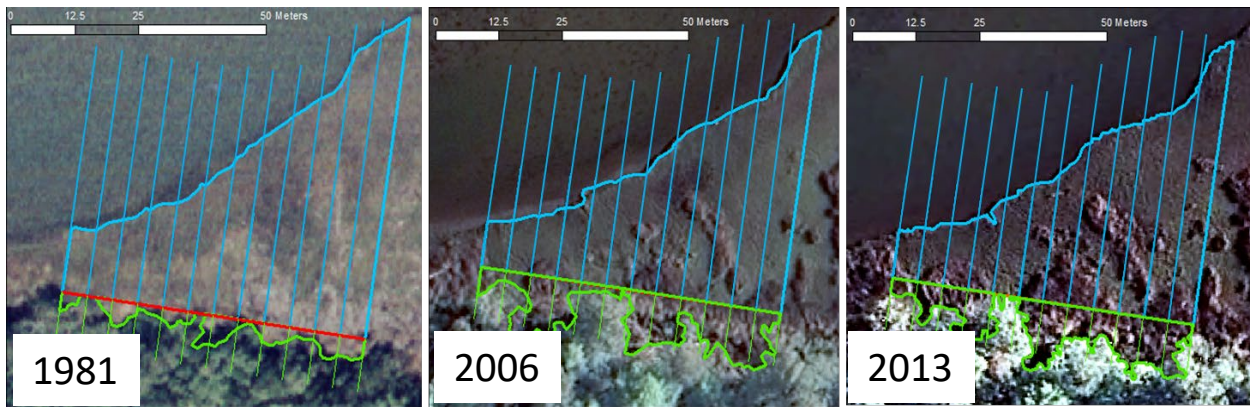


Medium (1.3m)



# Migration Corridors critical to maintaining marsh habitat

- Chesapeake Bay – 94 km<sup>2</sup> of drowned eroded marsh replaced by 101 km<sup>2</sup> new marsh in uplands over last century (Schieder et al. 2018)
- Carteret County NC – Marsh landward expansion documented at half of non-bulkheaded sites, but only 16% maintained area
  - Bulkheaded sites, with no landward expansion, had 3x higher net loss of marsh area



*Burdick et al, Submitted Est&Coasts*

- Statewide modeling efforts to identify and protect corridors for marsh migration

TNC Resilient Coastal Sites for Conservation in the South Atlantic US (2019) <https://www.nature.ly/SEcoast>

NC NWL Action Plan Coastal Habitats Appendix B

<https://storymaps.arcgis.com/collections/2154ab2816674f7d8c7429fe87f48830?item=4>



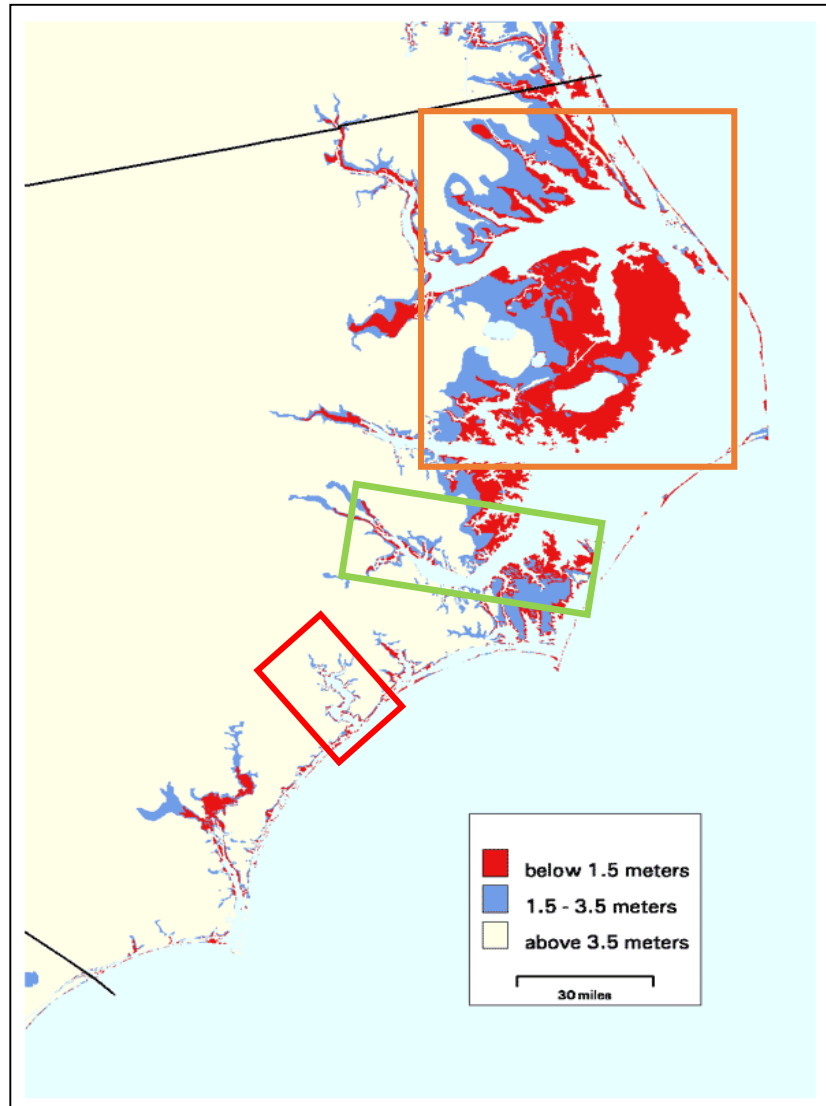
# Marsh Erosion

Fringing Salt Marshes occupy 65% of the NC estuarine shoreline (8000 miles of marsh)





# Erosion of marsh shorelines



## NC Shoreline Change Rates

-0.8 m/yr Albemarle Pamlico Sound

(Riggs and Ames 2003, Eulie et al. 2017)

-0.6 m/yr Neuse River Estuary

-0.5 m/yr wetland shorelines

(Cowart et al. 2011)

-0.3 m/yr New River Estuary

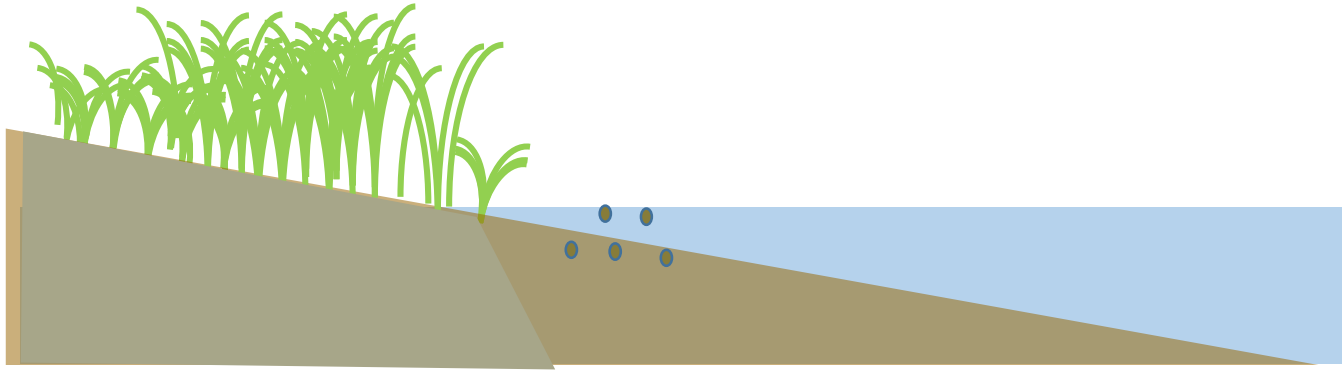
-0.2 m/yr marsh shorelines

(Currin et al. 2015)

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

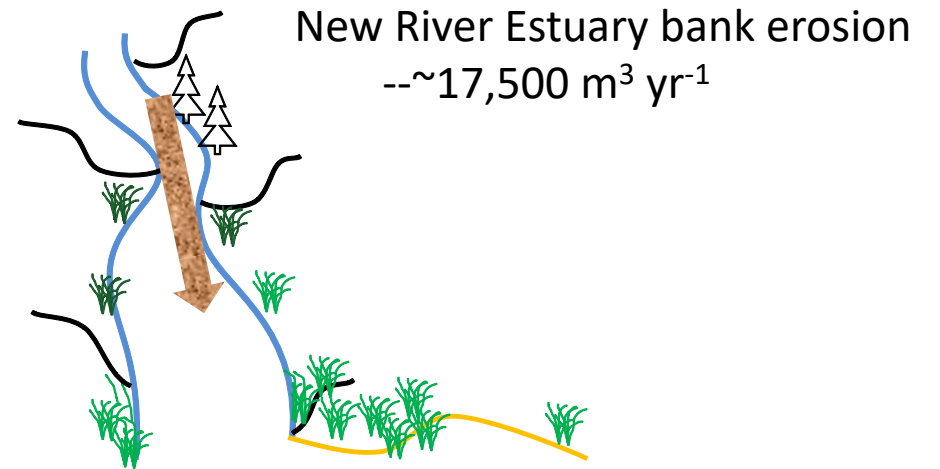


# Erosion of marsh shorelines



Erosion greatest when marsh edge is exposed

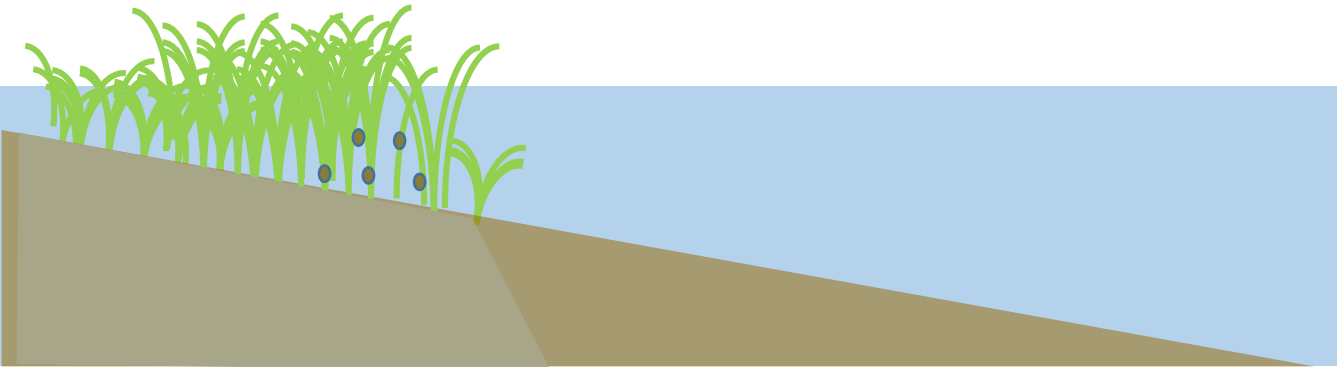
- can minimize hurricane impacts (Currin et al 2008, Gittman et al. 2014)
- scarped marsh edge > ramped edge (Theuerkauf et al 2015)



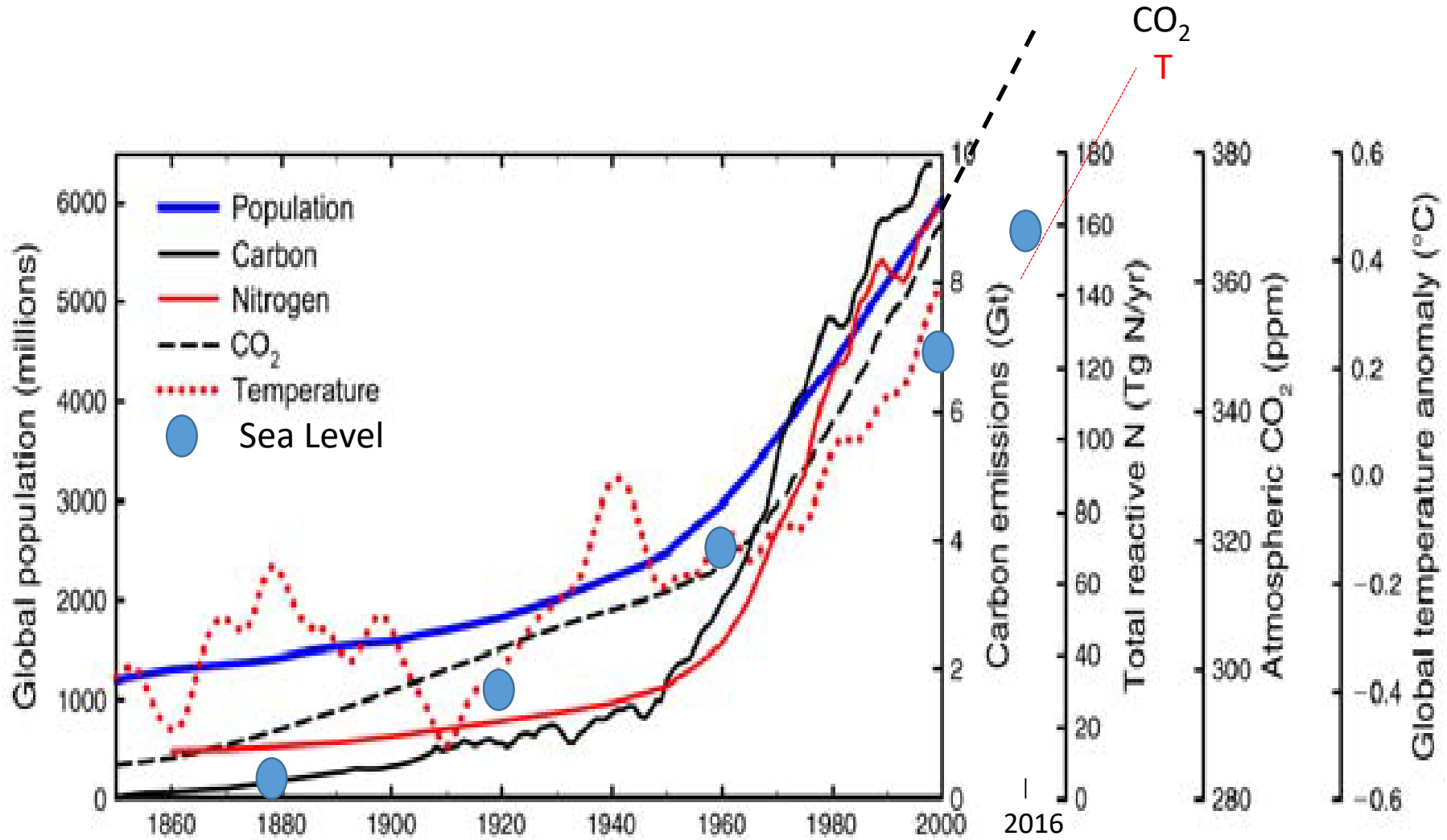
New River Estuary bank erosion  
-- $\sim 17,500 \text{ m}^3 \text{ yr}^{-1}$

NRE marsh sediment accretion  $3 \text{ mm/yr}$   
+  $\sim 15,000 \text{ m}^3 \text{ yr}^{-1}$

Currin et al. 2015



# Climate and Anthropogenic Drivers Impacting Coastal Wetlands



-SLR, wave energy, erosion, droughts, storms and built infrastructure will increase  
-Conservation will need to plan for FUTURE conditions

SLR (inches)