

*Waccamaw National Wildlife Refuge*

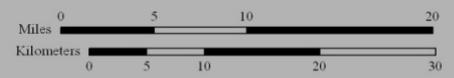
**Established in 1997**

-  Acquisition Boundary
-  Federally Protected Lands
-  EBA Project Area 2011

*Atlantic Ocean*

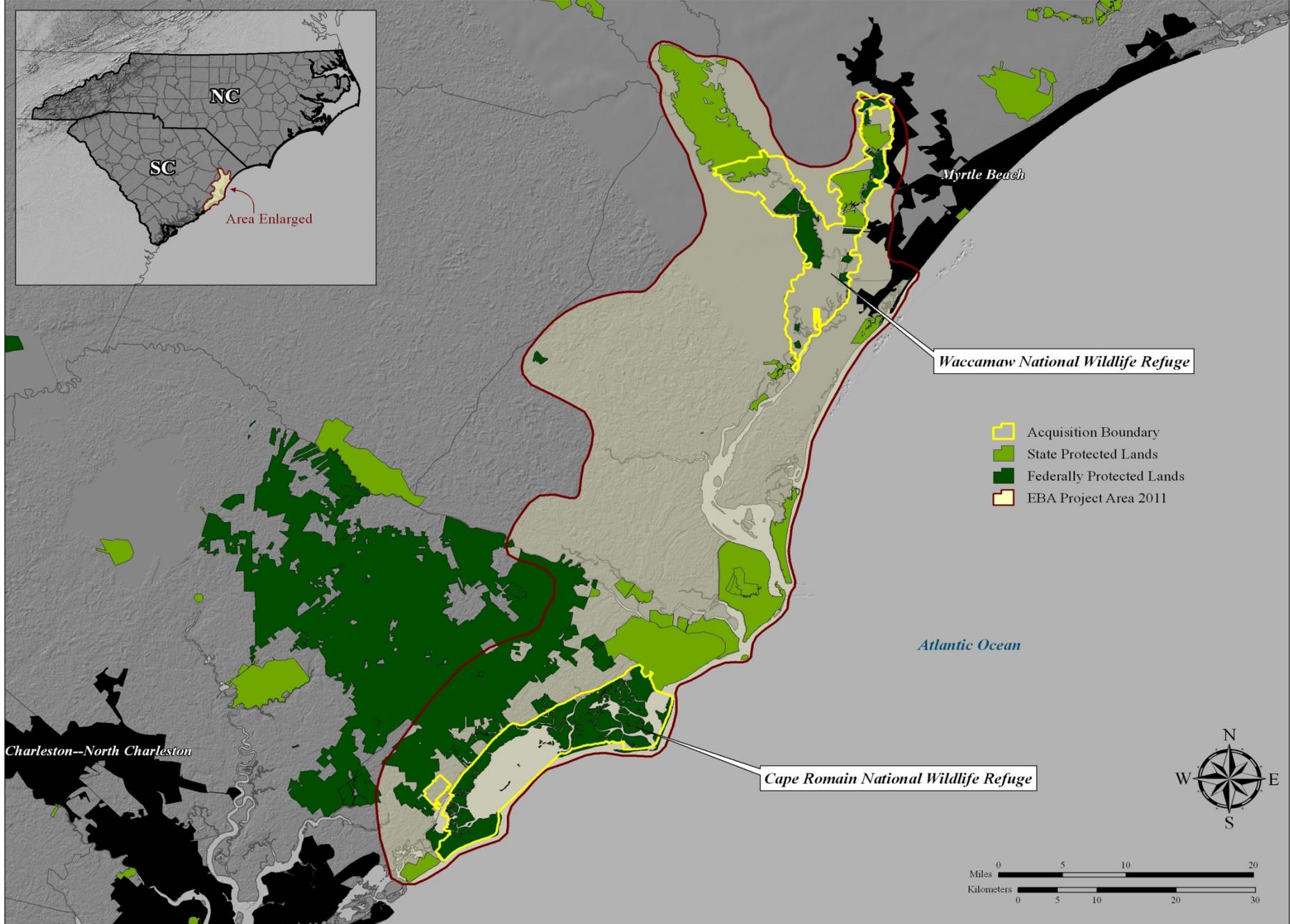
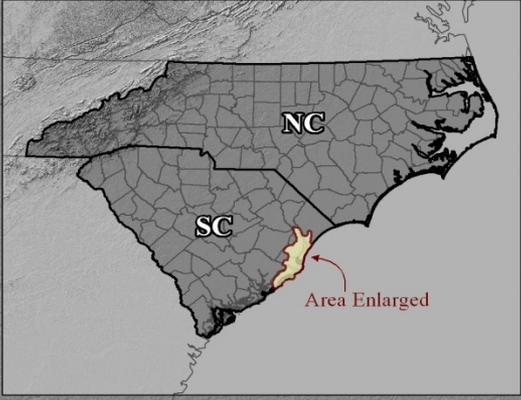
*Cape Romain National Wildlife Refuge*

**Established in 1932**



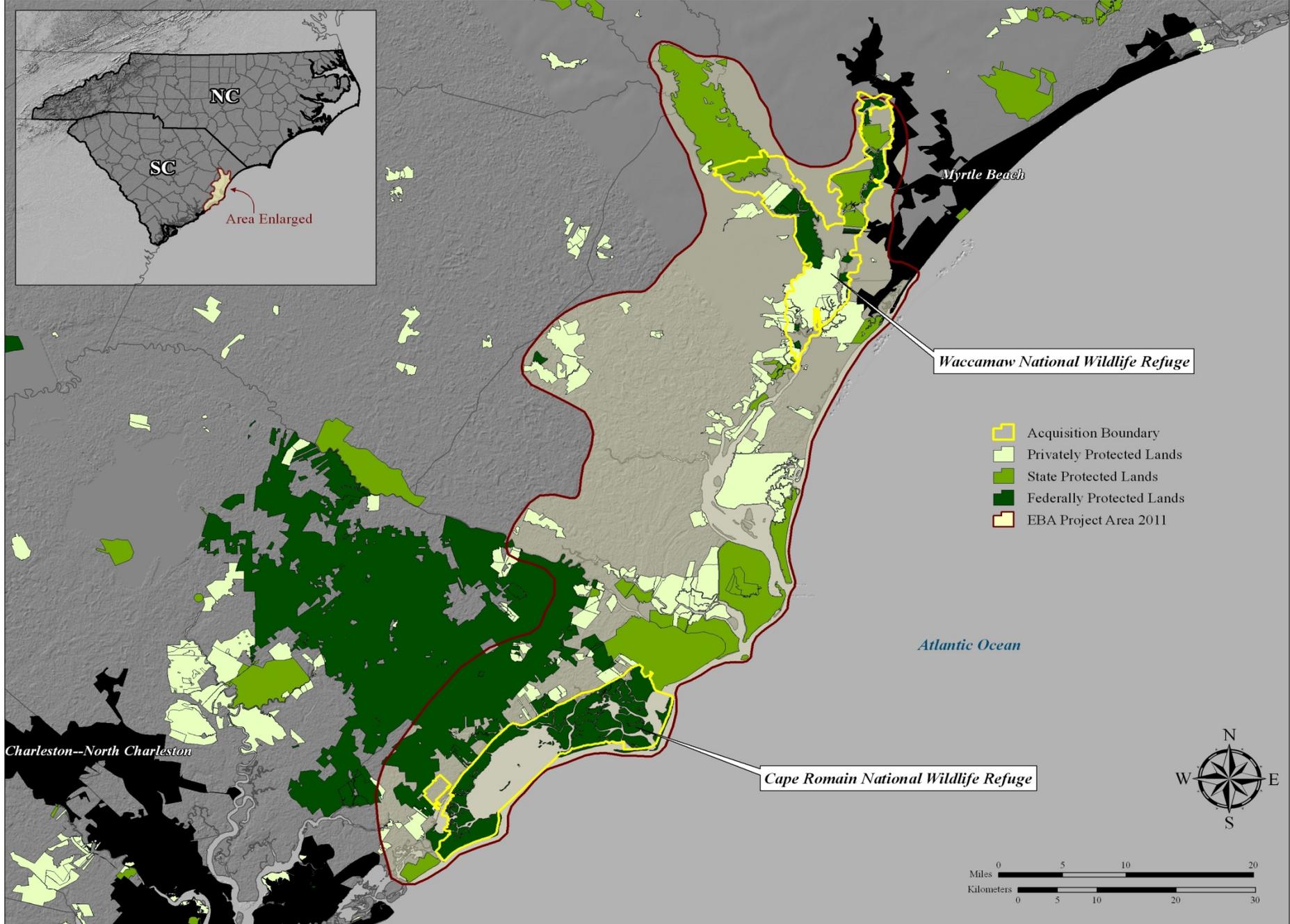
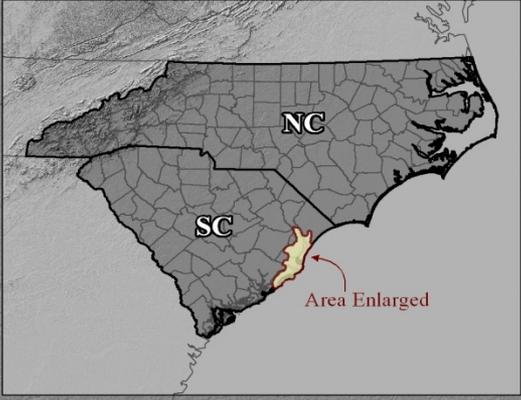
*Charleston-North Charleston*

*Myrtle Beach*



- Acquisition Boundary
- State Protected Lands
- Federally Protected Lands
- EBA Project Area 2011





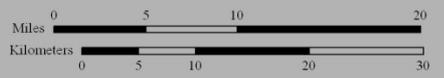
Waccamaw National Wildlife Refuge

Cape Romain National Wildlife Refuge

- Acquisition Boundary
- Privately Protected Lands
- State Protected Lands
- Federally Protected Lands
- EBA Project Area 2011

Atlantic Ocean

Charleston--North Charleston



The Challenge

# SC'S SHIFTING COASTAL COMMUNITIES

# Sea-level rise and SC's coastal habitats

As sea-level rises, land surfaces subside and salt water moves further inland...



## Loss of salt water habitats to open water



# Conversion of freshwater habitats to salt and brackish habitats



# Conversion of upland areas to open water or wetland habitats



# Goals of TNC and USFWS' MOU for Climate Adaptation

1. Connecting climate scientists with Refuge and other resource managers (two-way engagement).
2. Investing in iterative predictive analysis that will provide localized and finer resolution outputs that could guide management decisions.
3. Investing in demonstration areas that help us develop best management practices.





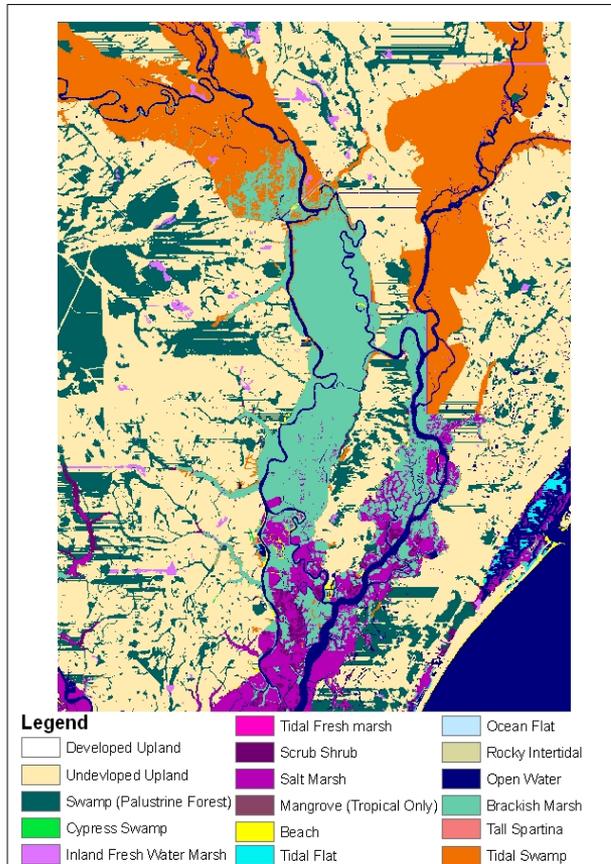
Strategies for Adaptation

# SEA-LEVEL RISE MODELING AND HABITAT CHANGE

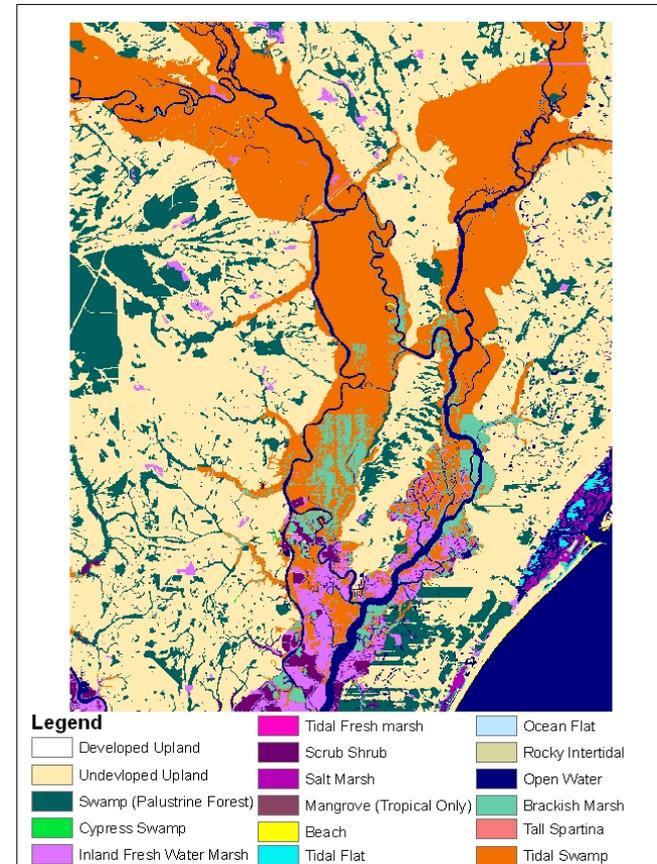
# Data: SLAMM Inputs

<b>Inputs</b>	<b>Regional</b>	<b>Local</b>
<b>Habitat data</b>	NWI – National Classification	NWI: site-specific reclassification
<b>Elevation</b>	National Elevation Dataset (30m)	High resolution lidar
<b>Tide Erosion Accretion</b>	Regional (Southeast)	Local

## Regional



## Local





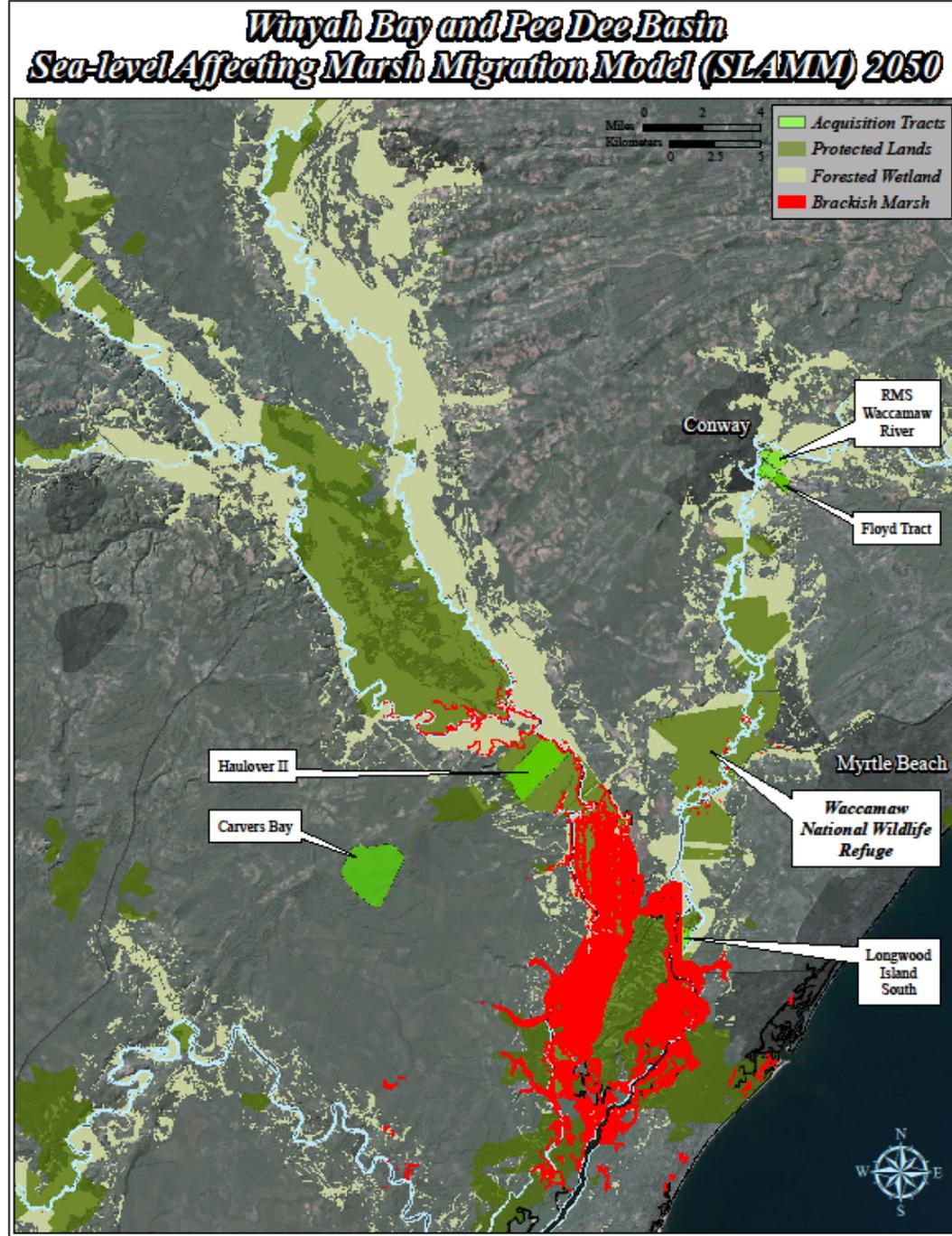
Conversion of freshwater wetlands to brackish marsh

Invest *now* in no-regrets protection of inland freshwater tracts and plan for a major Refuge expansion

Since 2007, SC TNC has generated over \$10 million to protect approx 11,000 acres.



But...what next to increase resolution and work at a smaller scale to provide management guidance to the Refuge?

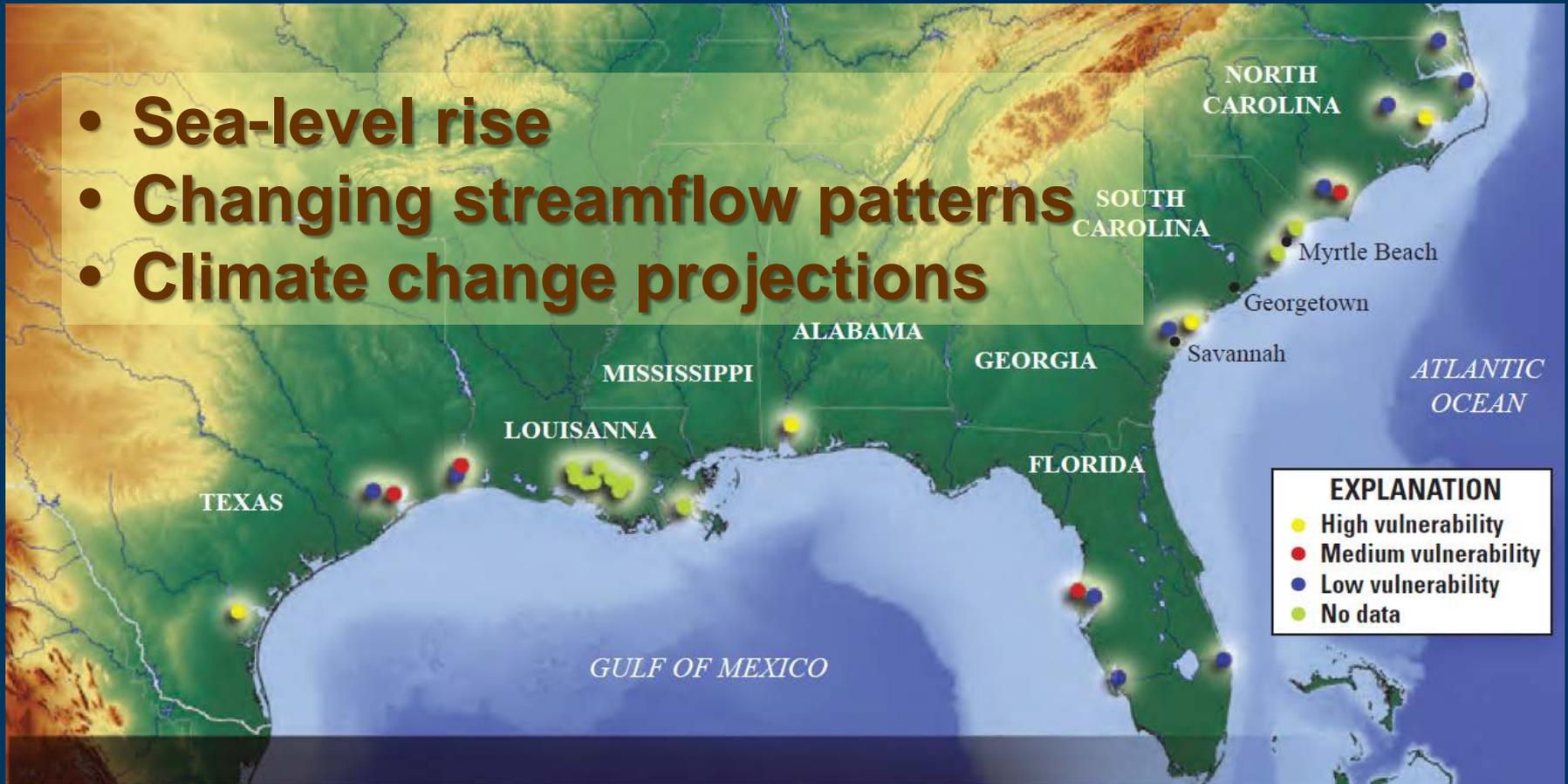




# PEE DEE RIVER AND INTRACOASTAL WATERWAY SALINITY INTRUSION MODEL (PRISM-2)

# Threaten Intakes along SE Coast Due to Climate Change

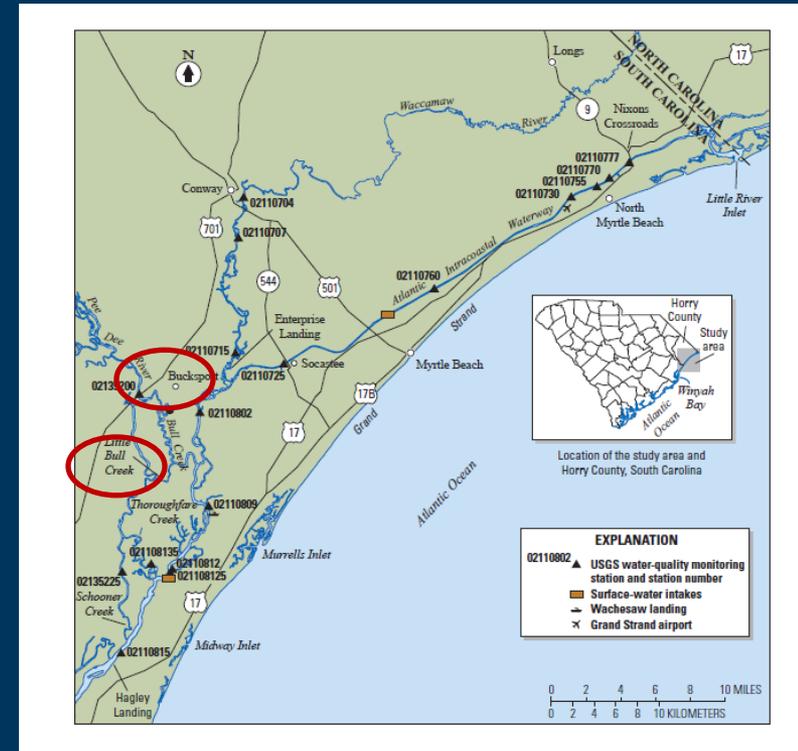
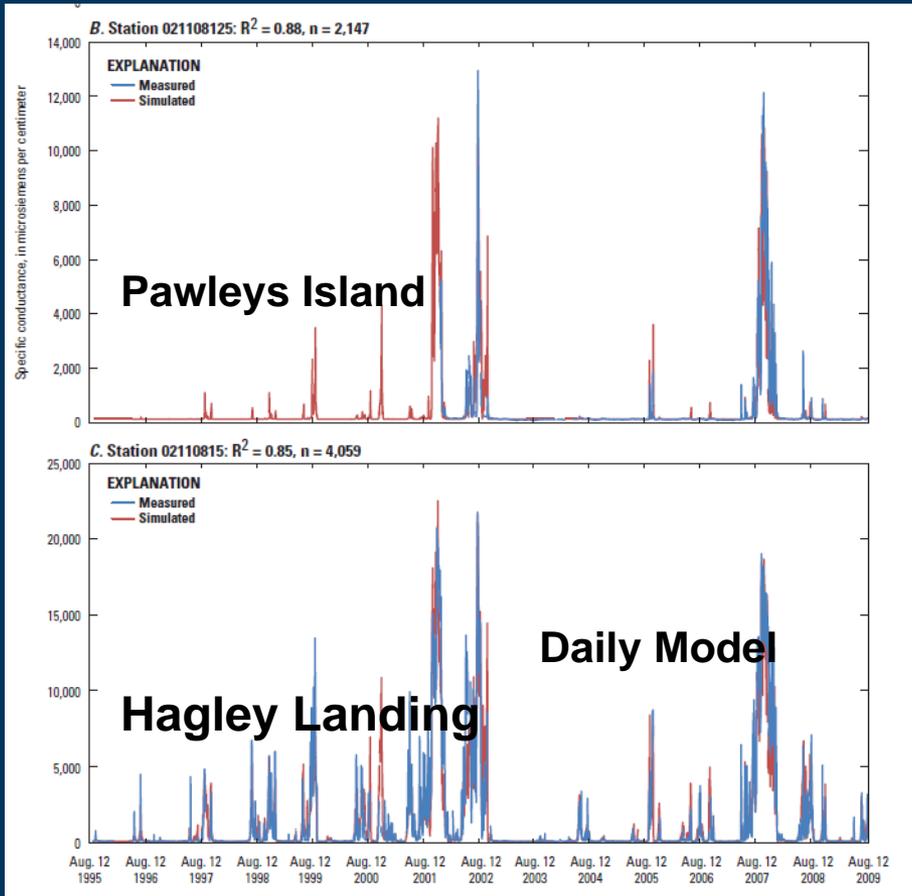
- **Sea-level rise**
- **Changing streamflow patterns**
- **Climate change projections**





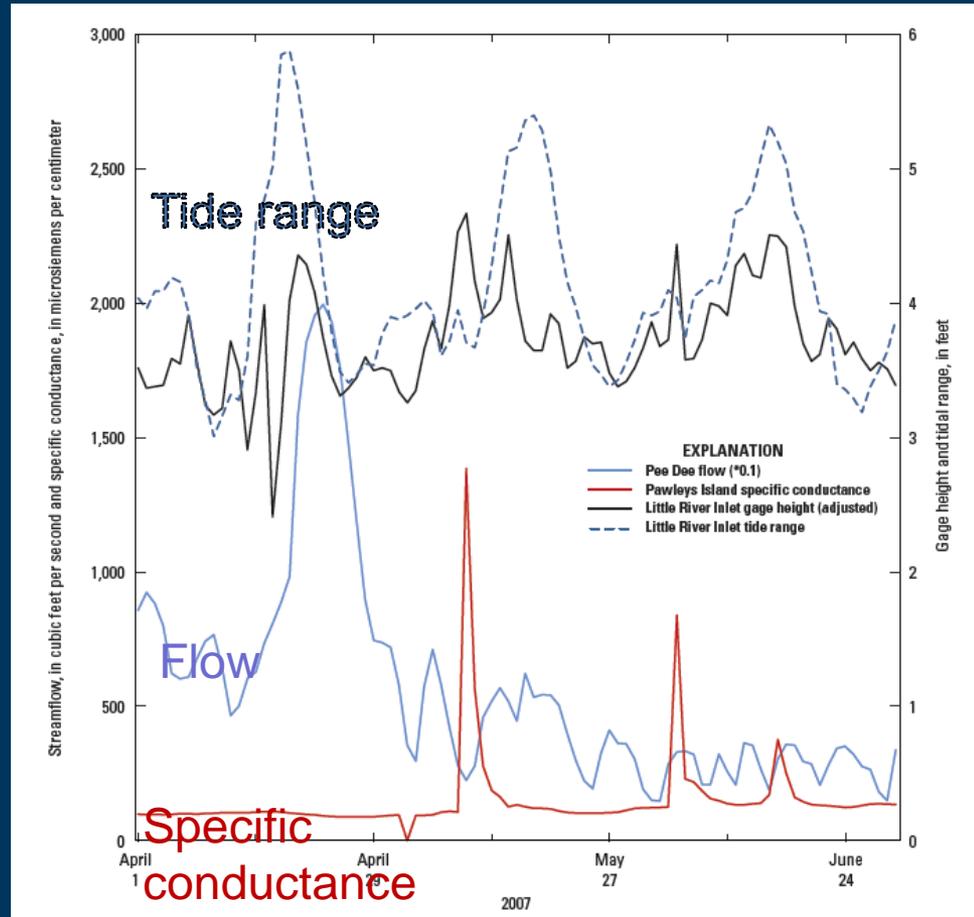
# Model Performance

## Pawleys Island & Hagley Landing



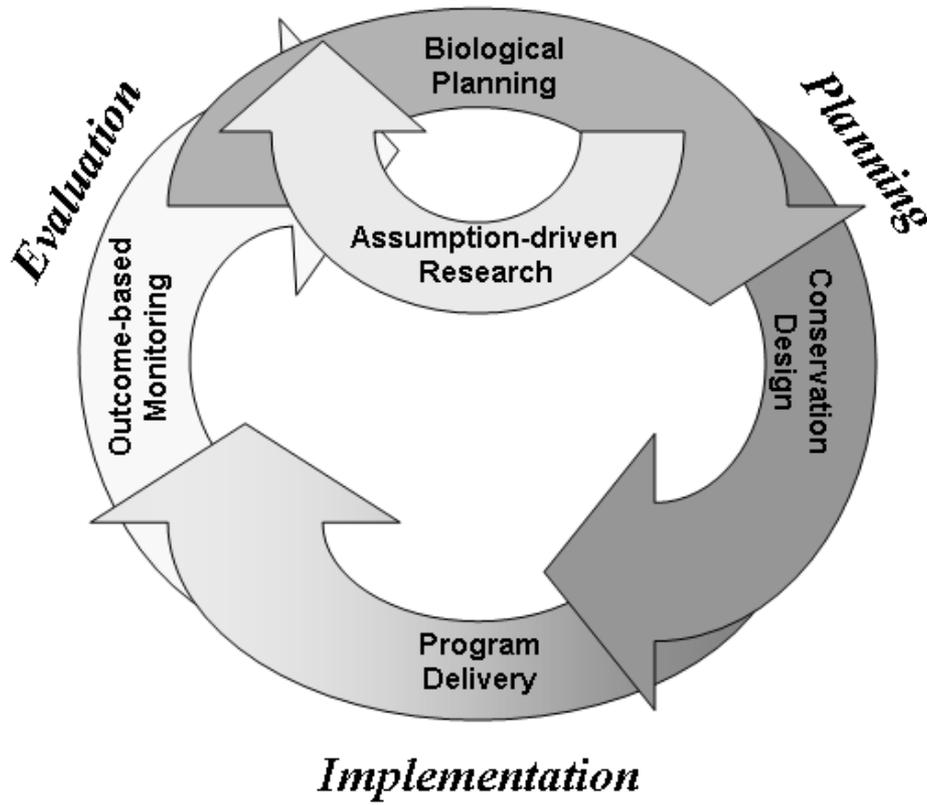
Conrads, P.A., Roehl, E.A., Jr., Daamen, R.C., and Cook, J.B., 2013, Simulation of salinity intrusion along the Georgia and South Carolina Coasts using climate-change scenarios: U.S. Geological Survey Scientific Investigations Report 2013-5036, 92 p. +5 apps.

# Salinity Intrusion Convergence of Conditions



Conrads, P.A., Roehl, E.A., Jr., Daamen, R.C., and Cook, J.B., 2013, Simulation of salinity intrusion along the Georgia and South Carolina Coasts using climate-change scenarios: U.S. Geological Survey Scientific Investigations Report 2013-5036, 92 p. +5 apps.

# Climate Change Research, Action & Monitoring: Essential to have an adaptive approach



A research collaboration between USGS-Univ of SC-TNC-USFWS proposes PRISM-3 a new iteration of the PRISM-2 model which would couple the flow data with GIS models to predict habitat change due to inundation and salinity intrusion.

Ours hopes are that this down-scaled approach with provide finer resolution information to guide conservation action.



Strategies for Climate Adaptation

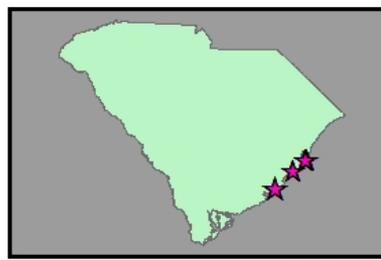
# OYSTER REEF INSTALLATION AND MODELING

## 5 years of installations

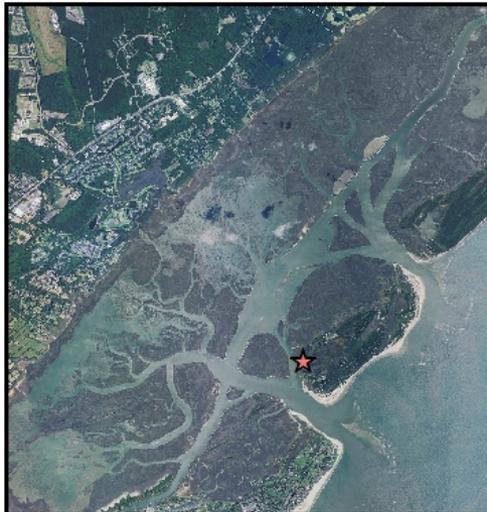
- Habitat
- Marsh stabilization
- Oyster recruitment
- Oyster growth

## Funding

- Federal
- Corporate
- Membership



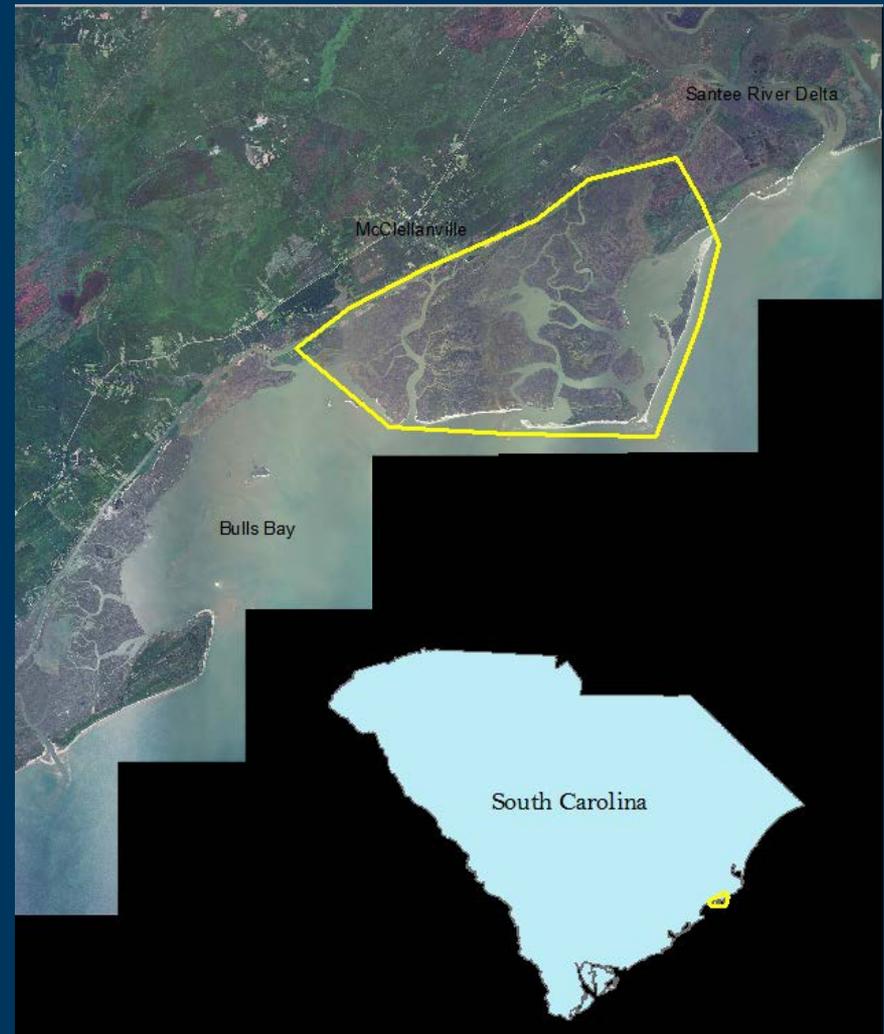
- 2012\_Palmetto Plantation
- ◊ 2011\_Winyah, North Island
- ◊ 2011\_Jeremy Island Expansion
- ◊ 2010\_Winyah, South Island
- ★ 2010\_Deweese Island
- ▲ 2009\_Jeremy Island
- 2009\_Tibwin Creek



Decision support tool  
for siting oyster  
reef installations  
(larger reefs)

Pilot Project  
Northern CRNWR

Data collection  
(1<sup>st</sup> iteration)



# LIDAR image at low-low tide: Intertidal flats visible as blue

## Direct partnership with NOAA CSC



# Salinity - Freshwater Flows Freshwater Pulses from Santee River (Dam) Direct partnership with USGS



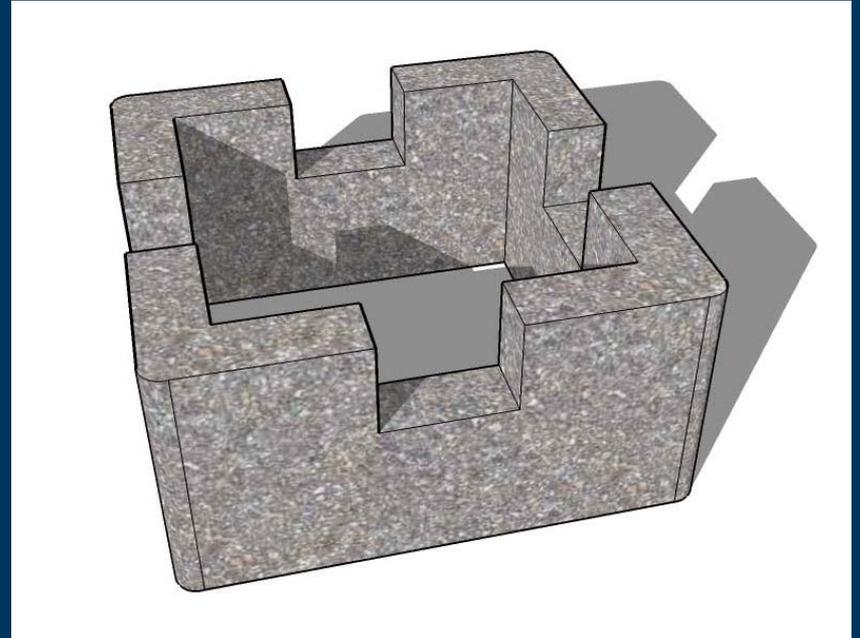
# Sediment Firmness Volunteer Based Data Collection

Direct partnership with DNR MRRI & USFWS Coastal



Strategies for Climate Adaptation  
Coastal Vulnerability Objective

# LIVING SHORELINE DEMONSTRATION SITES





# Partners, Cooperators & Funders

## **Federal**

U.S. Fish and Wildlife Service (FWS)  
National Oceanographic and Atmospheric Administration (NOAA)  
Army Corps of Engineers (ACOE)  
U.S. Geological Survey (USGS)  
U.S. Forest Service

## **State**

South Carolina Department of Natural Resources (SCDNR)  
South Carolina Sea Grant Consortium  
Department of Health and Environmental Control

## **University**

University of South Carolina  
College of Charleston  
Coastal Carolina University  
Horry-Georgetown Technical College

## **Non-profit organizations and others**

Pee Dee Land Trust (PDLT)  
Ducks Unlimited (DU)  
American Rivers  
Waccamaw River Keeper  
Gullah Geechee Nation

## **For-profit organizations**

Boeing  
Alcoa  
Duke Energy  
Coastal Expeditions

