



The SECAS Third Thursday Web Forum

Understanding coastal wetland change from the perspective of
refuge managers, long-term monitoring, and remote sensing



Agenda

- Introduction
- Monthly topic
- Q&A and discussion
- Preview of next webinar
- Staff updates



Understanding coastal wetland change from the perspective of refuge managers, long-term monitoring, and remote sensing

Michelle Moorman, U.S. Fish and Wildlife Service
Zafer Defne, U.S. Geological Survey

5-16-2024





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Understanding coastal wetland transformation from the perspective of NWR managers, long-term monitoring, and remote sensing

Michelle Moorman, U.S. Fish and Wildlife Service

Neil Ganju, USGS

Zafer Defne, USGS



Today's talk

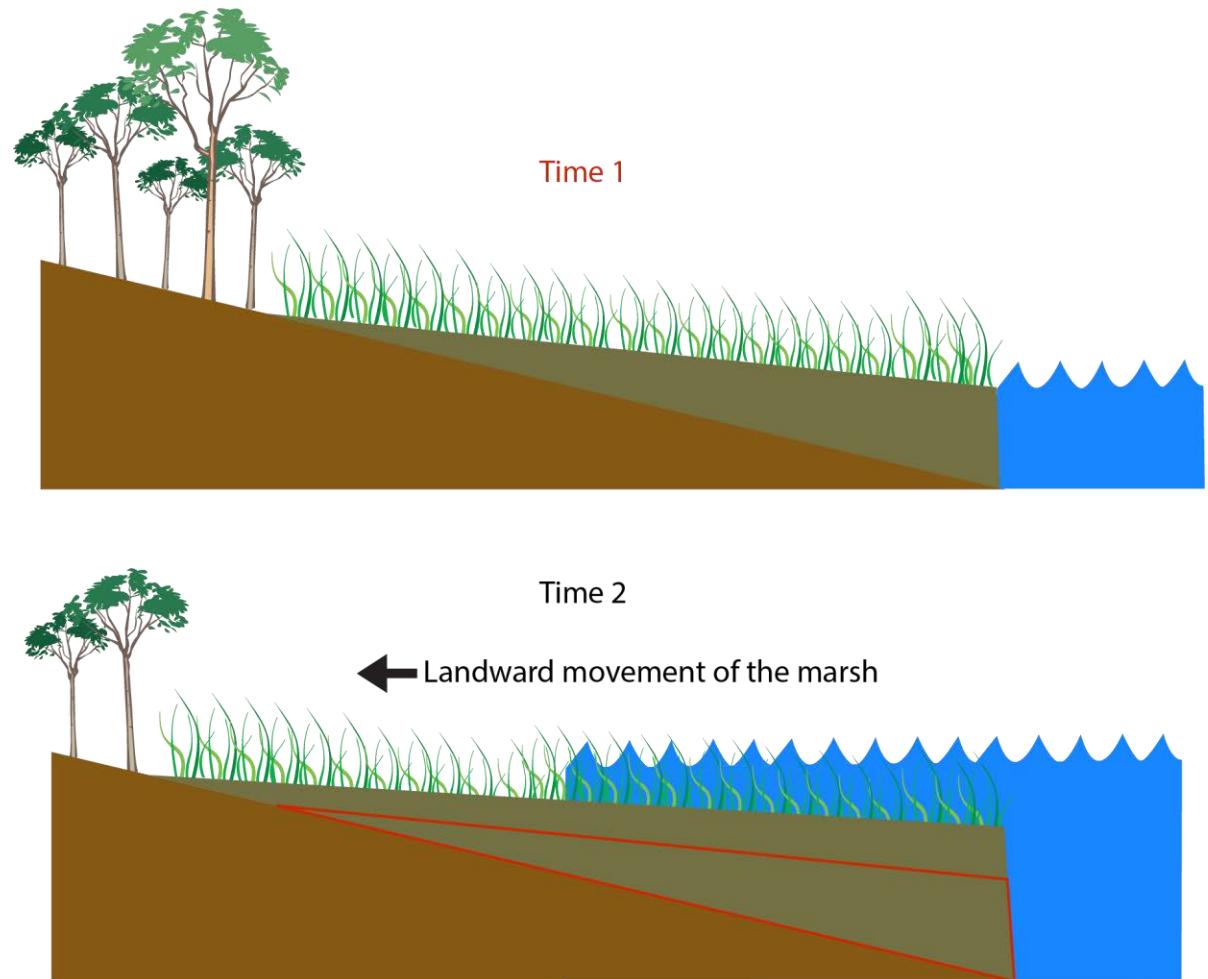
- Coastal wetland transformation
- Monitoring coastal wetland transformation:
 - Surface Elevation Tables (SET)
 - Unvegetated-Vegetated Ratio (UVVR)
- Utilizing monitoring data to inform decision making



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Ecological Transformation

Change that re-arranges historical species composition and the ecological function of habitats



**Coastal wetlands
provide important
ecosystem services
including habitat for a
variety of fish and
wildlife species**



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Our coastal wetlands are being transformed by

Sea-level rise

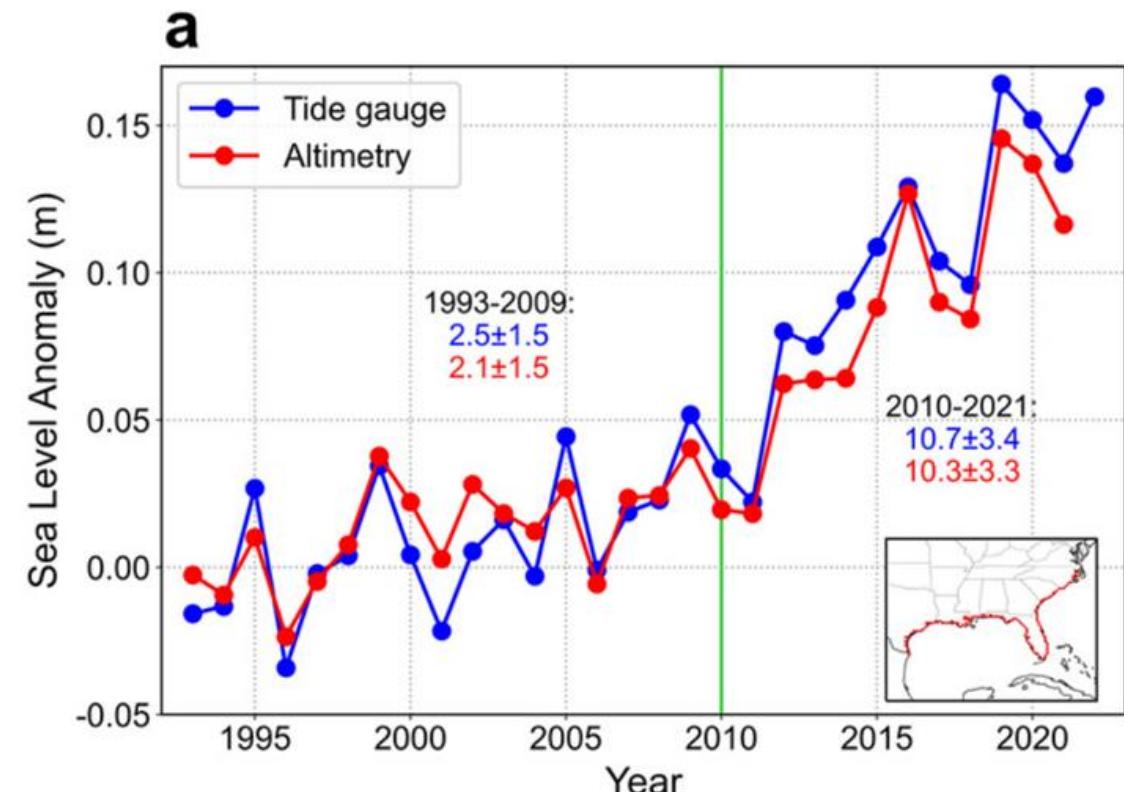
- Shoreline/beach erosion
- Flooding
- Habitat loss

Saltwater intrusion

- Harbor dredging
- Habitat conversion
- Impoundment management

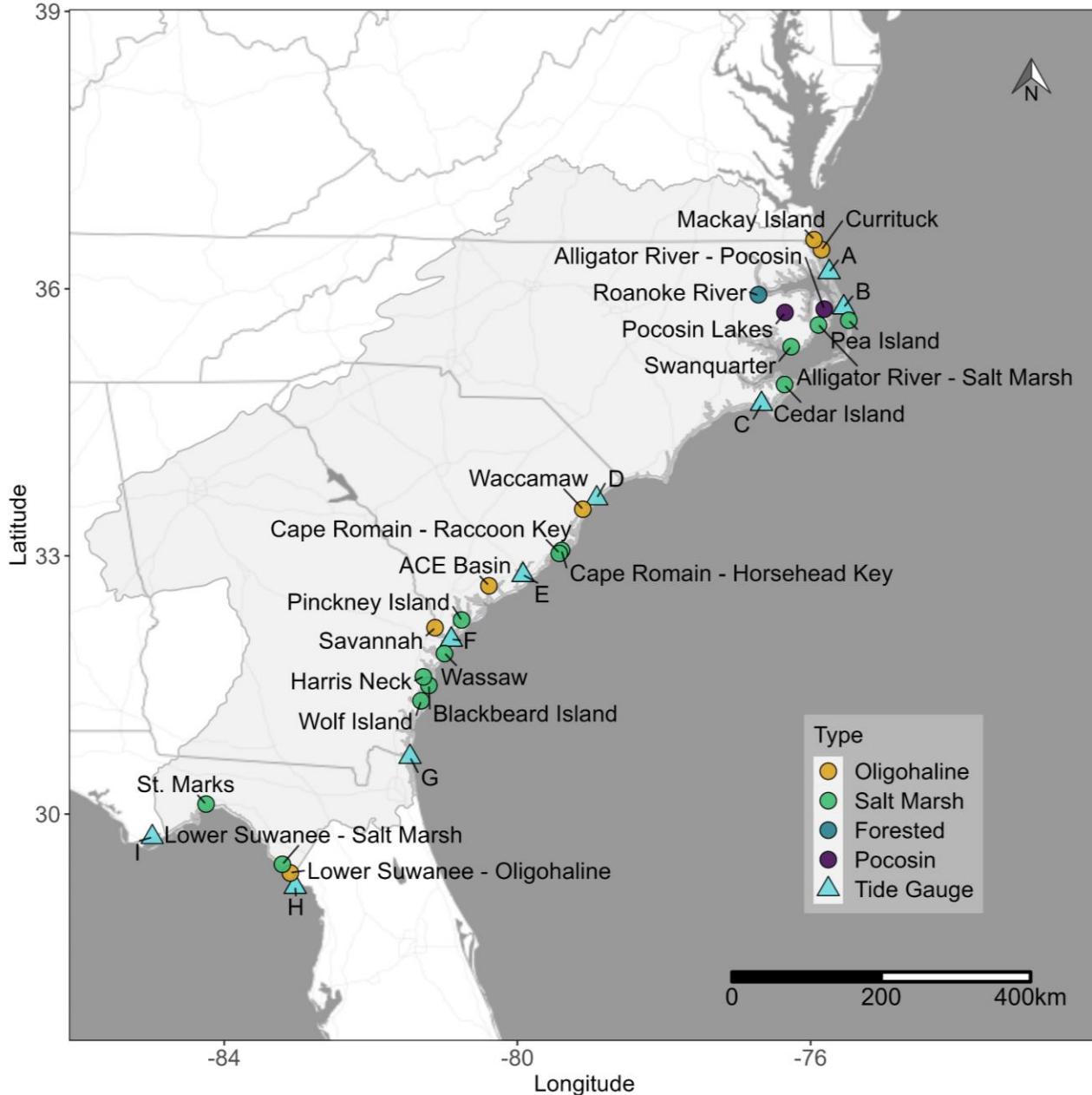
Floods and Droughts

- Water quality and quantity
- Fire



Monitoring Coastal Wetland Transformation

- Regional NWRS monitoring program in 22 priority habitats across 20 NWRs in the South Atlantic geography
- Monitoring sites in:
 - Oligohaline marshes (12)
 - Salt marshes (6)
 - Forested wetlands (1)
 - Pocosins (2)



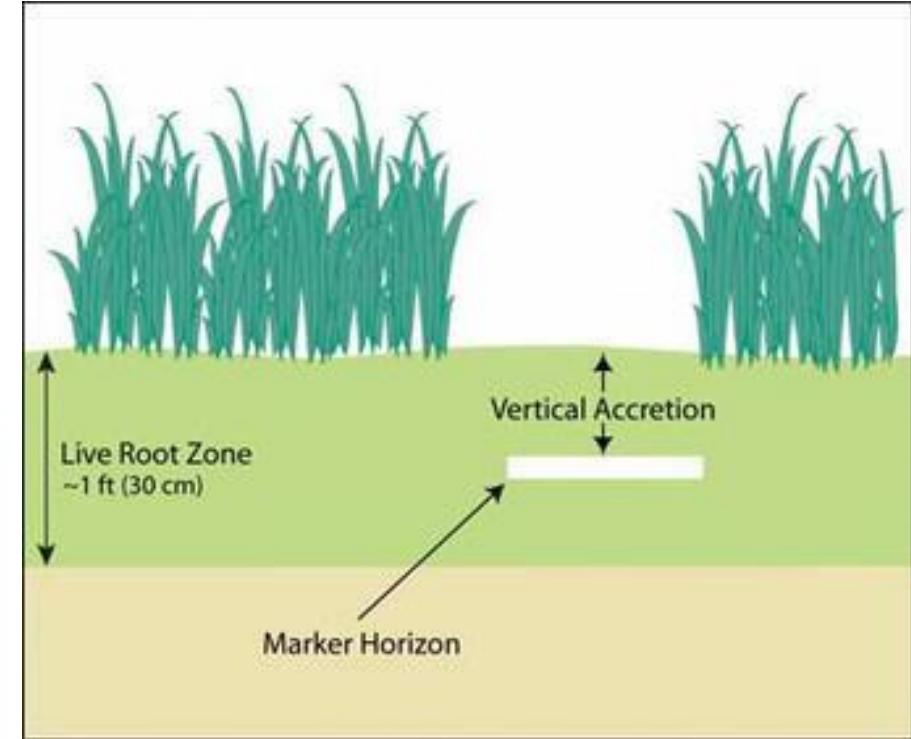
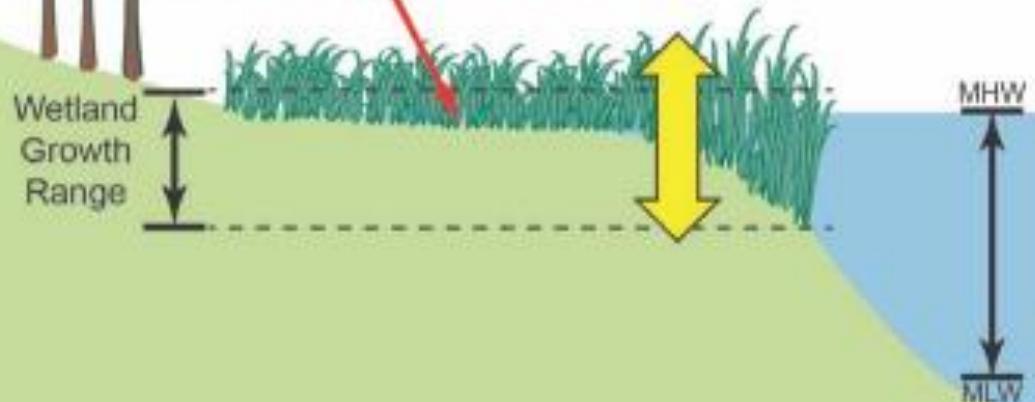
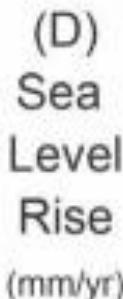
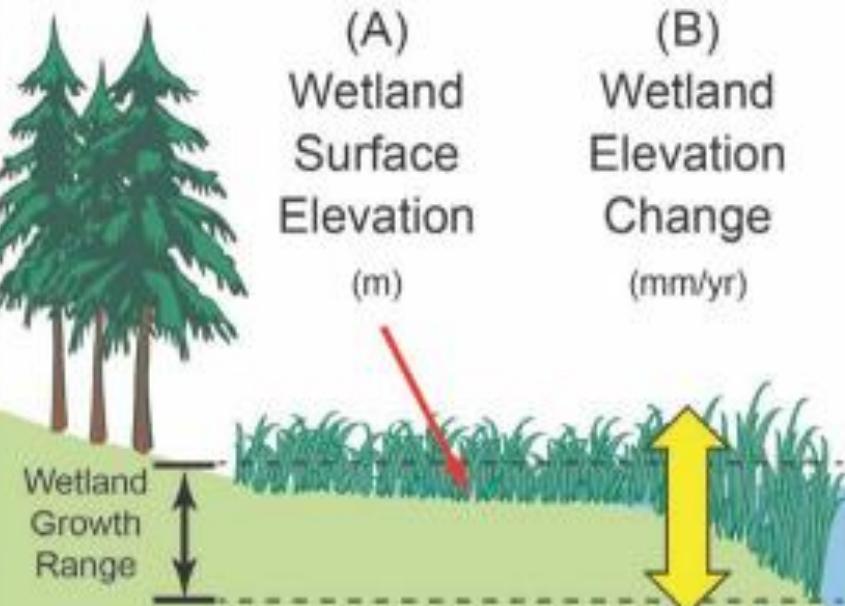
The Surface Elevation Table – Marker Horizon Technique (SET-MH)

- Monitoring began in 2012
- Estimates rates of coastal wetland surface elevation change and accretion and compare those rates to sea-level rise



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Tidal Wetlands



Method: Surveying SET Tide Gauge Tide Gauge

USGS

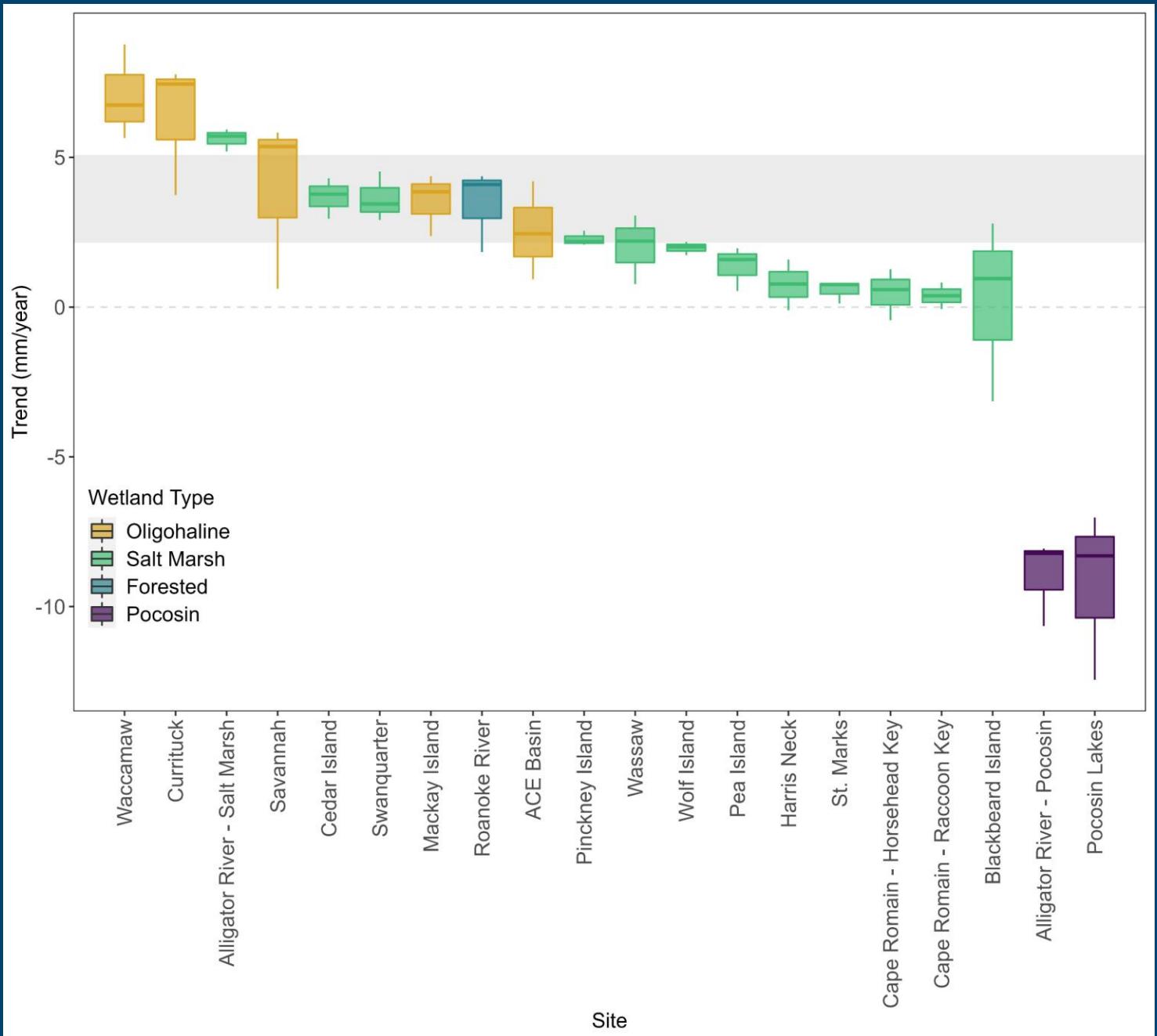
Lynch et al., 2015



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What is the rate of wetland elevation change?

How do rates of wetland elevation change compare to rates of SLR?

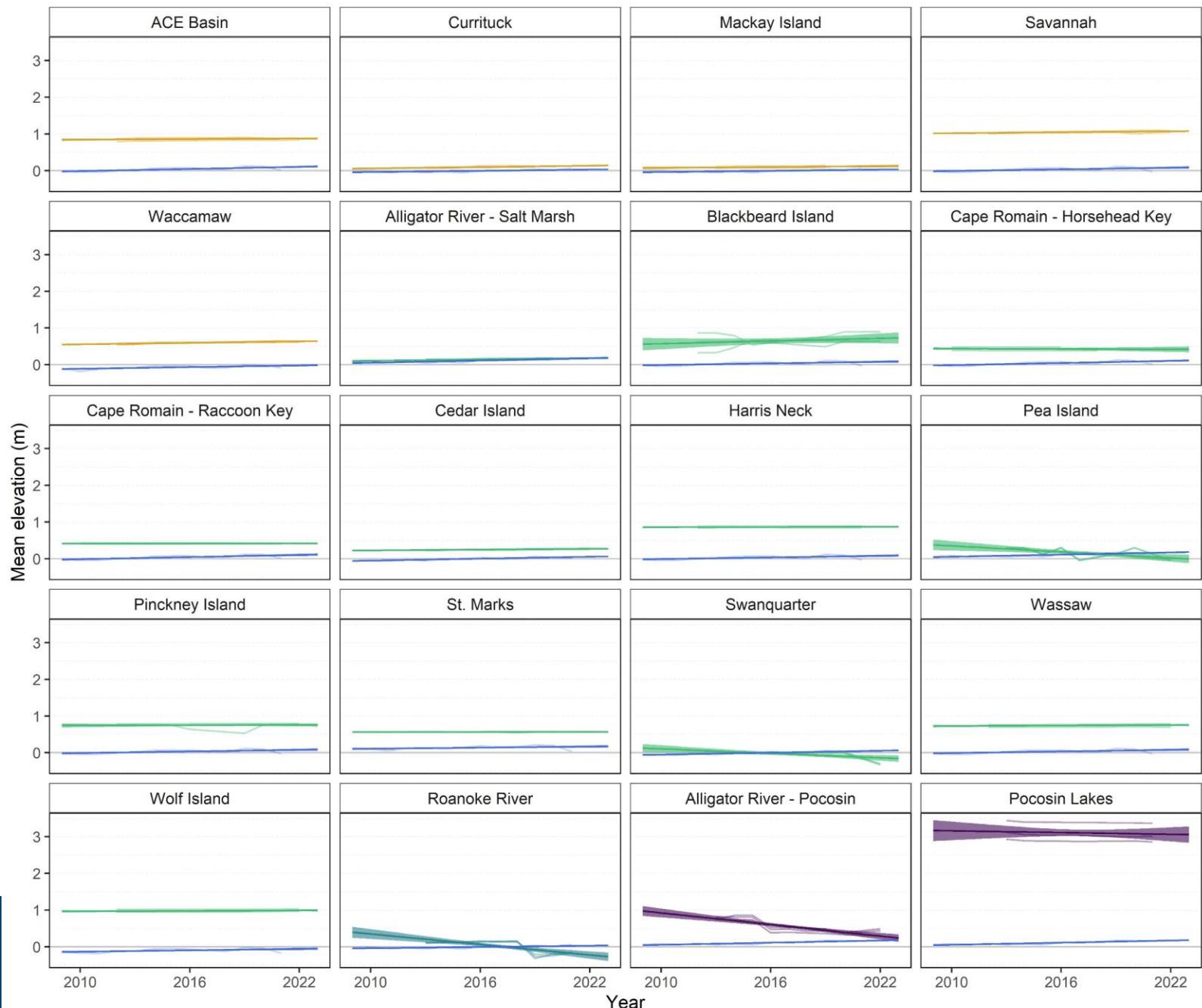




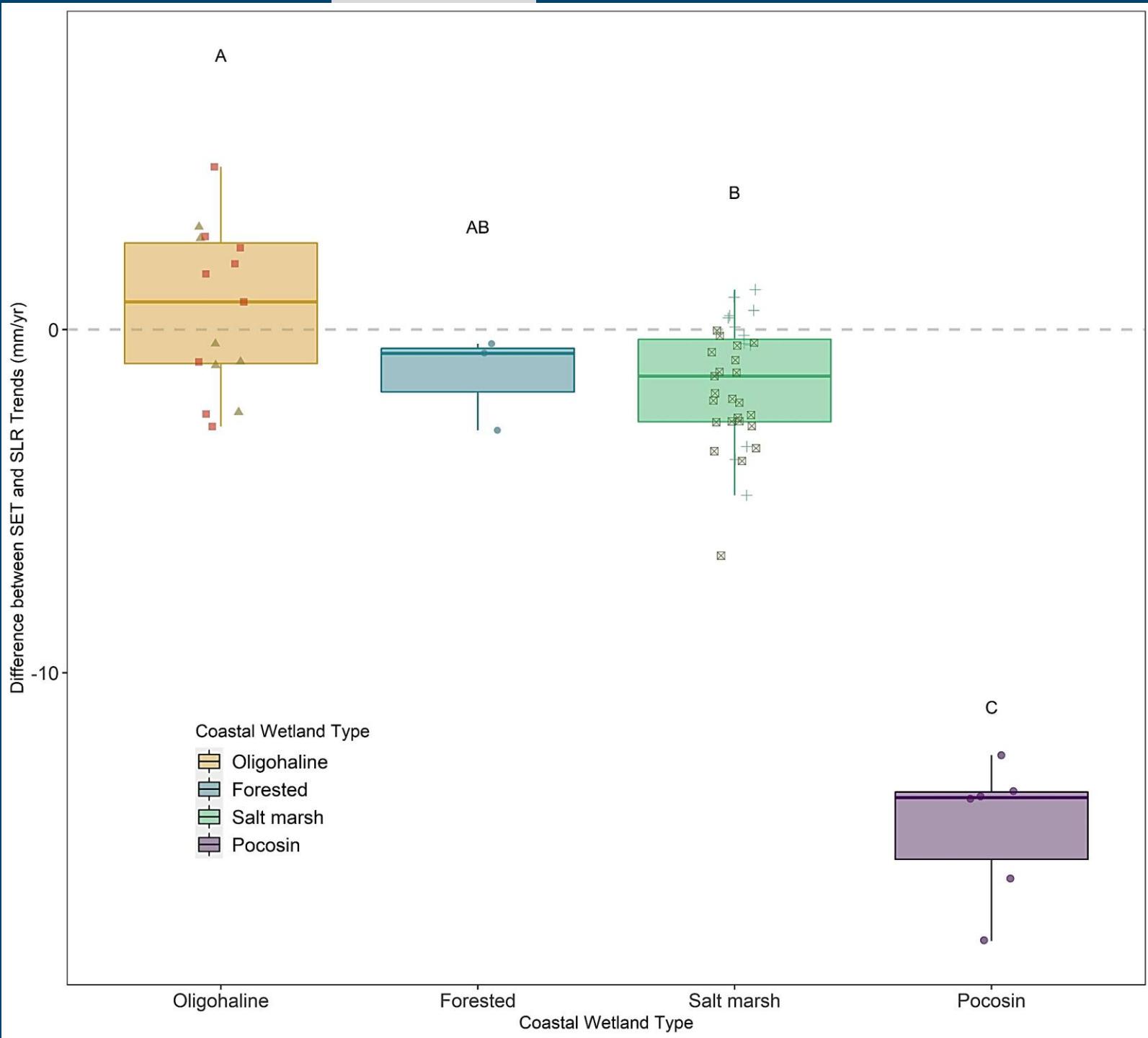
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SLR versus SET trend

Wetland Type Oligohaline Salt marsh Forested Pocosin



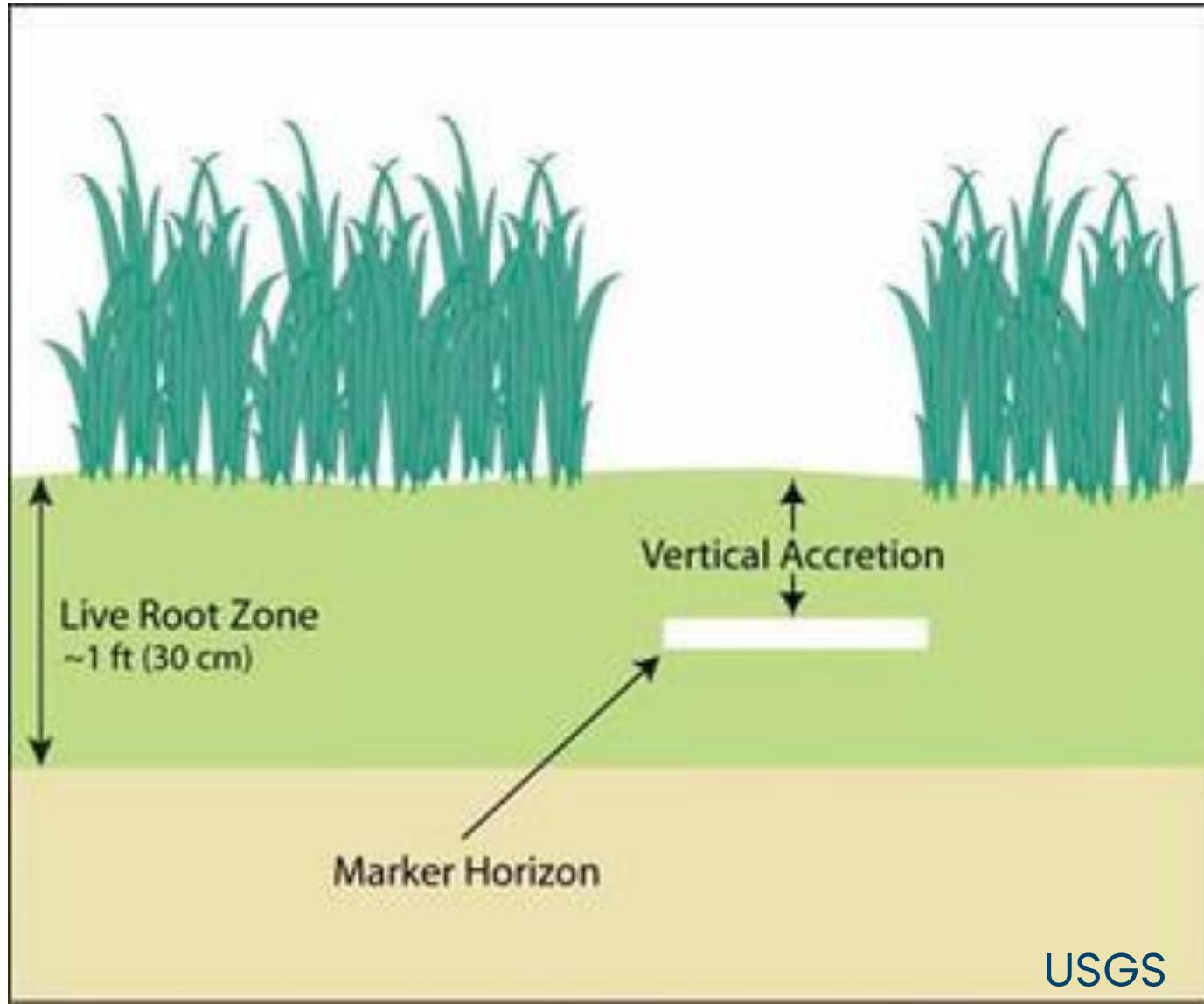
How do rates of elevation change vary by habitat?



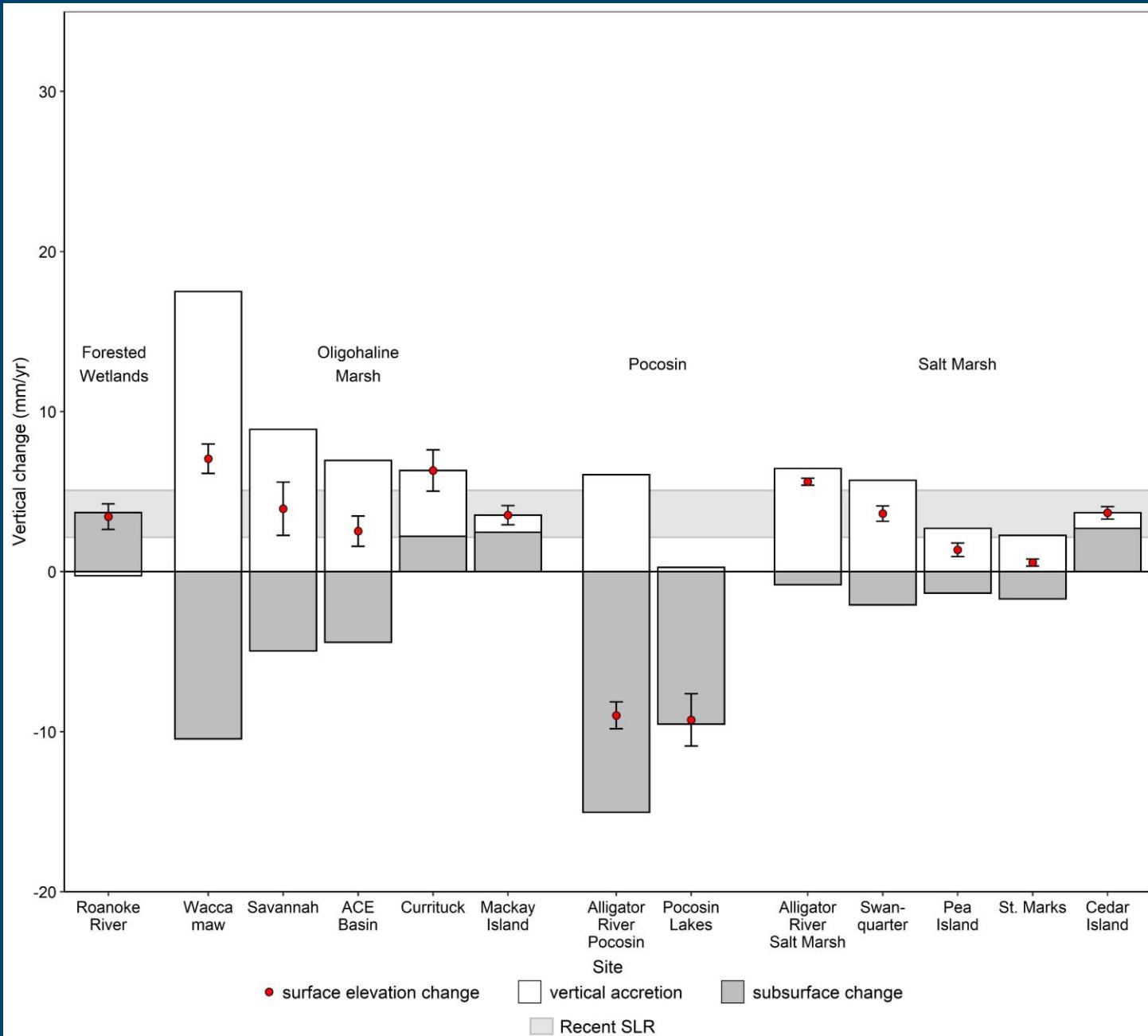


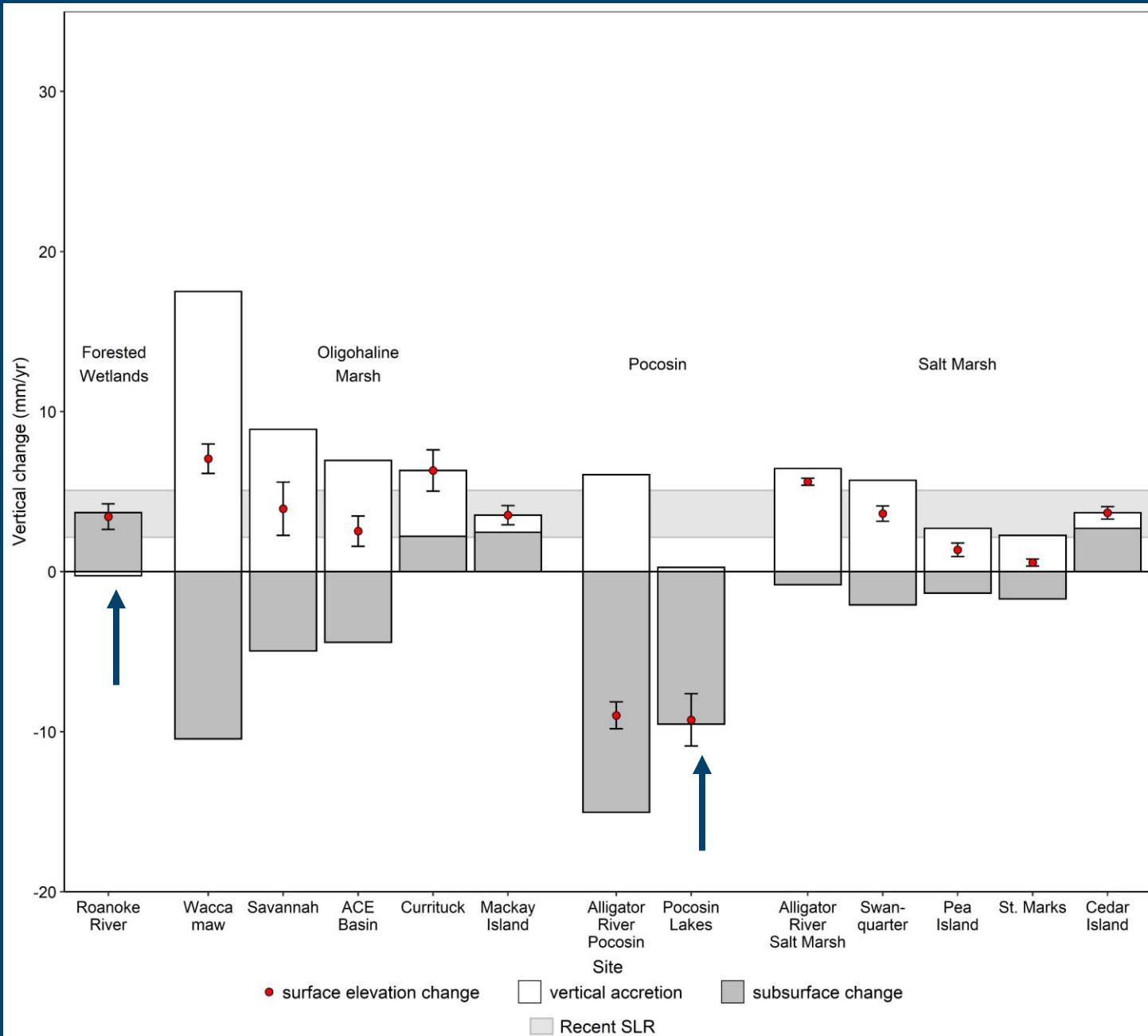
What aboveground and below ground processes might be driving elevation change in coastal wetlands?

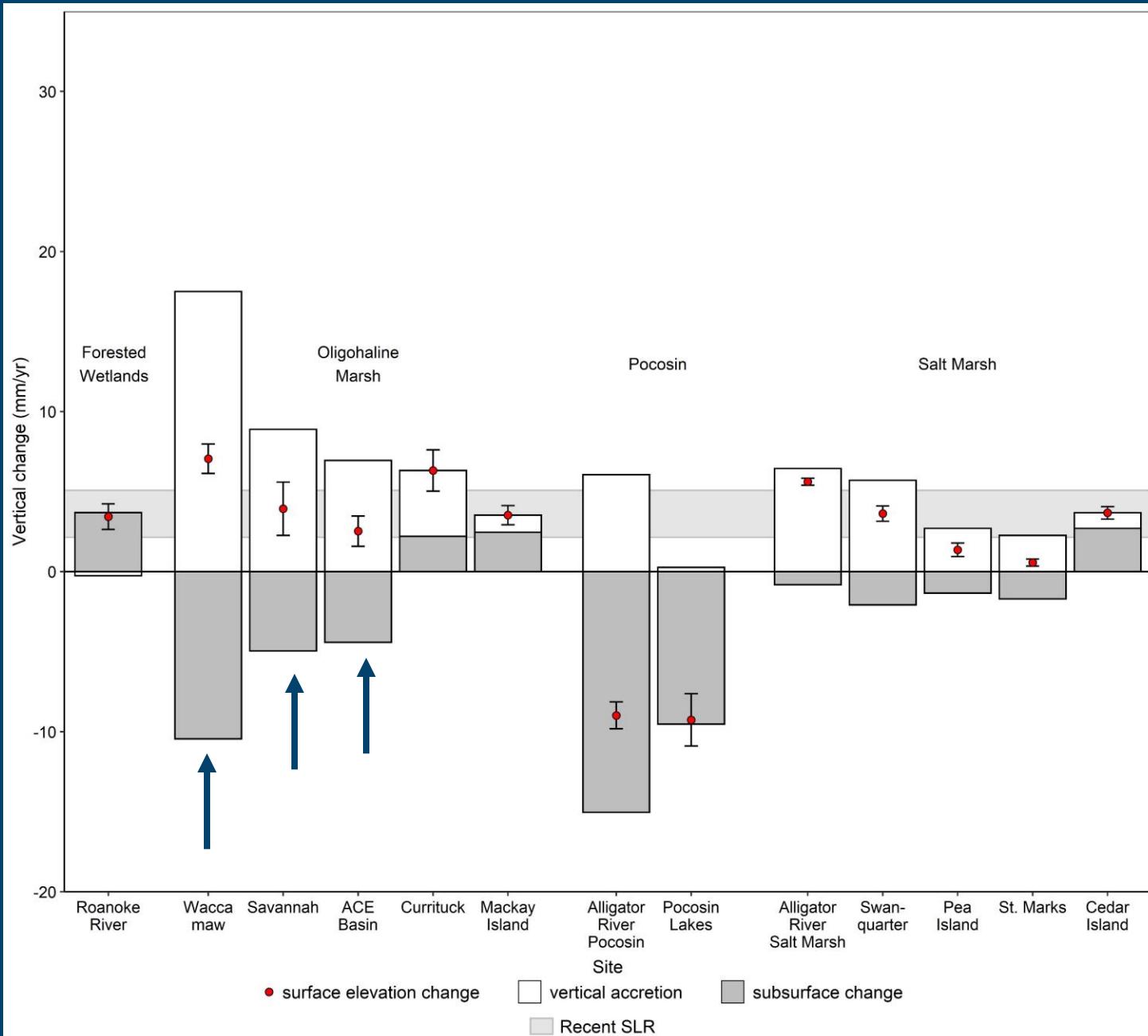


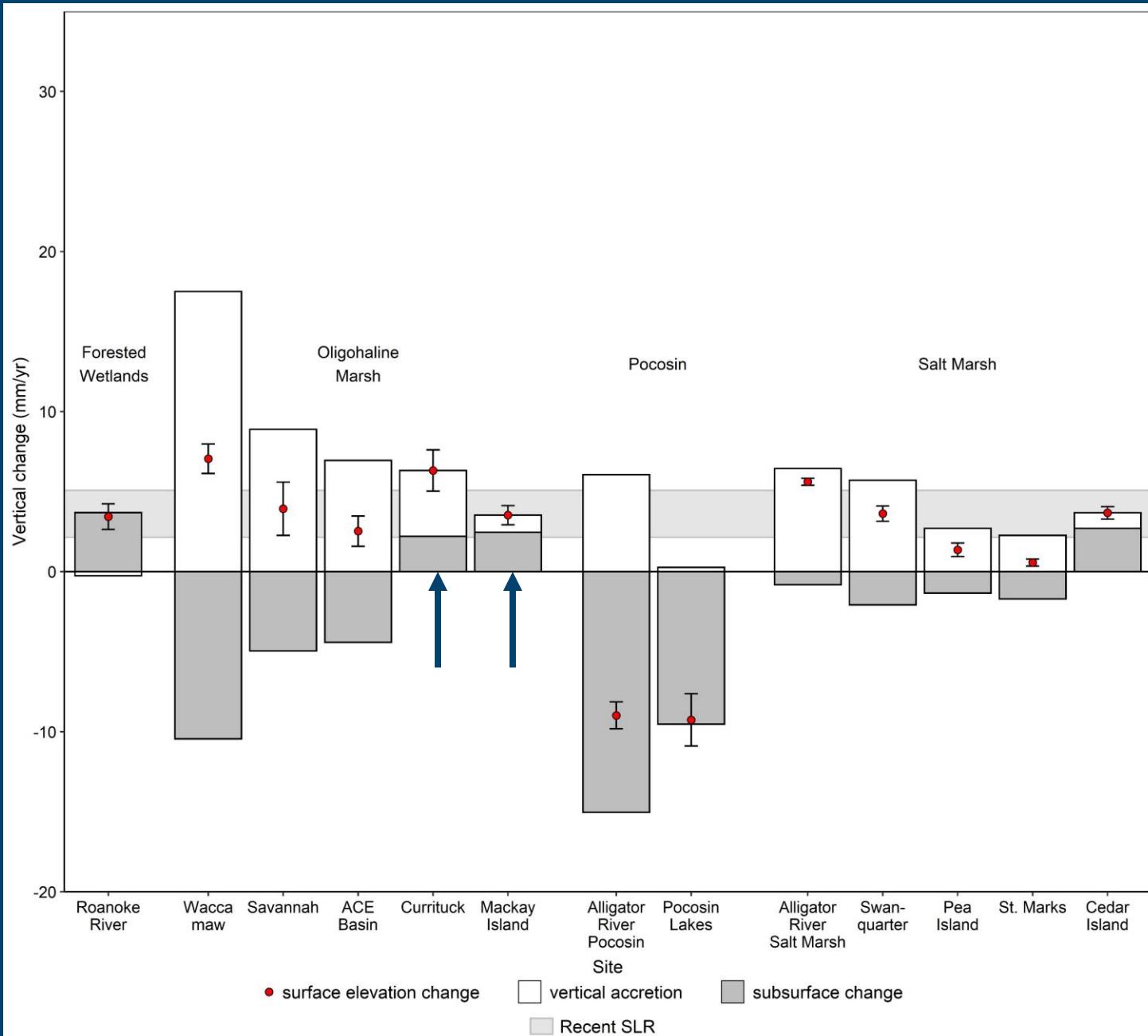


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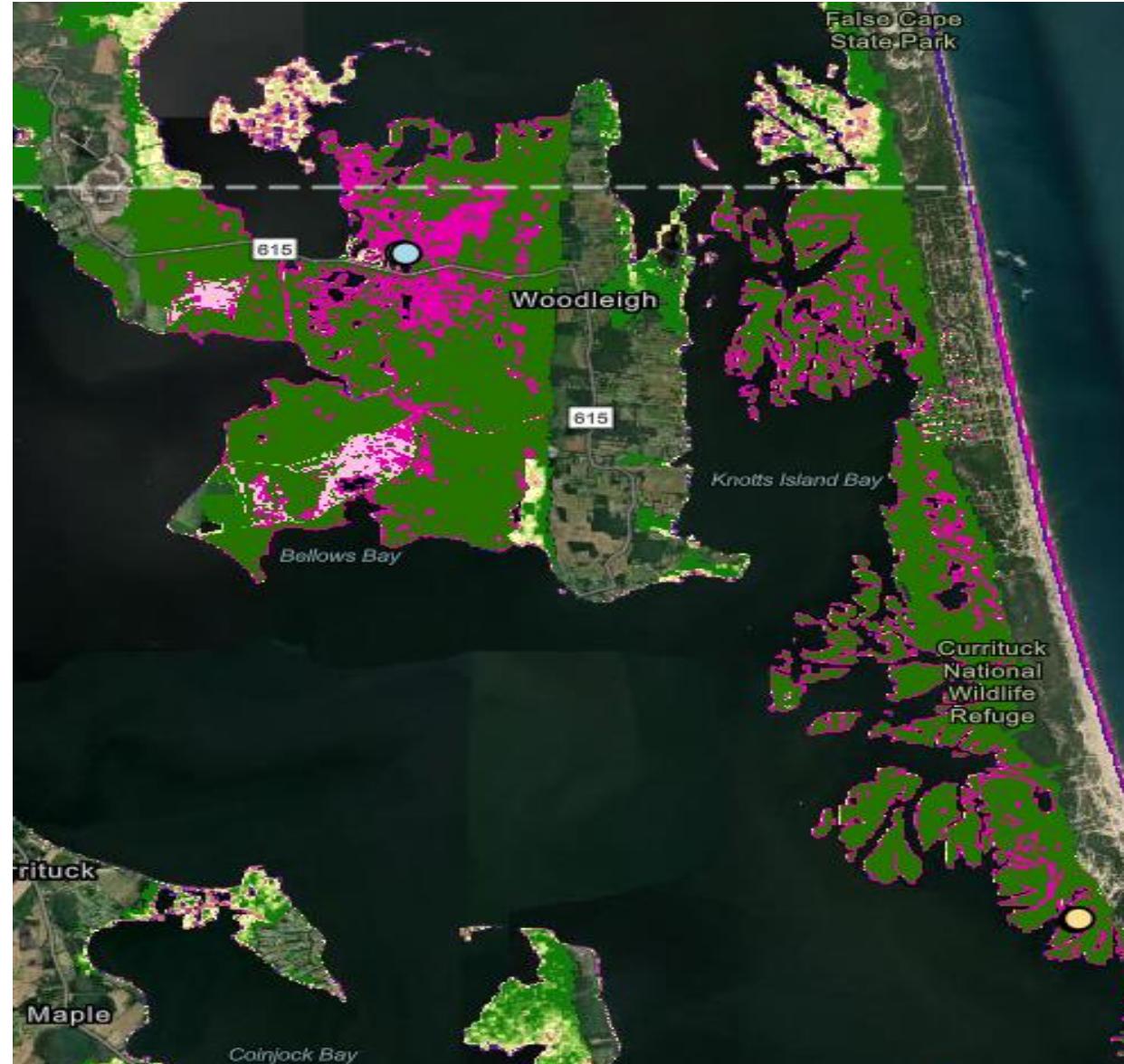
Information sharing beyond NWRs

- Partnerships have facilitated data and information sharing at the state, regional and national level which has informed understanding beyond NWR boundaries
- 85% of SETs in all studies not keeping pace with SLR



Understanding SET results at the landscape scale

- New remote-sensing tools have allowed us to explore other techniques for understanding coastal wetland vulnerability
- A collaborative effort with USGS allowed us to compare results from SET with remotely-sensed assessments of marshes



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Monitoring Take Homes

- SET-UVVR data are well correlated. Both datasets help provide site-specific information on wetland vulnerability and restoration response.
- SET data suggests current day marshes cannot keep pace with accelerated rates of SLR and provide insight on site-specific above and below-ground processes.
- UVVR provides a spatial assessment of wetland stability and vegetation change across the wetland plain that can be used to assess restoration success and plan for climate adaptation.



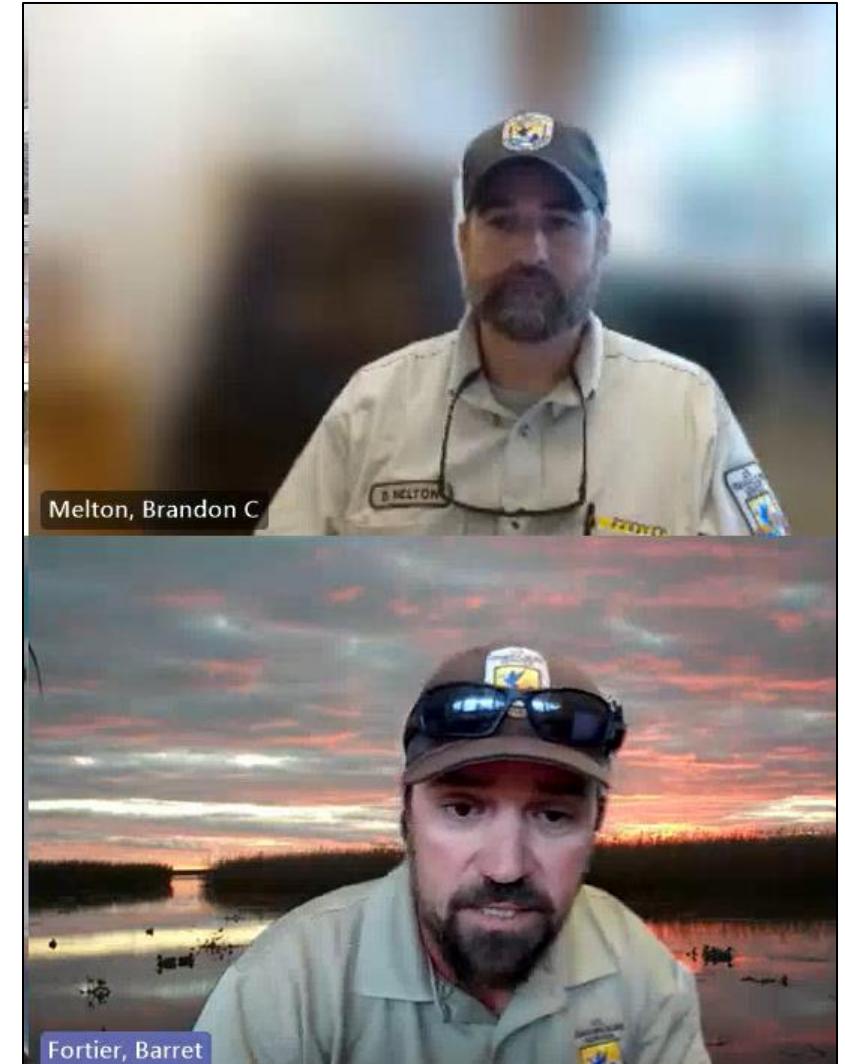
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Sharing data and results

- Developed SET-UVVR on-line mapping tool data for southeast NWRs

Workshops provide:

- Ground-truthing of results by managers
- Training on data and tool
- Improved understanding of how monitoring data can inform decision making – Example: Waccamaw NWR story map



Southeast Region Application

Monitoring status of coastal wetlands in National Wildlife Refuges

Legend Bookmarks Details Layers Info

- ALLIGATOR RIVER NATIONAL WILDLIFE REFUGE
- BAYOU SAUVAGE URBAN NATIONAL WILDLIFE REFUGE
- BIG BRANCH MARSH NATIONAL WILDLIFE REFUGE
- BLACKBEARD ISLAND NATIONAL WILDLIFE REFUGE
- BRETON NATIONAL WILDLIFE REFUGE
- CAMERON PRAIRIE NATIONAL WILDLIFE REFUGE
- CAPE ROMAIN NATIONAL WILDLIFE REFUGE
- CEDAR ISLAND NATIONAL WILDLIFE REFUGE

<< Collapse

Search NWR by name

Nashville Tennessee Knoxville Greenville Columbia Atlanta Birmingham Jackson Mississippi Montgomery Tallahassee Jacksonville New Orleans Tampa Orlando

100 mi

Earthstar Geographics | U.S. Geological Survey | USGS | U.S. Fish and Wildlife Service | Powered by Esri

[Click here to open in new window](#)

Southeast Region Application

Monitoring status of coastal wetlands in National Wildlife Refuges

Legend



ALLIGATOR RIVER NATIONAL WILDLIFE REFUGE

Bookmarks



BAYOU SAUVAGE URBAN NATIONAL WILDLIFE REFUGE

Details



BIG BRANCH MARSH NATIONAL WILDLIFE REFUGE

Layers



BLACKBEARD ISLAND NATIONAL WILDLIFE REFUGE

Info



BRETON NATIONAL WILDLIFE REFUGE



CAMERON PRAIRIE NATIONAL WILDLIFE REFUGE

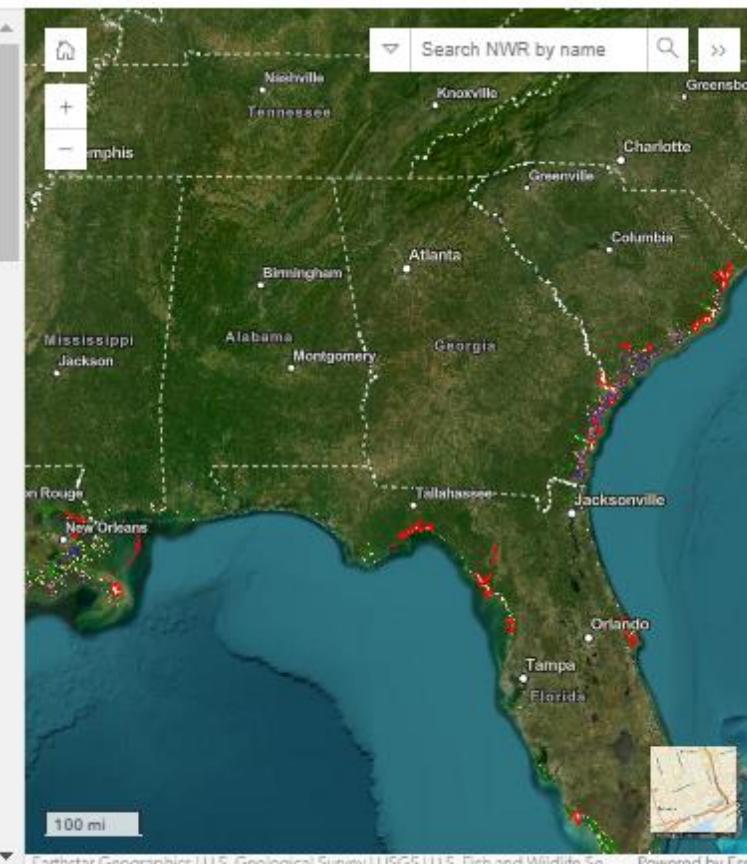


CAPE ROMAIN NATIONAL WILDLIFE REFUGE



CEDAR ISLAND NATIONAL WILDLIFE REFUGE

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Southeast Region Application

Monitoring status of coastal wetlands in National Wildlife Refuges

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- CAMERON PRAIRIE NATIONAL WILDLIFE REFUGE
- CAPE ROMAIN NATIONAL WILDLIFE REFUGE
- CEDAR ISLAND NATIONAL WILDLIFE REFUGE

<< Collapse

Search NWR by name

Nashville, Tennessee, Greenville, Charlotte, Greensboro, Memphis, Birmingham, Atlanta, Columbia, Mississippi, Jackson, Alabama, Montgomery, New Orleans, Tallahassee, Jacksonville, Orlando, Tampa, Florida.

100 mi

[Click here to open in new window](#)

Southeast Region Application

Monitoring status of coastal wetlands in National Wildlife Refuges

- [Legend](#)
- [Bookmarks](#)
- [Details](#)
- [Layers](#)
- [Info](#)

ALLIGATOR RIVER NATIONAL WILDLIFE REFUGE

BAYOU SAUVAGE URBAN NATIONAL WILDLIFE REFUGE

BIG BRANCH MARSH NATIONAL WILDLIFE REFUGE

BLACKBEARD ISLAND NATIONAL WILDLIFE REFUGE

BRETON NATIONAL WILDLIFE REFUGE

CAMERON PRAIRIE NATIONAL WILDLIFE REFUGE

CAPE ROMAIN NATIONAL WILDLIFE REFUGE

CEDAR ISLAND NATIONAL WILDLIFE REFUGE

<< Collapse

Search NWR by name

Nashville

Knoxville

Greensboro

Charlotte

Greenville

Columbia

Atlanta

Birmingham

Jackson

Montgomery

Tallahassee

New Orleans

Orlando

Tampa

100 mi

[Click here to open in new window](#)

Monitoring status of coastal wetlands in National Wildlife Refuges



SET data

Net vertical elevation (mm/yr)

- 1.9 - 5.6
- 0.1 - 1.8
- -0.8 - 0.0
- -1.8 - -0.9
- -3.4 - -1.9
- -6.6 - -3.5
- -12.3 - -6.7
- -17.9 - -12.4

SE NWR approved

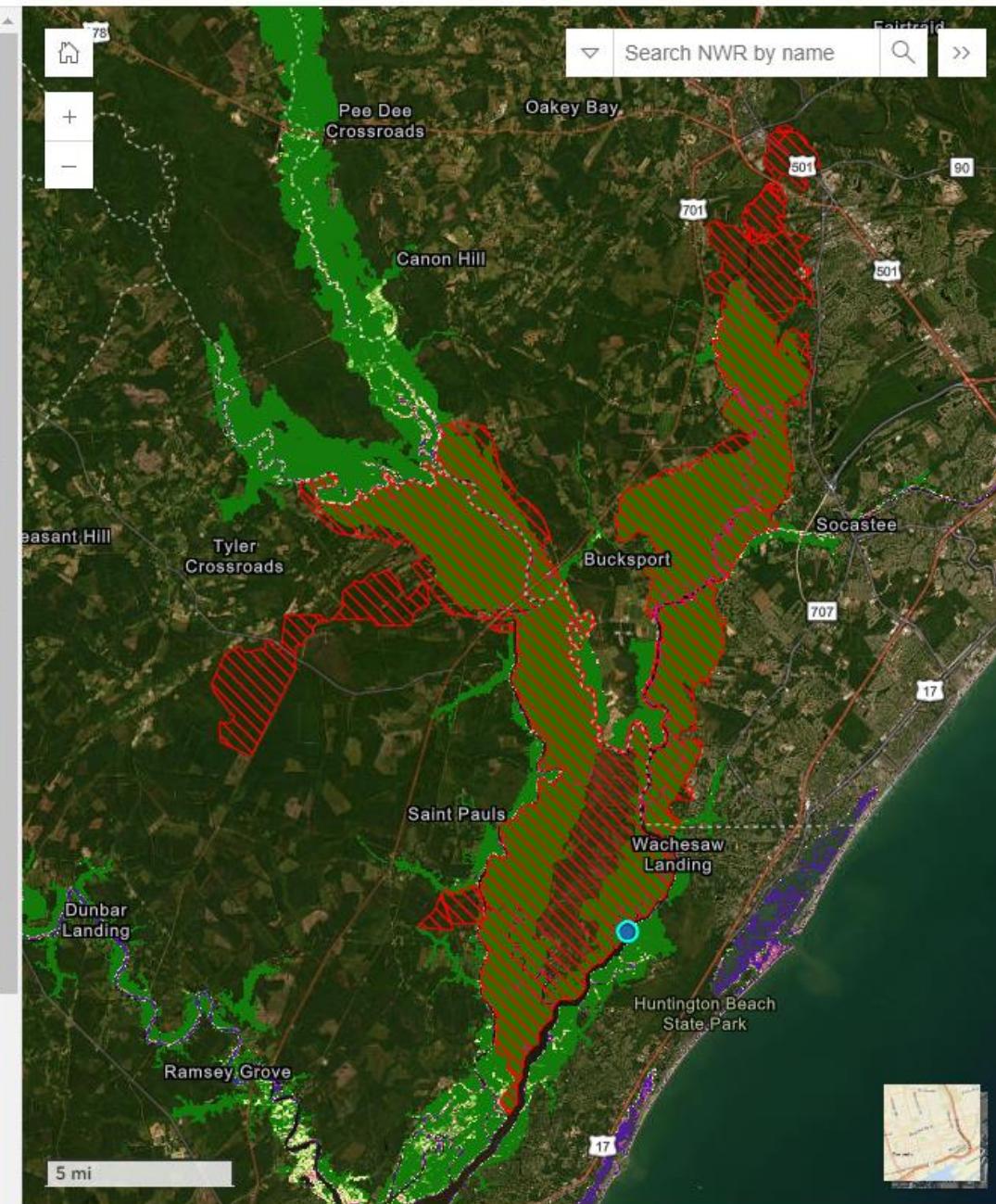


SE NWR UVVR Status

- stable, low uncertainty
- stable, high uncertainty
- unstable, high uncertainty
- unstable, low uncertainty

CONUS UVVR

- > 2
- 1 - 2
- 0.5 - 1
- 0.25 - 0.5
- 0.15 - 0.25
- 0.1 - 0.15



Monitoring status of coastal wetlands in National Wildlife Refuges

- SET data
- SE NWR interest
- SE NWR approved
- Vegetated cover change (2014 to 2018) ✖
- SE NWR UVVR Status
- CONUS UVVR

Search NWR by name»

Fieldtrips



WACCAMAW NATIONAL WILDLIFE REFUGE X

+ Zoom to Foldout

i South Carolina Lowcountry Refuge Complex Search NWR by name >>

v WACCAMAW NATIONAL WILDLIFE REFUGE

d Area (sqkm) 234.238

d Area (acres) 57,881.5

e Coastal wetland status for 2014 and 2018:

2014

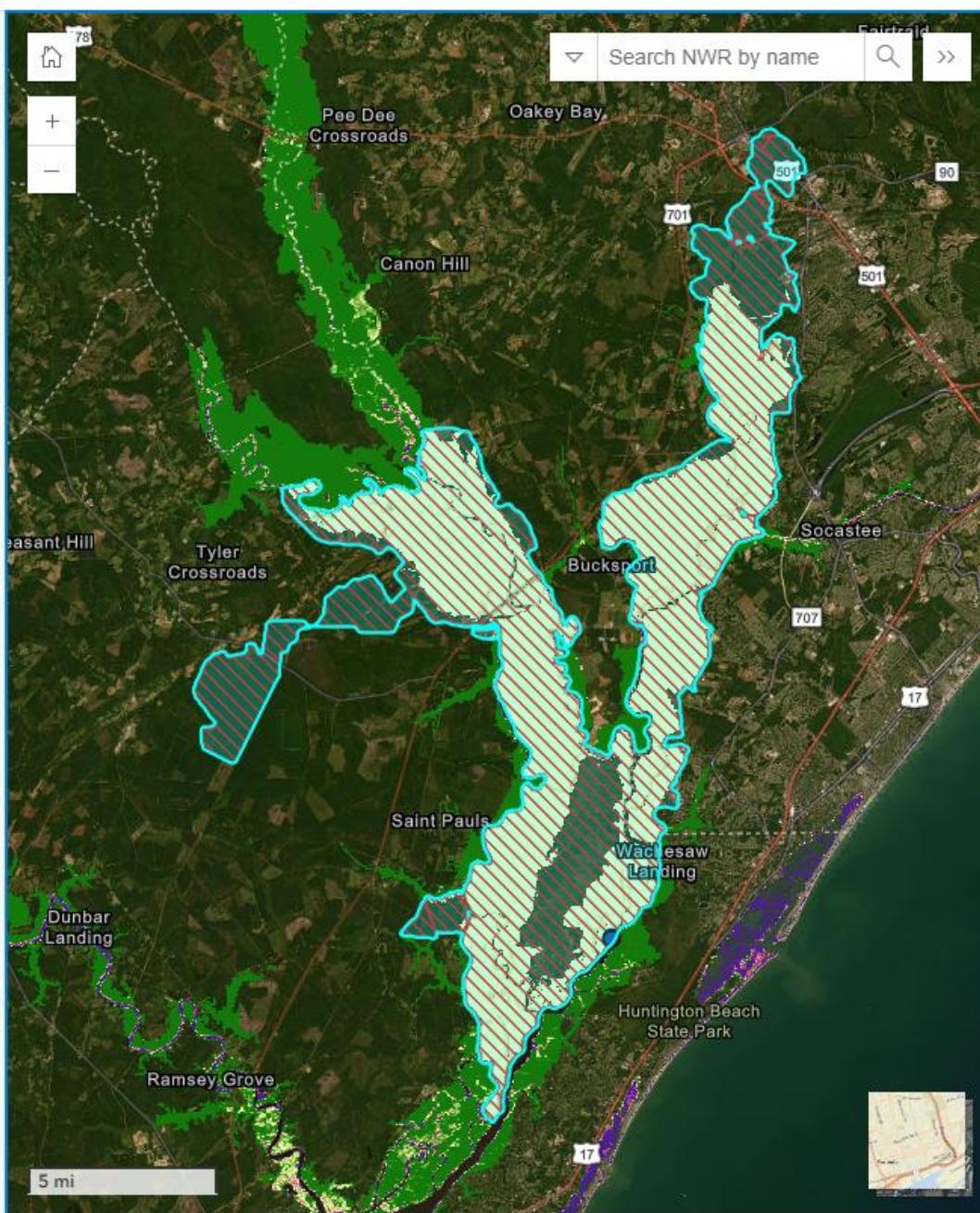
Total coastal wetland area detected = 162.331 sqkm.
Total vegetated area = 159.146 sqkm.
Vegetated fraction = 0.98
UVVR = 0.020013

2018

Total coastal wetland area detected = 161.838 sqkm.
Total vegetated area = 158.413 sqkm.
Vegetated fraction = 0.98
UVVR = 0.021618

➡

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Monitoring status of coastal wetlands in National Wildlife Refuges

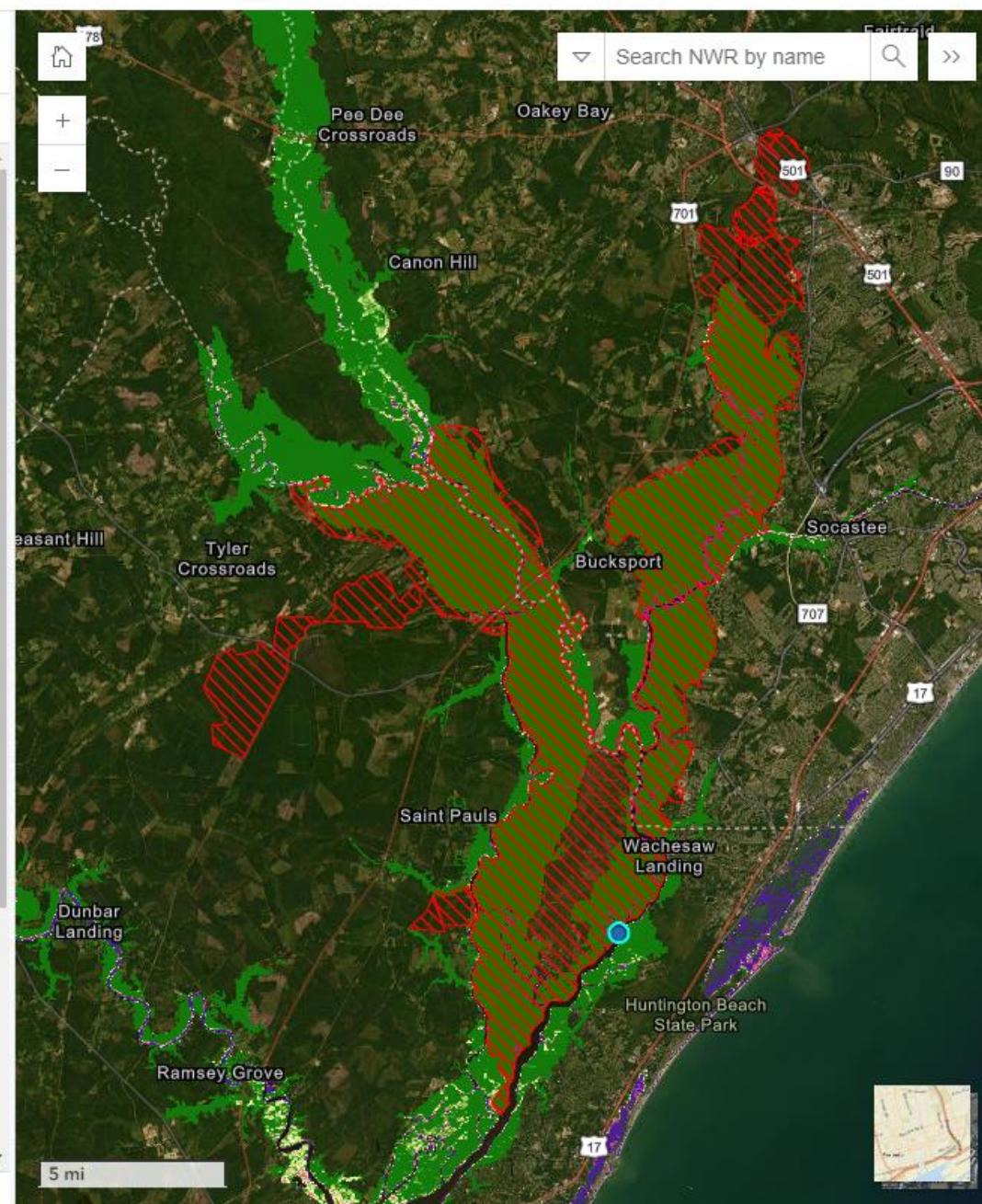


WAW000C

➡

ObjectID	59
Site	WAW000C
Latitude	33.532178
Longitude	-79.107818
Start date	2012.000000
End date	2023.000000
Organization	USFWS
Contact	michelle_moorman@fws.gov
Comments	CWEM Network WAW000C
Accretion (mm/yr)	24.492060
Elevation rate (mm/yr)	6.745549
MSL rate (mm/yr)	3.150000
MSL agency	NOAA
MSL site ID	8661070.000000
Net vertical elevation (mm/yr)	3.595549
Subsidence estimate (mm/yr)	17.746510
Land surface elevation (mm)	845.000000
Year landsurface elevation measurement	2013.000000
Inundation frequency	
NWI classification	PEM1Rd
Salinity	0.030556
Hydrologic zone	Freshwater

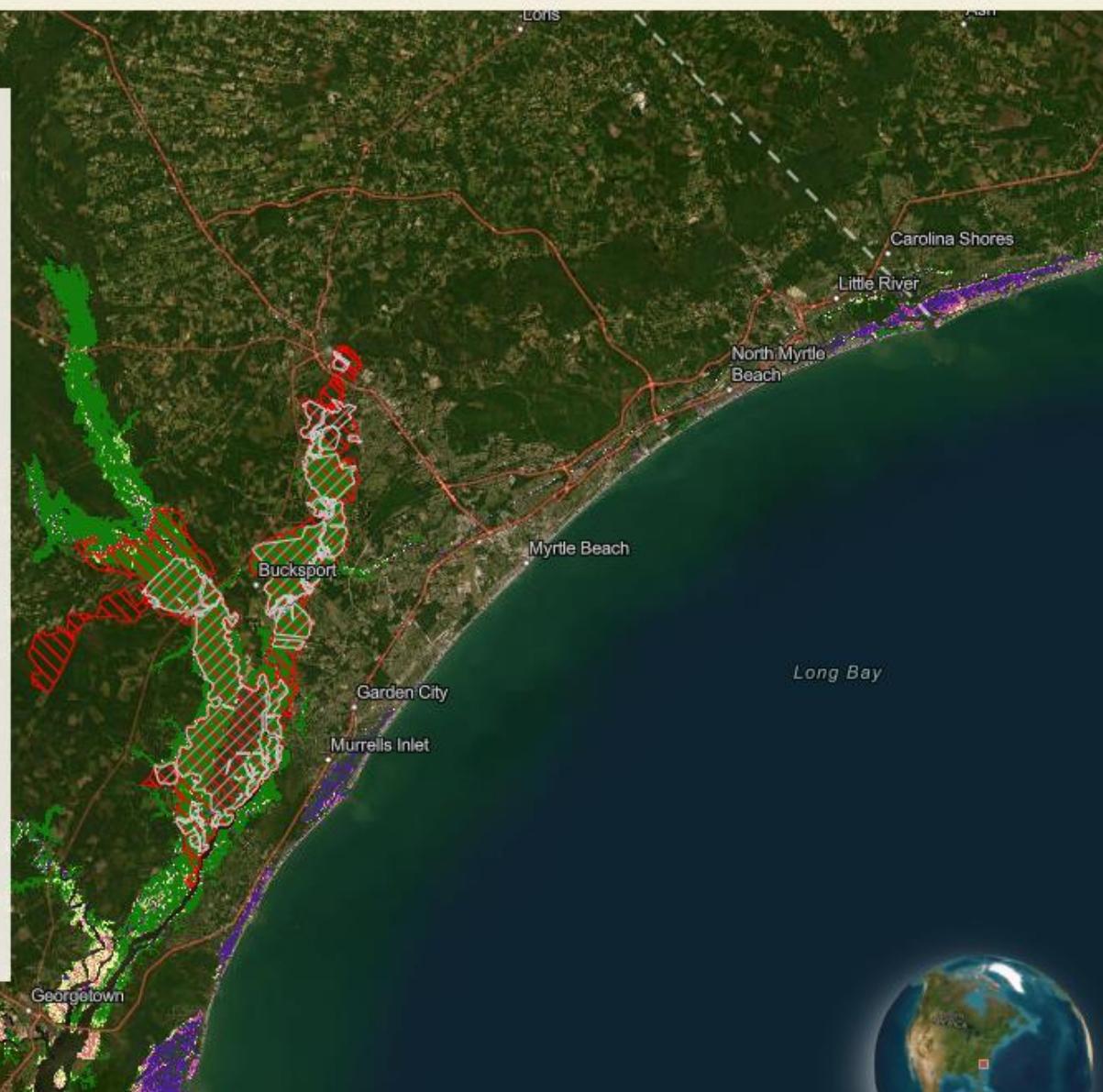
» < > 1 of 6



[Coastal Wetland Transformation](#)[Waccamaw's Coastal Wetlands](#)[Informing Conservation](#)[Future Management Directions](#)[The Science Behind the Data](#)

During workshops, participants explored and discussed various data within Waccamaw's management boundary (i.e. interest polygon in grey) and acquisition boundary (i.e. approved polygon hatched in red).

The first UVVR data layer we are looking at is the **UVVR value**. When looking at all lands Waccamaw NWR currently manages (hatched in grey), it is easy to see that the majority of their coastal wetlands have a UVVR of less than 0.1 suggesting they are stable and intact (i.e. pixel value is a shade of green).

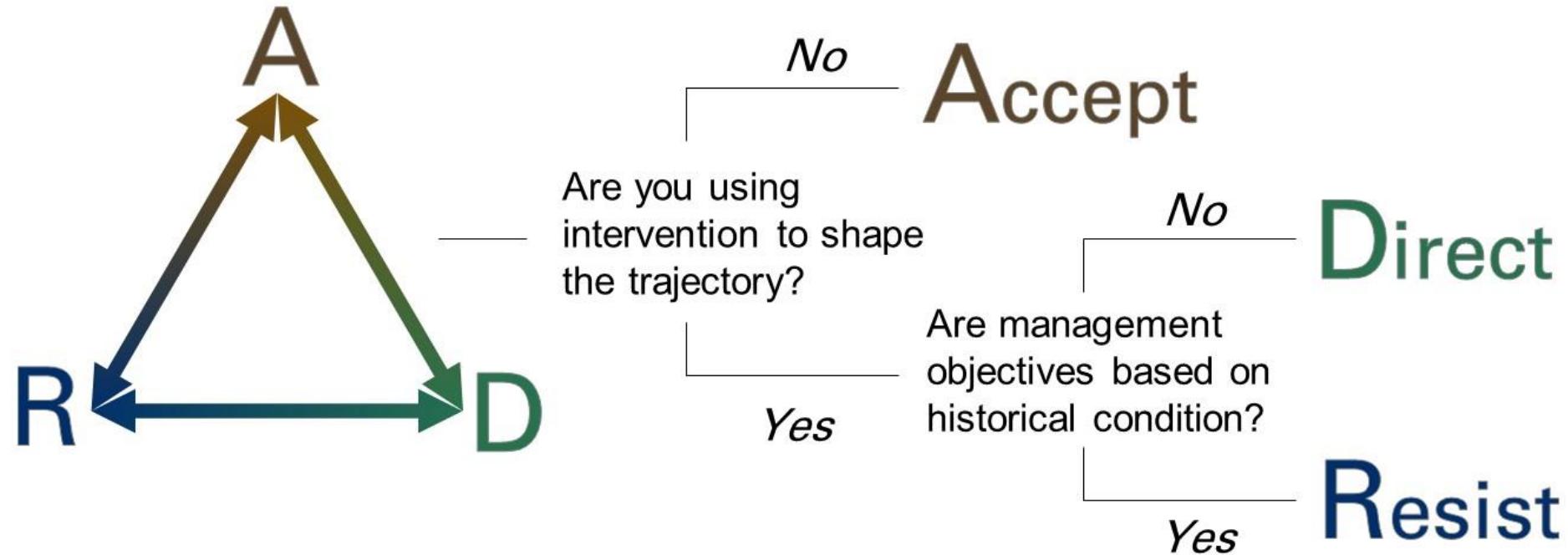


Decision Making

- Refuge managers are using the information from the SET and UVVR data to assess wetland vulnerability, make RAD decisions, and evaluate restoration success
- Feedback from managers: We now have the science we need to support what we are seeing on the ground

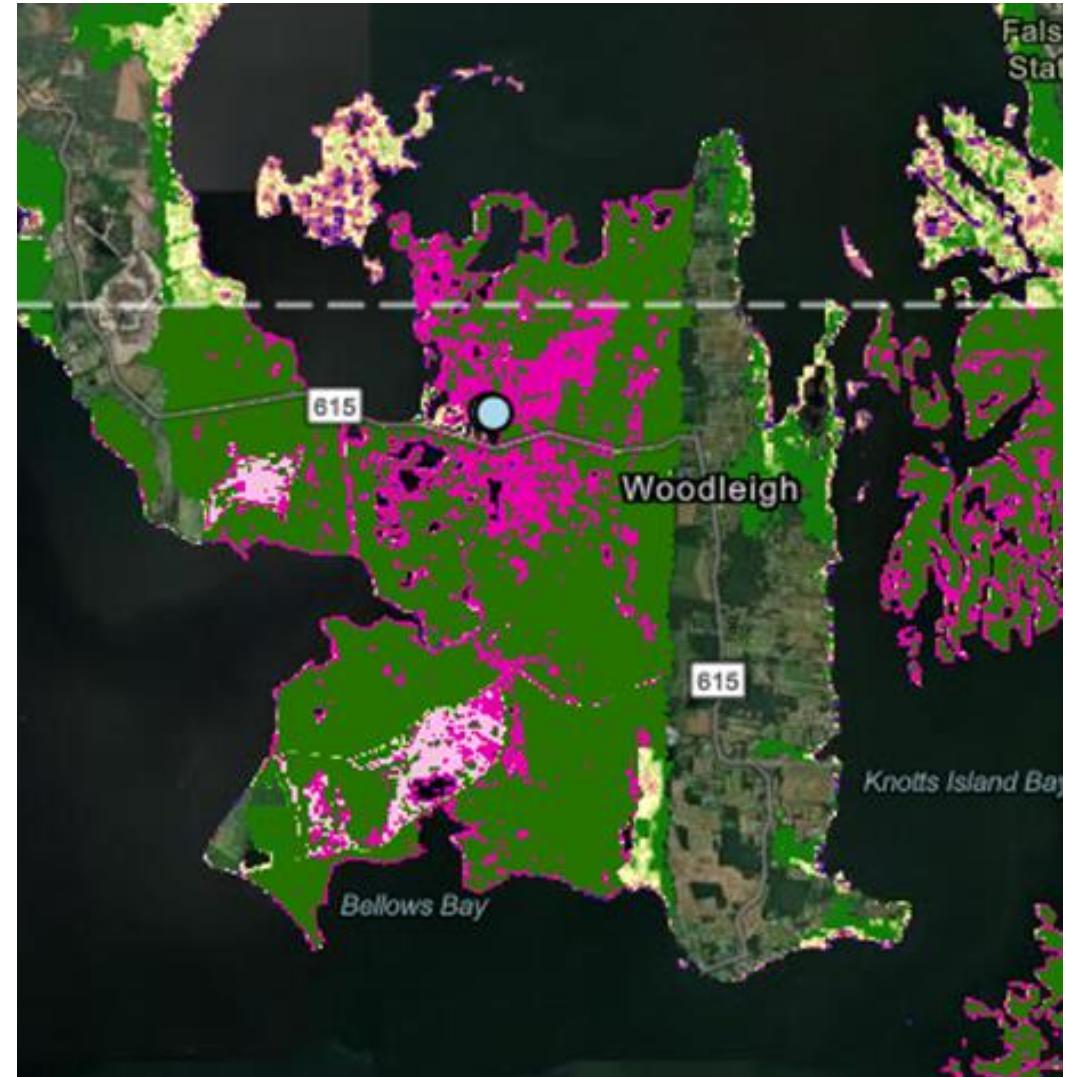


Understanding the RAD Framework

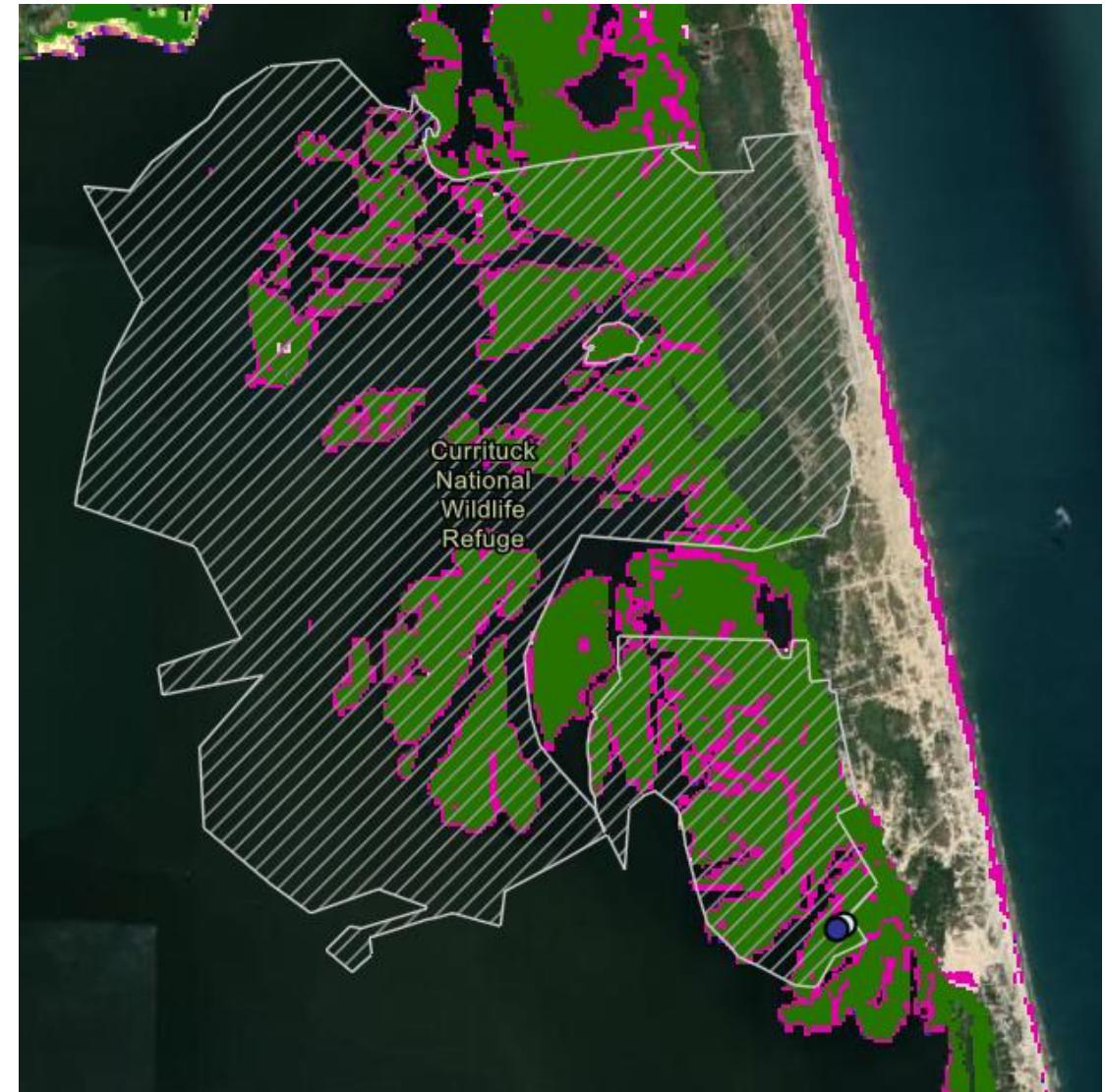


Resist marsh loss

Identify vulnerable marshes that should be prioritized for restoration activities because they protect critical habitat or infrastructure

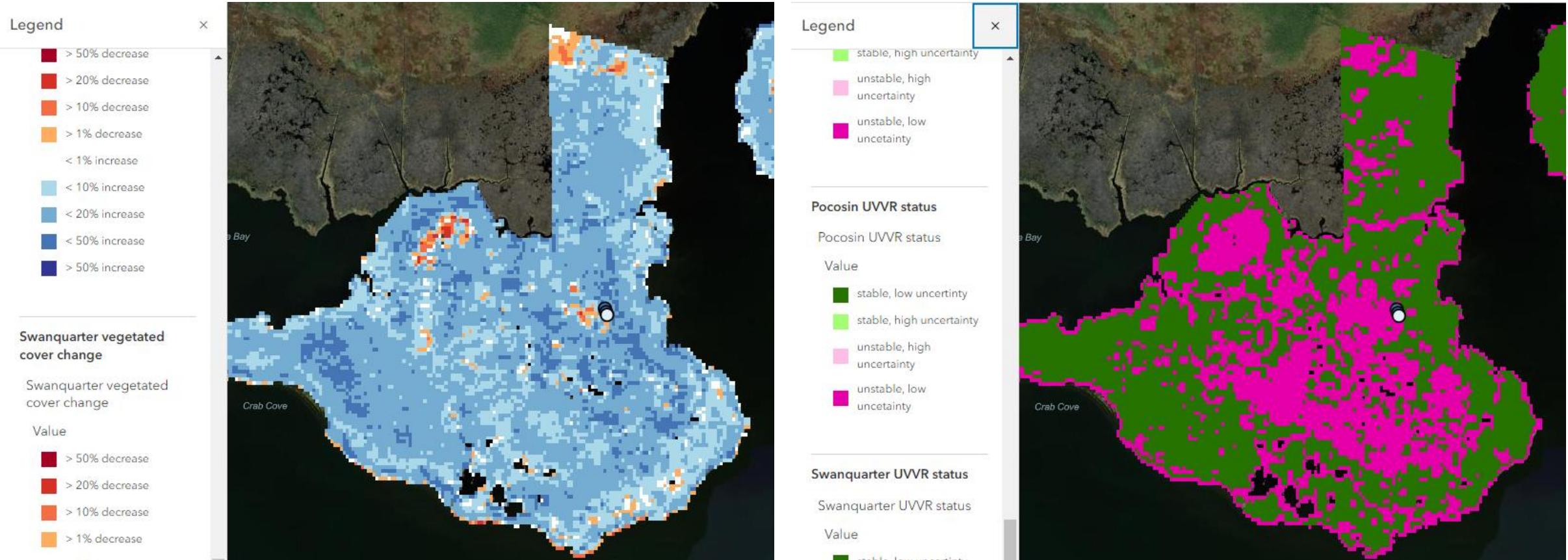


Continue to monitor stable marshes



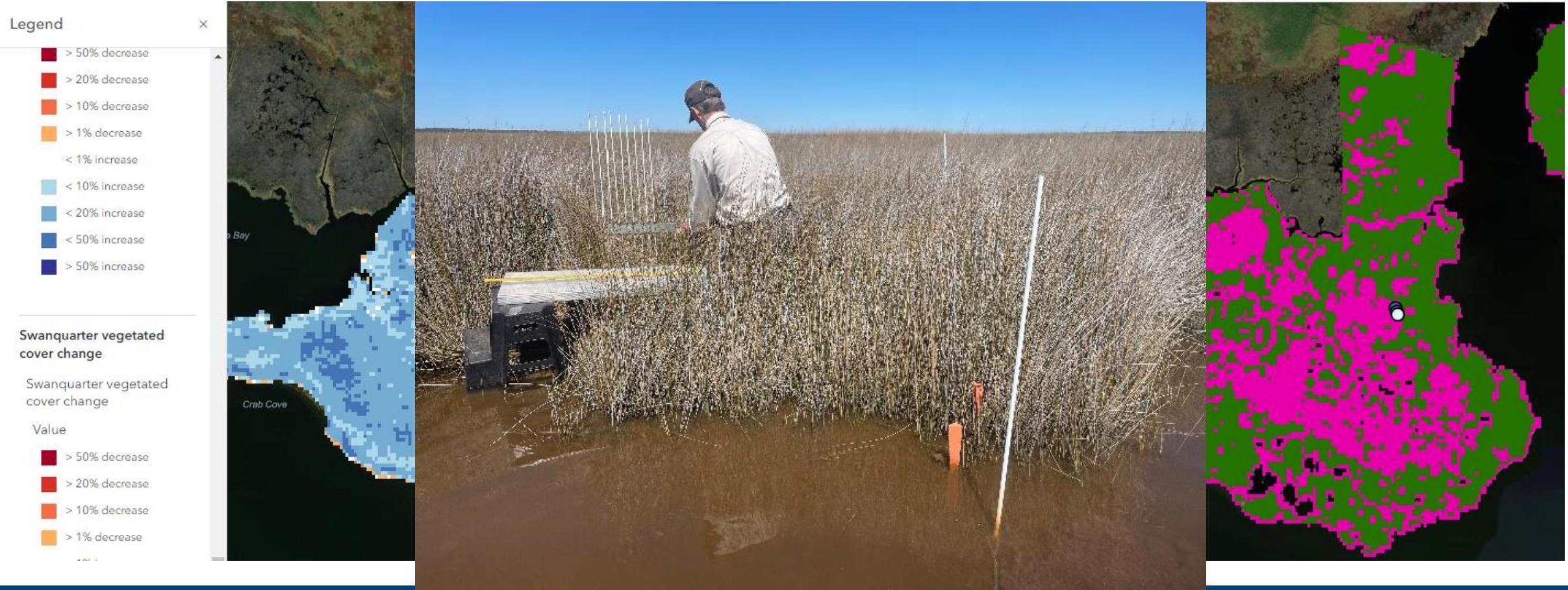
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Accept potential marsh loss designated Wilderness Areas



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Accept potential marsh loss in designated Wilderness Areas

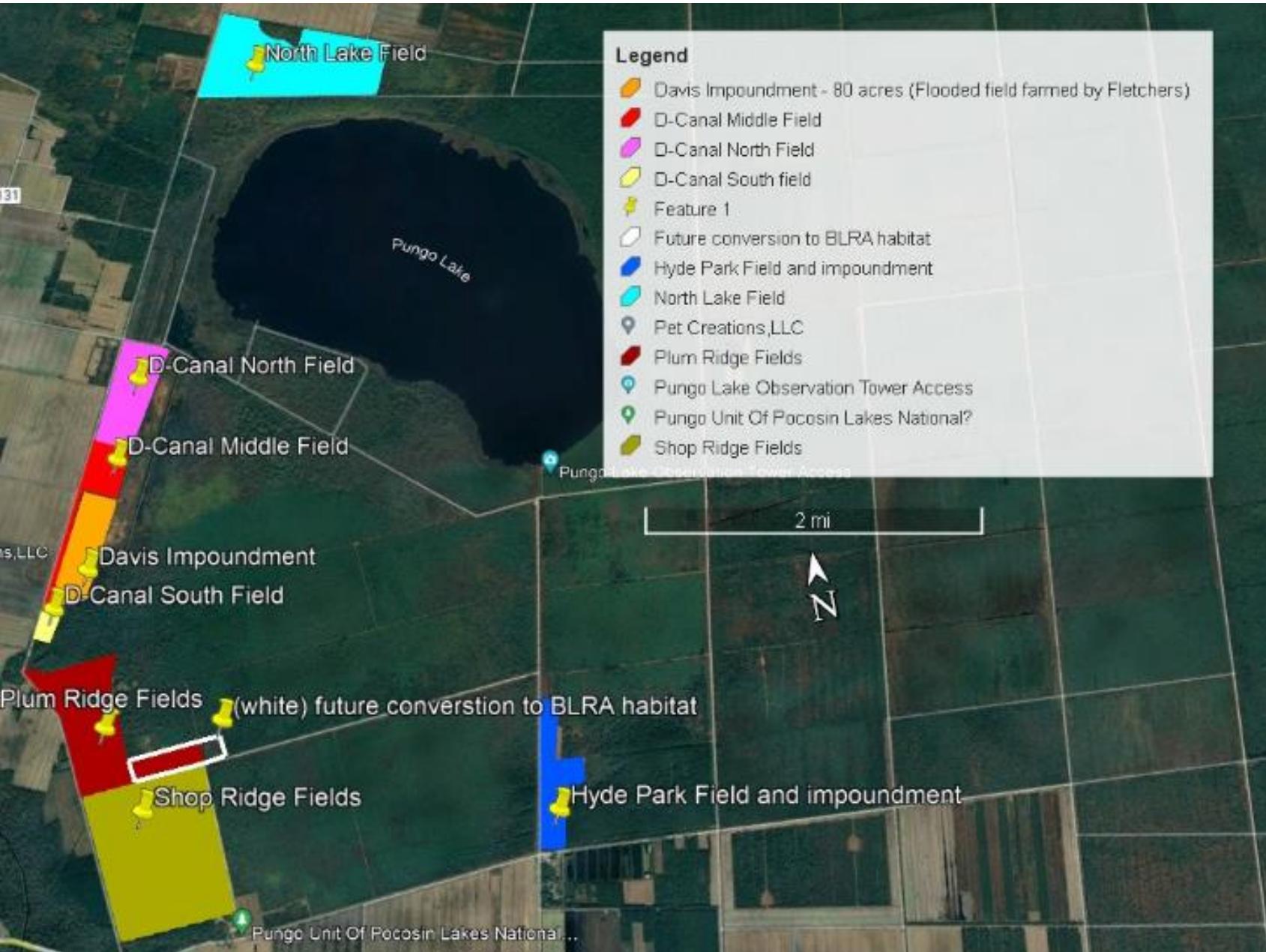


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**Accept coastal wetland
transgression and
acquire migration
spaces**



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Direct black rail management inland along the east coast

Convert inland impoundments into freshwater marshes for black rail to provide inland habitat as high marsh habitat is lost



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Conclusions

- SET data suggests 85% of coastal wetlands are not keeping pace with sea-level rise
- SET-UVVR data are well correlated
- The SET-UVVR mapper provides site-specific evidence on coastal wetland vulnerability and can inform planning and decision making
- Moving forward, we hope to include additional UVVR timesteps into the mapper

Acknowledgements

SET-UVVR mapper: Zafer Defne, Neil Ganju, Brian Klingbiel, EmmaLi Tsai, Jeremy Conrad, Ansley Williamson, Refuge staff from Waccamaw NWR, Southeast Louisiana NWR Complex, and Coastal NC NWR Complex

Analysis: Zach Ladin, EmmaLi Tsai, Adam Smith, USFWS

Previous CWEM coordinators: Nicole Rankin and Mike Chouinard

Literature reviews and mapping: Dorothy Wells and Jacob Weiss, USFWS

Pin readers: Amanda Bessler, M. Forbes Boyle, Pete Campbell, Brian Van Druten, Kristina Fair, Wayne Harris, Rebecca Harrison, Chuck Hayes, Mike Hoff, Matt Howle, Zoe Hughes, Mike Keys, Rosetta Railey, Nicole Rankin, Jean Richter, Craig Sasser, Wendy Stanton, Jerry Tupacz, and Larry Woodward

SET database managers: Brent Frakes, Alan Gilbert

USFWS staff from other regions: Erin King, Alan Gilbert, Rachel Katz, Laura Mitchell, Scott Covington, Jena Moon, Lee O'Brien

USGS: Neil Ganju, Zafer Defne, Caroline Schwab, Justine Neville, Ken Krauss, Don Cdhoon, Glenn Guntenspergen, and Nicole Cormier

NPS: Lisa Baron, Forbes Boyle, Ellen Cheng, Jacob McDonald, Jim Lynch

Allie Mulligan, Cassie Cook, and Jacob McDonald

NOAA for their SLR data, coordination and support

NC SET Community of practice

USFWS RAD implementation guidance team



Contact:

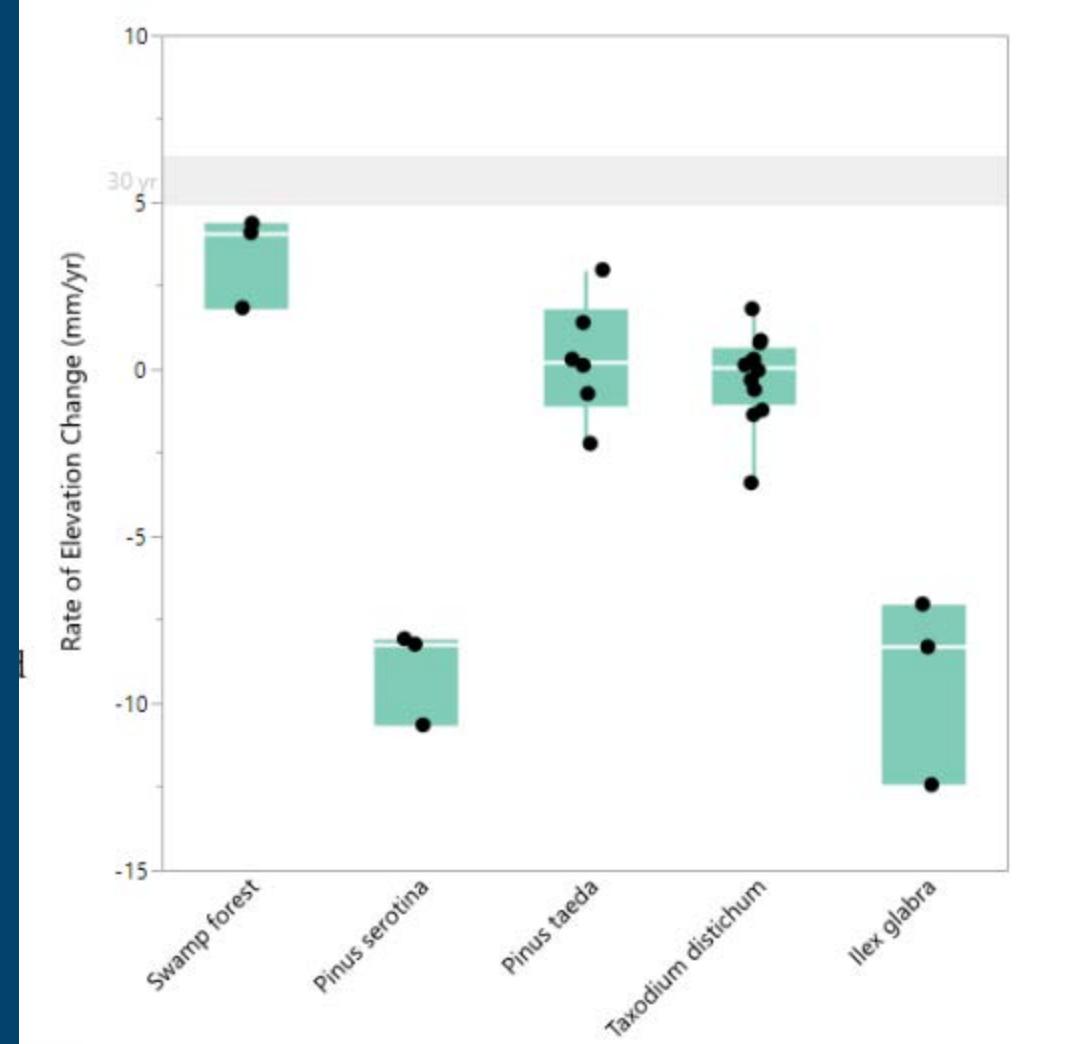
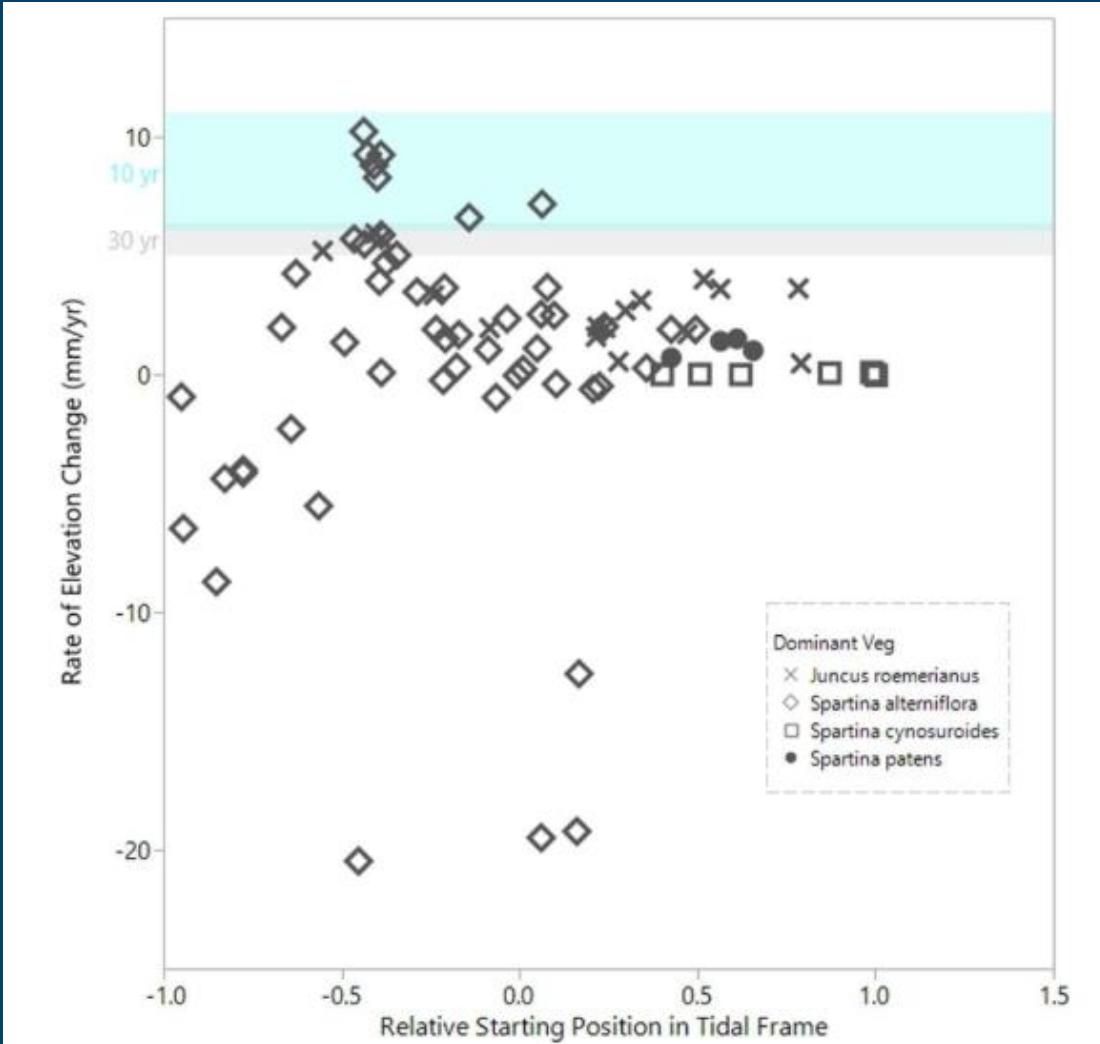
Michelle Moorman

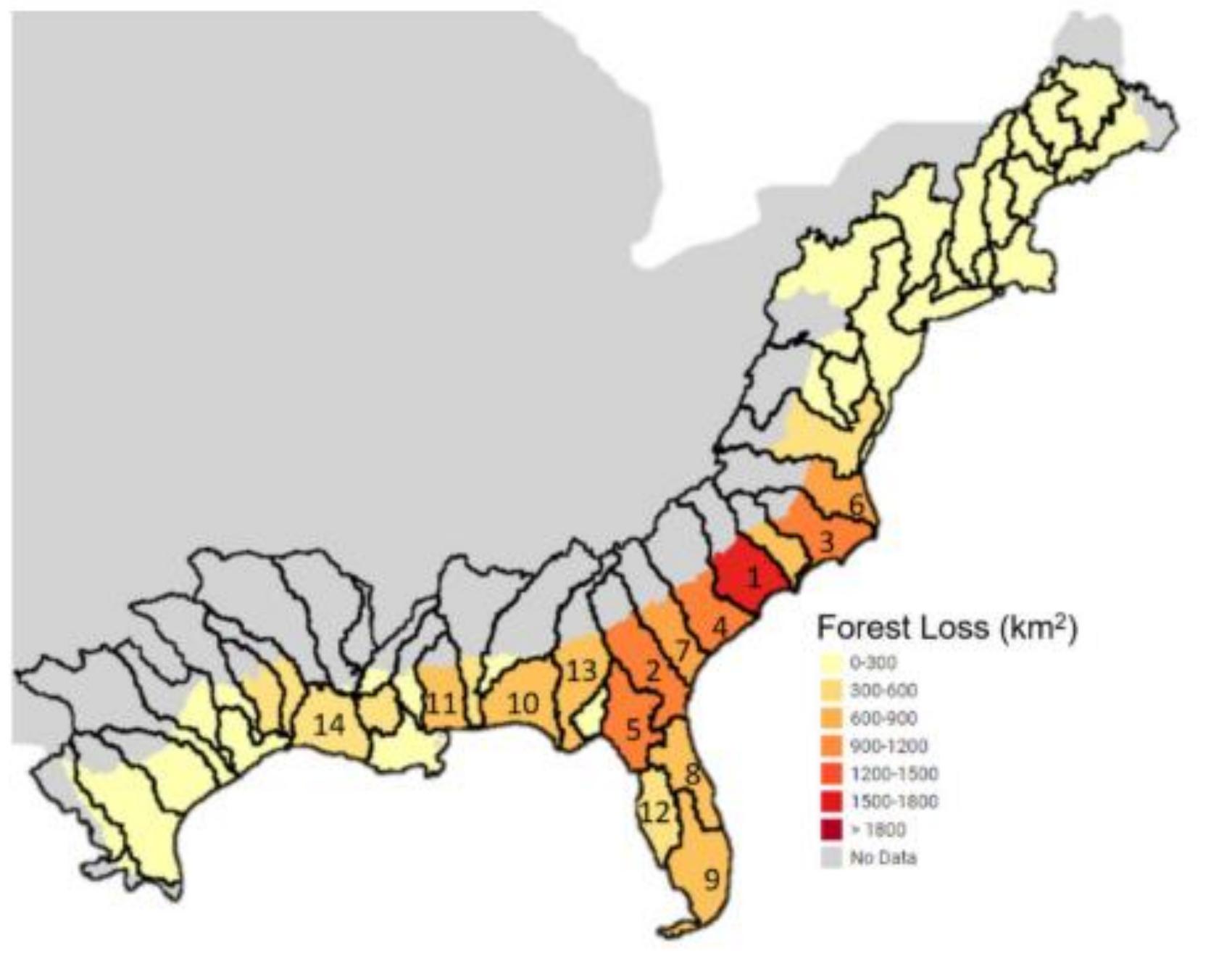
Michelle_moorman@fws.gov

Additional Resources

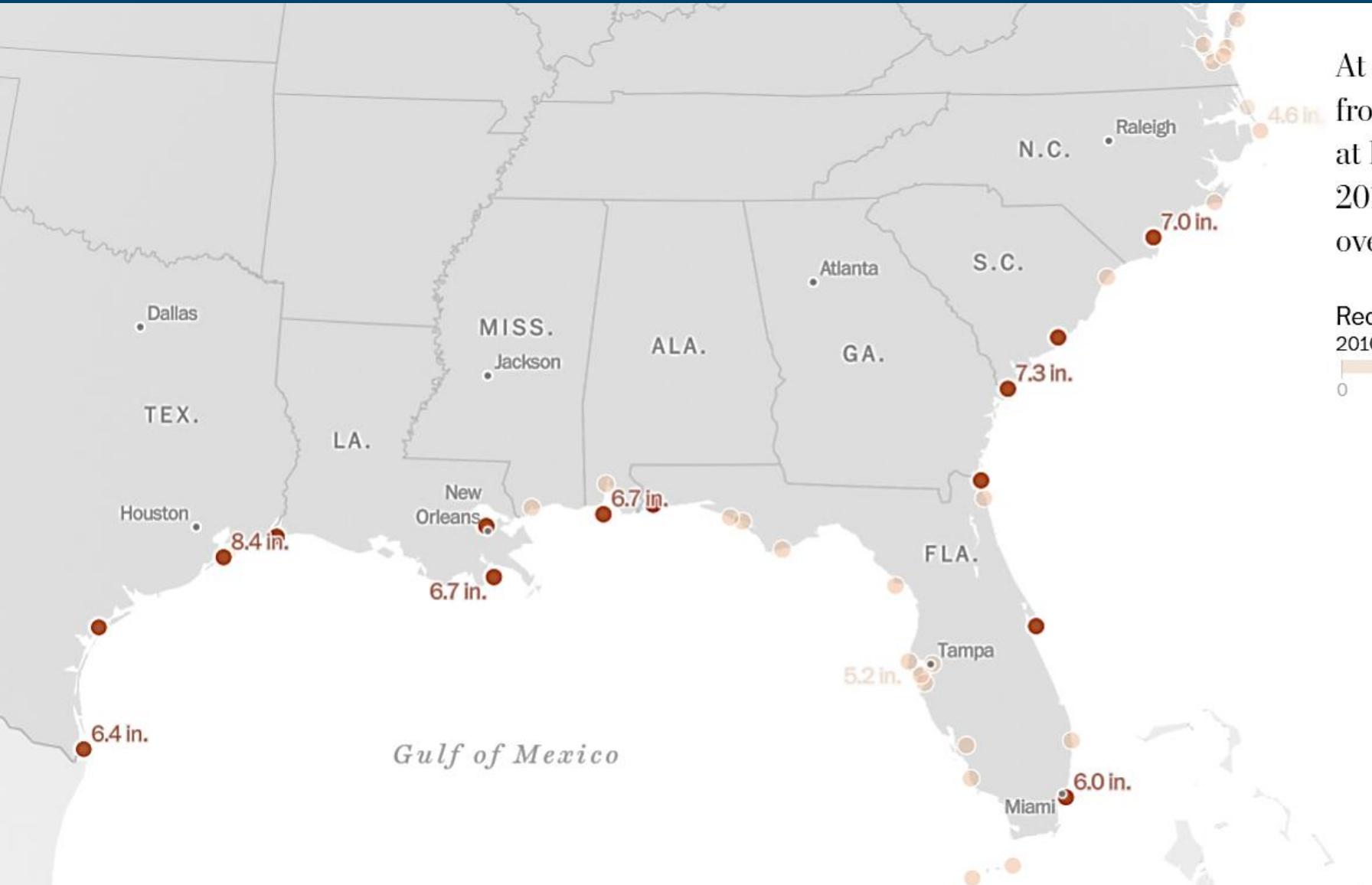
- [CWEM SET analysis paper](#)
- [SET-UVVR paper](#)
- [NC SET article](#)
- [NC SET COP white paper](#)
- [Geonarrative with link to southeast coastal Refuges application](#)
- [Southeast region NWR instant app](#)
- [Waccamaw NWR storymap](#)

NC wetlands are not keeping pace with SLR

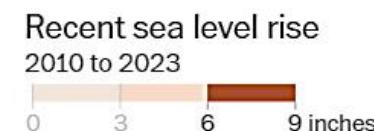


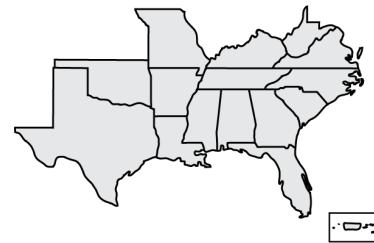


White et. al found that almost 5 million acres of tidal forest has been deforested between 1996–2016



At more than a dozen tide gauges spanning from Texas to North Carolina, sea levels are at least 6 inches higher than they were in 2010 – a change similar to what occurred over the previous five decades.





Next Third Thursday
Web Forum

6-20-2024

10:00 am ET

Lauren Berry

University of
Arkansas Department
of Biological Sciences,

Caleb Roberts

Arkansas Cooperative
Fish & Wildlife
Research Unit

secassoutheast.org

Finding the core: Tools for identifying intact grasslands and tracking restoration outcomes





Staff updates

- Sneak peek of new SECAS logo!

Sneak peek of new SECAS logo!



**Southeast
Conservation
Adaptation Strategy**

How to get involved in SECAS

- Sign up for the SECAS newsletter

secassoutheast.org

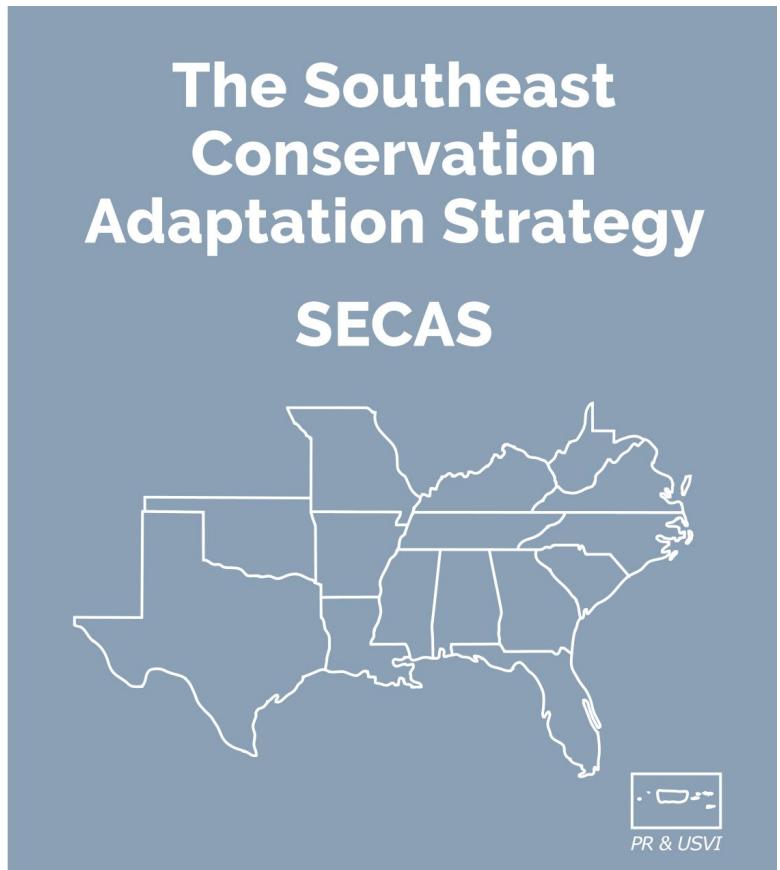
- Connect with SECAS staff or partners

secassoutheast.org/staff

secassoutheast.org/partners

- Explore the Southeast Conservation Blueprint

secassoutheast.org/blueprint





Questions?