



**Samantha Chapman, Ph.D.**  
Villanova University





Exploring the Roles of Altered  
Hydrology and Nitrogen Cycling  
in Sustaining the Coastal  
Wetlands of Northeast Florida

*Samantha Chapman*  
*Villanova University*

with Lisa Chambers, Adam Langley, Tess  
Adgie, Nikki Dix, Kaitlyn Dietz, Shannon  
Dunnigan, Scott Jones, Cathilyn McIntosh,  
Allix North, Lia Sansom, Jennifer Volk

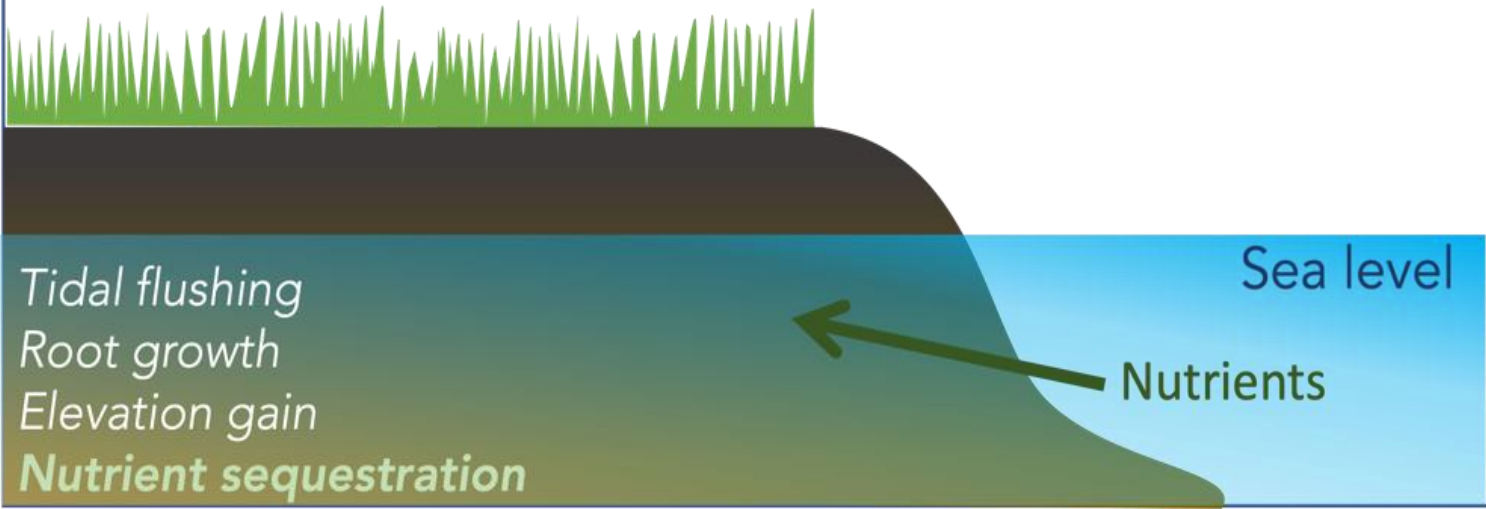
*This work supported by the Friends of the  
GTMNERR*



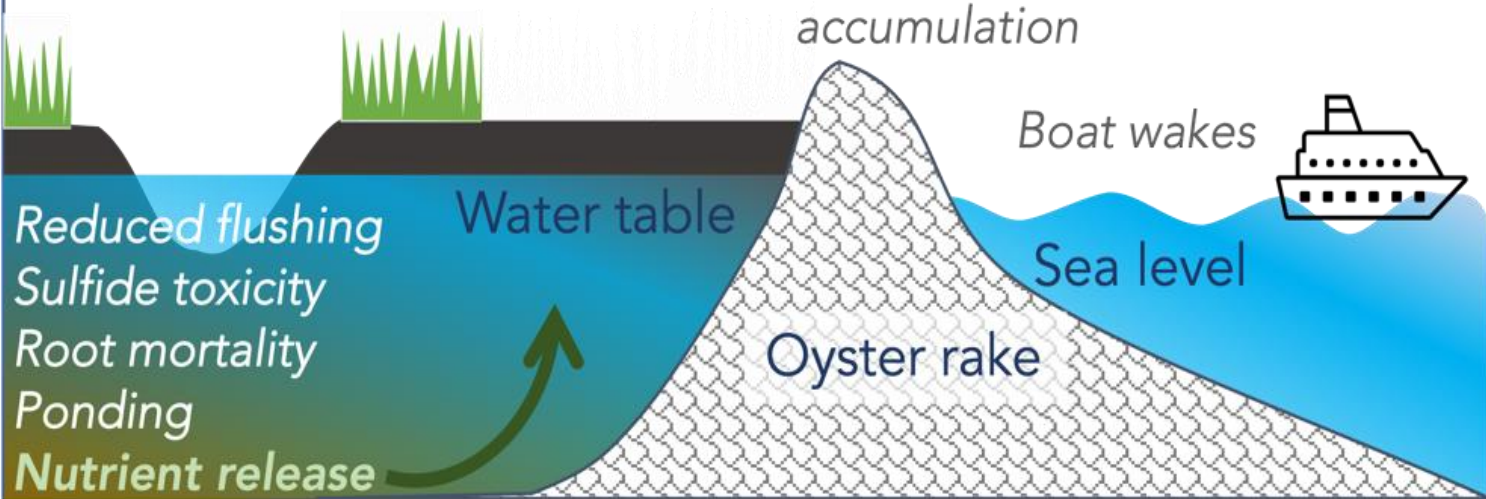
National Estuarine  
Research Reserve System  
Science Collaborative



## Sustainable wetland



## Vulnerable wetland

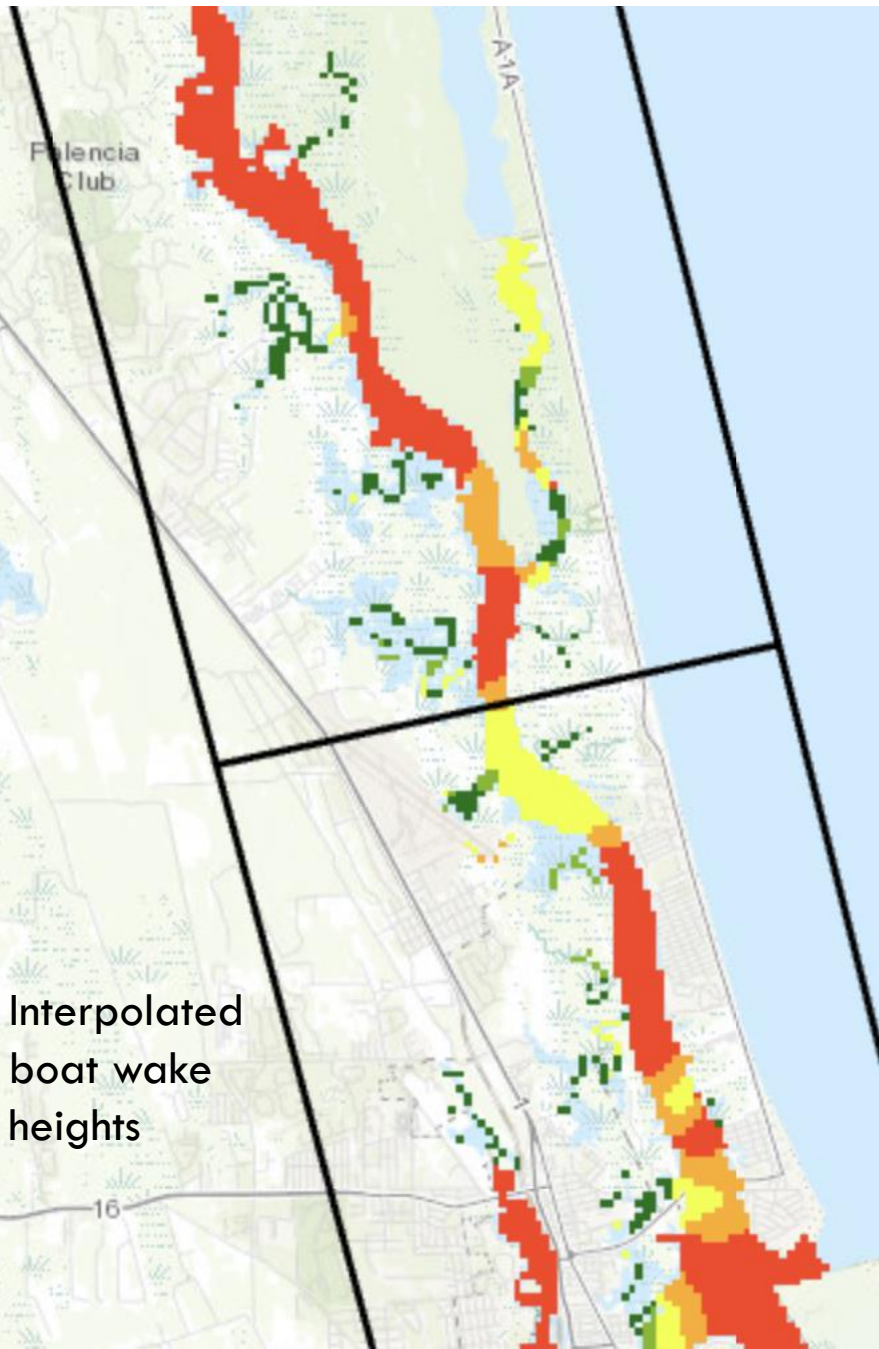


Oyster shell rakes, which are common along the intracoastal waterway in Northeast Florida, may alter **water movement, nutrient fluxes** and **marsh sustainability**.

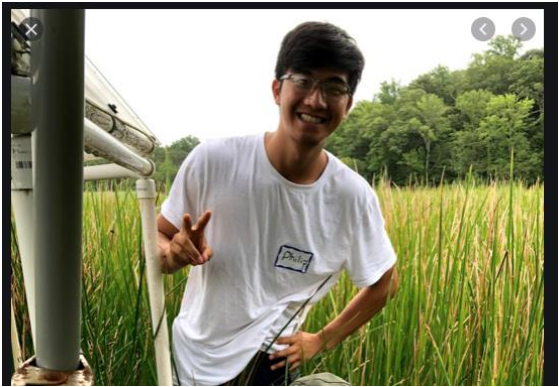


- Do rakes cause stressful conditions for the wetlands behind them?
  - Approach- At four sites with rakes, we are exploring the impact of shell rakes on plant and soil stress, marsh nutrient cycling, and elevation
- Do excess nutrients in waterways contribute to the vulnerability of marshes to ponding and erosion?
  - Approach- We will integrate new water quality and nutrient data with an existing coastal vulnerability assessment to facilitate site-specific conservation and restoration planning.





We chose four sites along the Intracoastal Waterway, which were previously determined to be vulnerable.



Phil Yang  
boat wake assessment





Marsh coastlines are receding a lot (up to 1m/yr), but not everywhere.

1994

ST2U3  
ST2S3  
ST2S2  
ST2U2  
ST2S1  
ST2U1

Image U.S. Geological Survey

55 m

Google Earth

2022

ST2

Average ~30 m  
coastline recession

Image © 2023 Maxar Technologies

55 m

Google Earth

Rakes aren't  
growing more  
prominent  
everywhere.



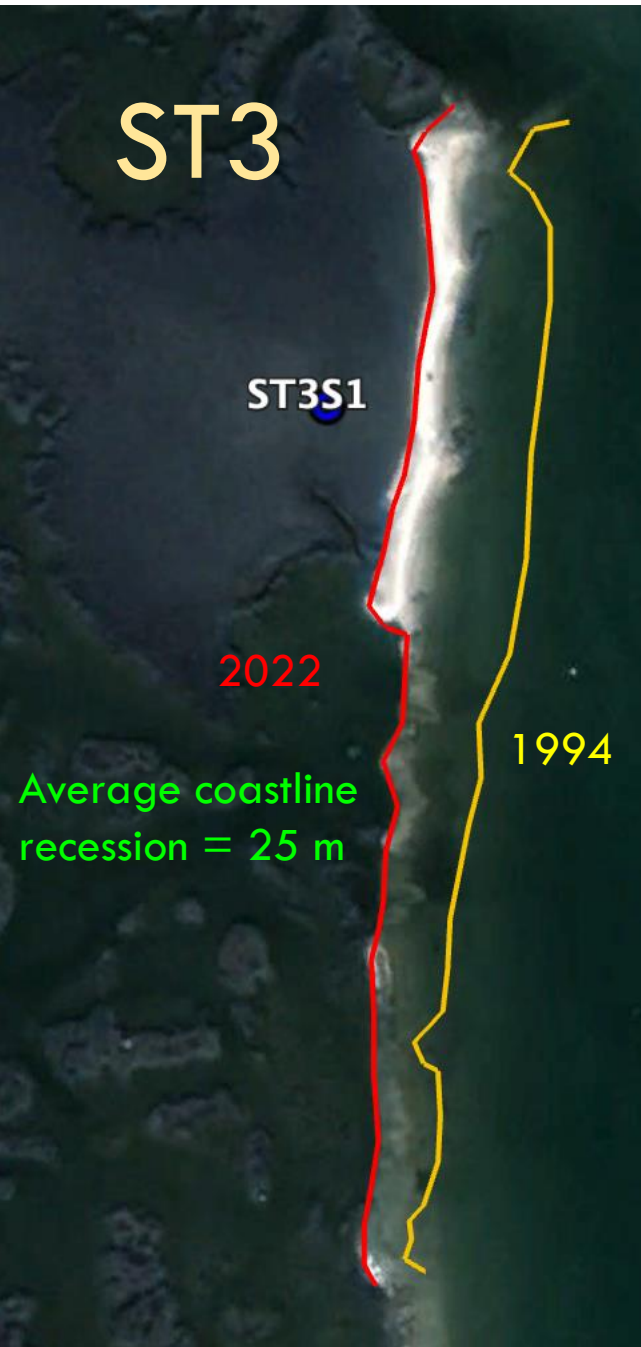
ST3

ST3S1

2022

1994

Average coastline  
recession = 25 m



ST4

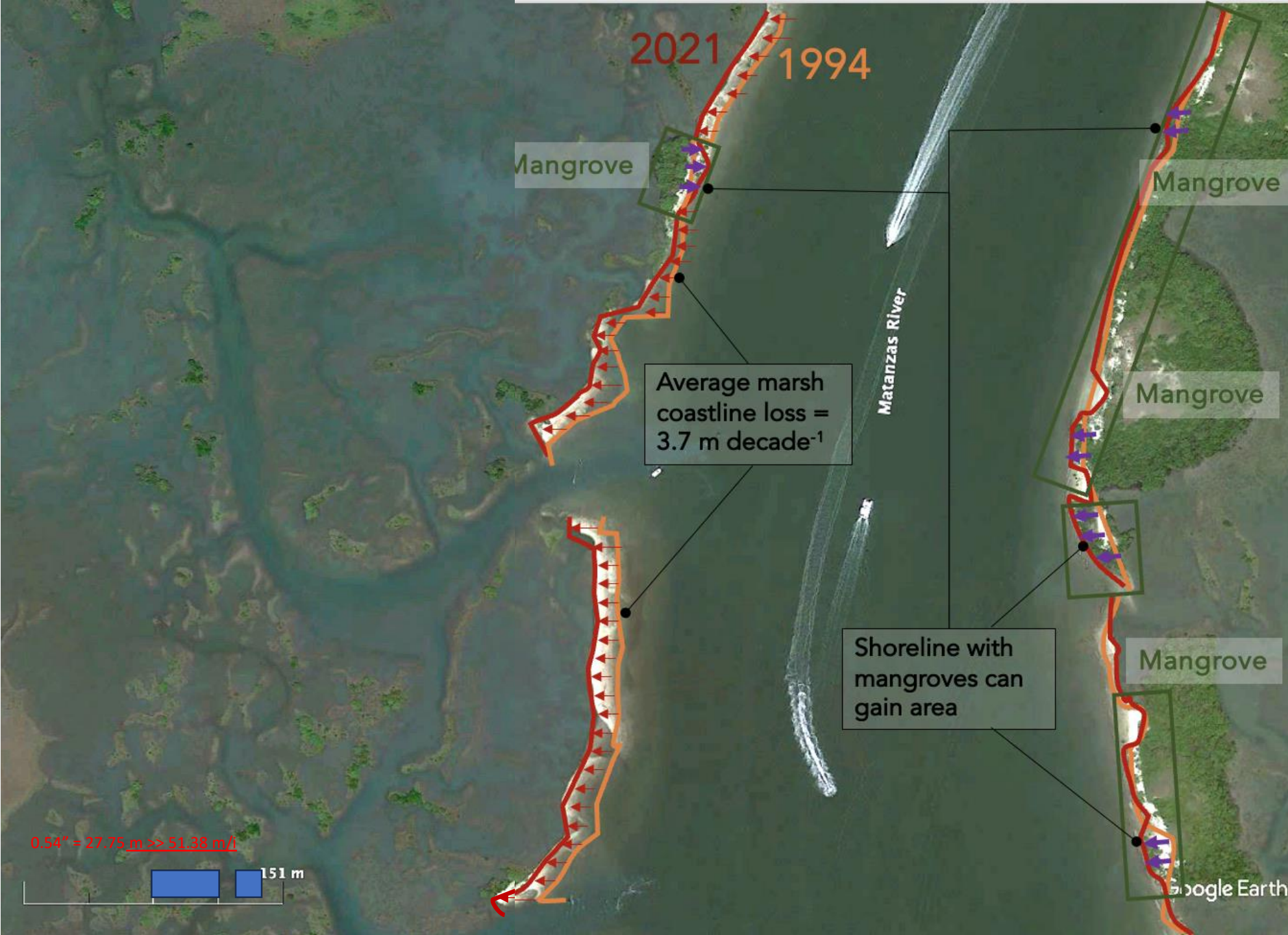
ST4U3

ST4S1

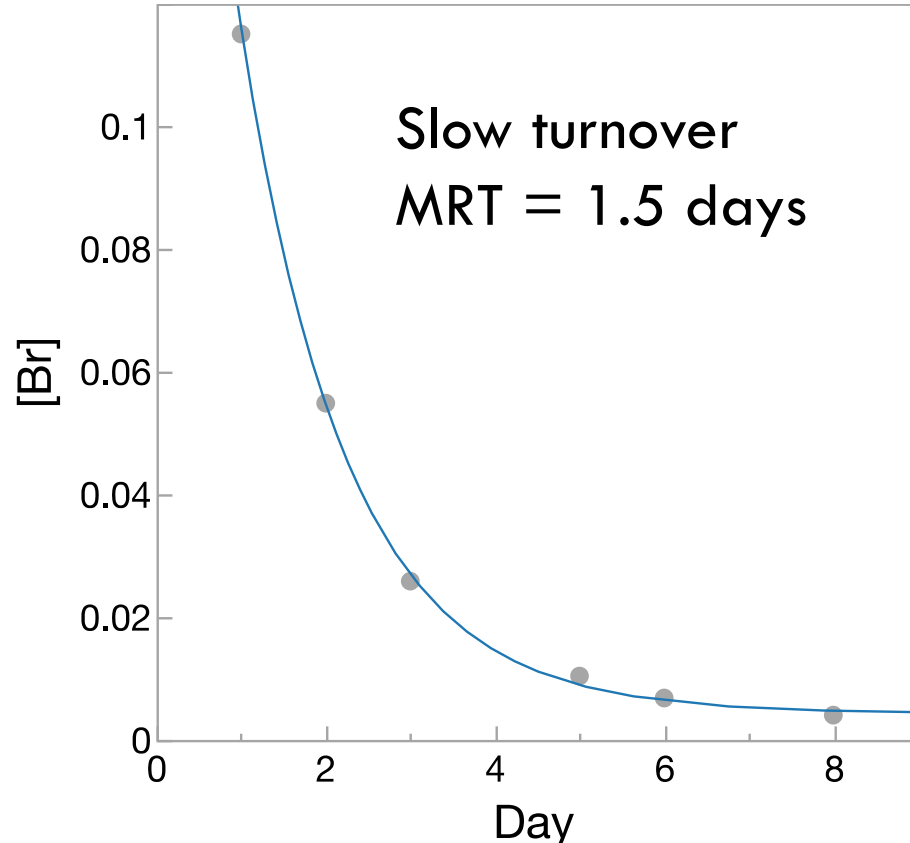
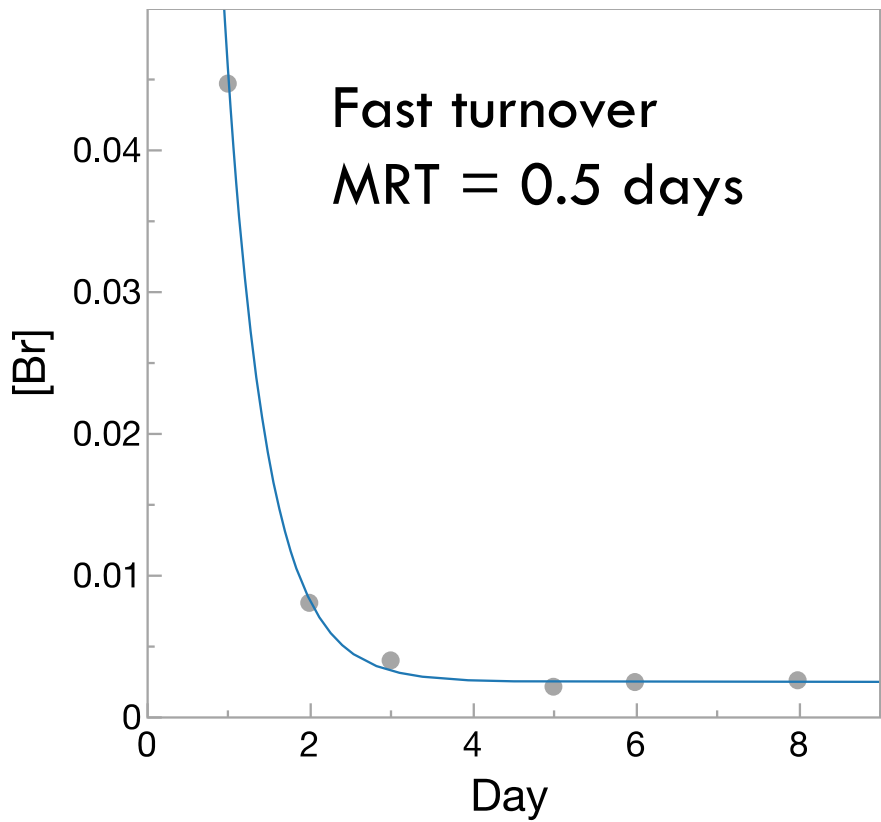
Average coastline  
recession ~ 12 m







Potentially protective role mangroves can play



Bromide spiking

Tidal treatment		Mean residence time (days)
Above + Below	<span style="color: red;">●</span>	2.86
Below	<span style="color: yellow;">●</span>	0.89
Above	<span style="color: green;">●</span>	1.98
Control	<span style="color: blue;">●</span>	0.83



# Field study design







**Field Data collection variable**

**What will this variable tell us about marsh health behind the rakes?**



Below: Cathi McIntosh with soil penetrometer

Root growth

How strong is the soil? How well is it building elevation?

Bromide tracing

How much is the wetland being flushed by the tide?

Soil chemistry and physical strength

How much buildup of sulfide/salinity is there in soils?  
Are nutrients being retained in the wetland?  
How well do soils hold together?

Elevation

How is this site poised to keep up with rising sea levels (or not)?



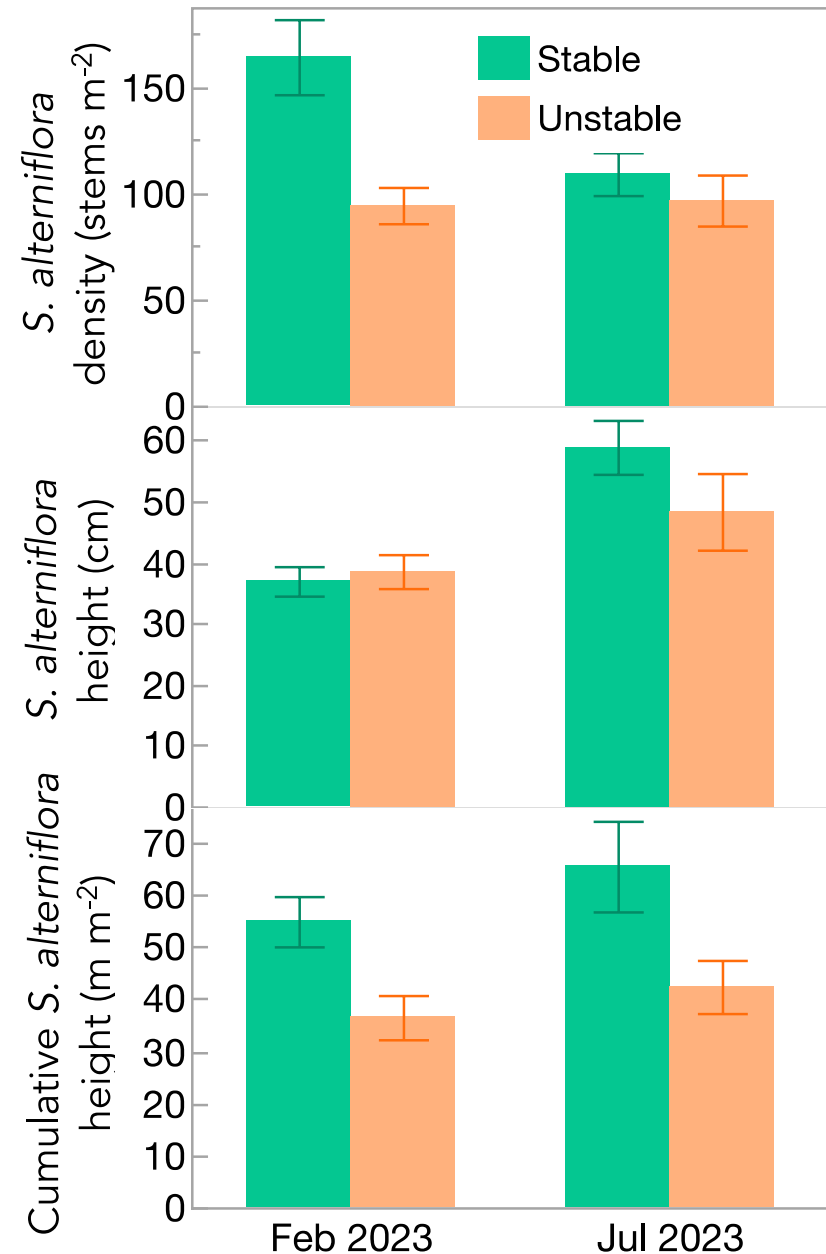


# Marsh plant status

*Spartina alterniflora* density nor height are consistently different between stable and unstable plots

But cumulative *Spartina* height is 50% lower in unstable marshes

This metric may provide an easily assessable indicator of marsh decline.



# Root ingrowth bags

- installed February '23
- removed October '23
- reinstalled October '23

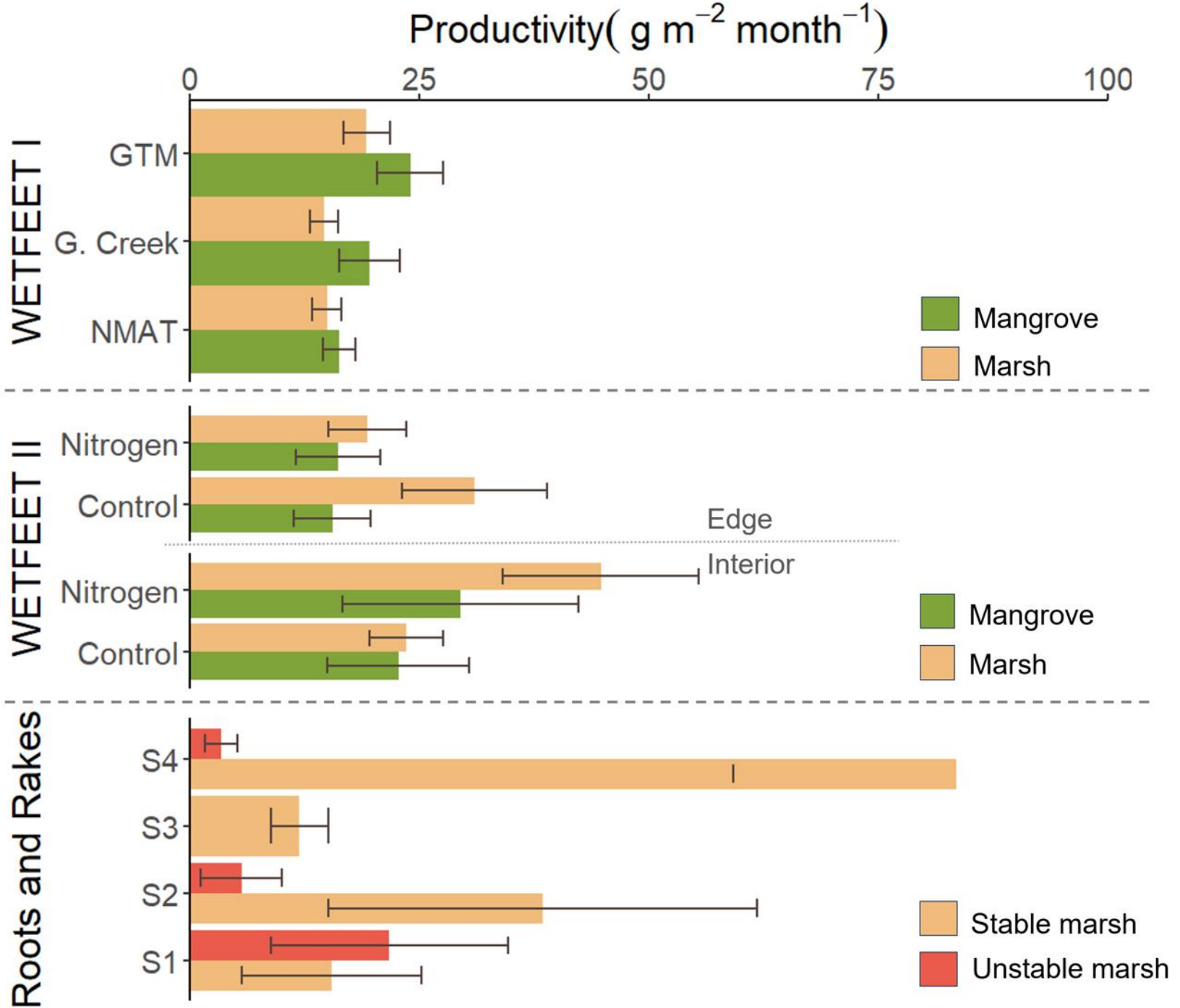
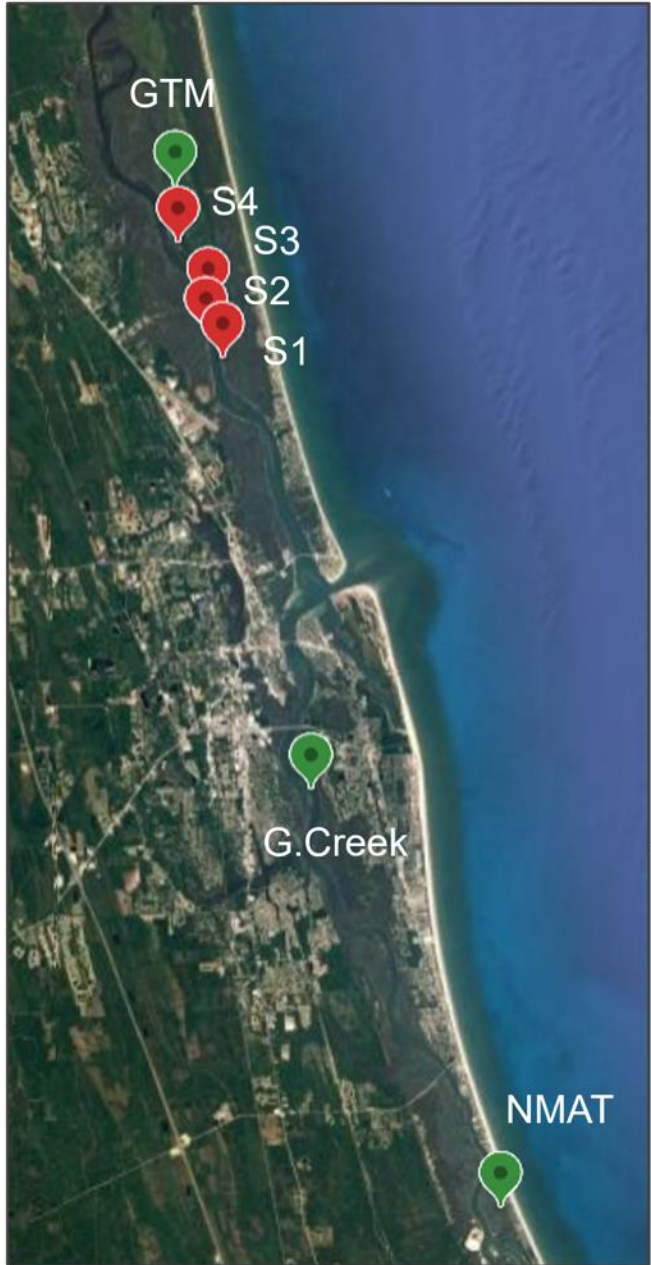


Below: Tess Adgie pulls out a soil core to place a root ingrowth bag (30cm). Root ingrowth bag is pictured in the two left images.





Data summary by Tess Adgie  
 WFII data by Jocelyn Bravo





Scott Jones and Cathi McIntosh measuring carbon dioxide and methane fluxes from plants plus soil at a Roots and Rakes site.

See Cathilyn McIntosh's poster  
See Jocelyn Bravo's poster  
See Jennifer Volk's poster  
See Mercedes Pinzon Degado's poster



Lisa Chambers and team collecting soil cores for soil biogeochemistry





# Samantha Chapman

[samantha.chapman@villanova.edu](mailto:samantha.chapman@villanova.edu)

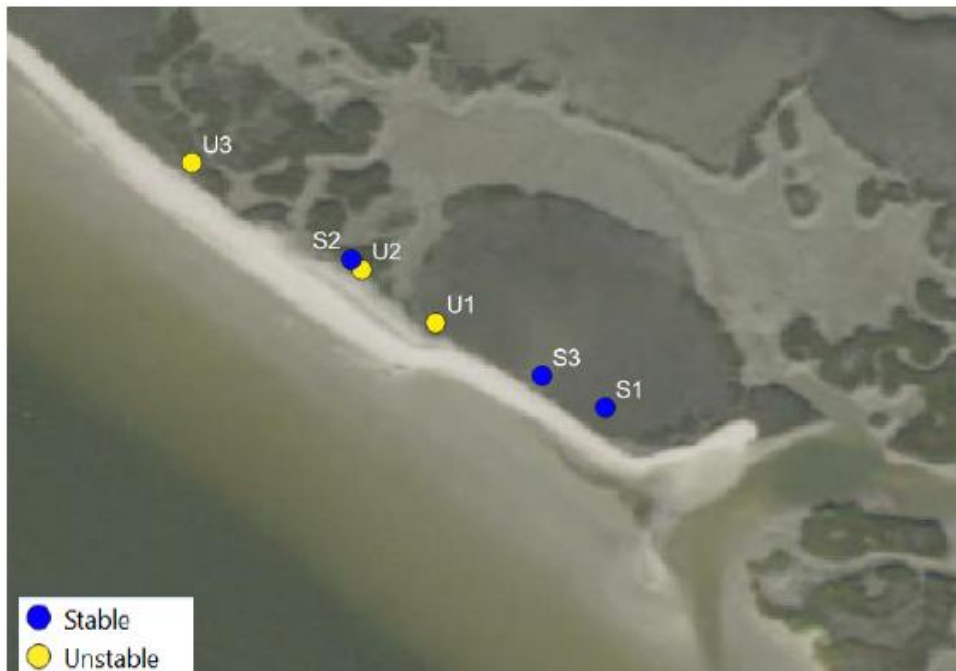
Thanks to: Tess Adgie, Jacob Berna, Jocelyn Bravo, Shannon Brew, Lisa Chambers, Kaitlyn Dietz, Nikki Dix, Shannon Dunnigan, Candy Feller, Aaron Freeman, Scott Jones, Abby Kuhn, Scott Jones, Adam Langley, Pam Marcum, Morgan Mack, Cathi McIntosh, Allix North, Mercedes Pinzon Delgado, Hans Prevost, Phillip Rivera, Lia Sansom, Silas Tanner, Kirstin Thompson, Ches Vervaeke, Gregg Verutes, Dale Viger, Jennifer Volk, Phil Yang and the rest of WETFEET TEAM



National Estuarine  
Research Reserve System  
Science Collaborative



Site 1



Site 2



Site 3



Site 4

