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Evaluating the Ability of Natural Features to Enhance Coastal Resilience in Southwest Florida

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Director – NCCOS Competitive Research Program

SCIENCE SERVING COASTAL COMMUNITIES

Overview

- Objectives:
  - Provide a project overview and anticipated products
  - Communicate how watershed restoration will inform coastal resilience to sea level rise and inundation

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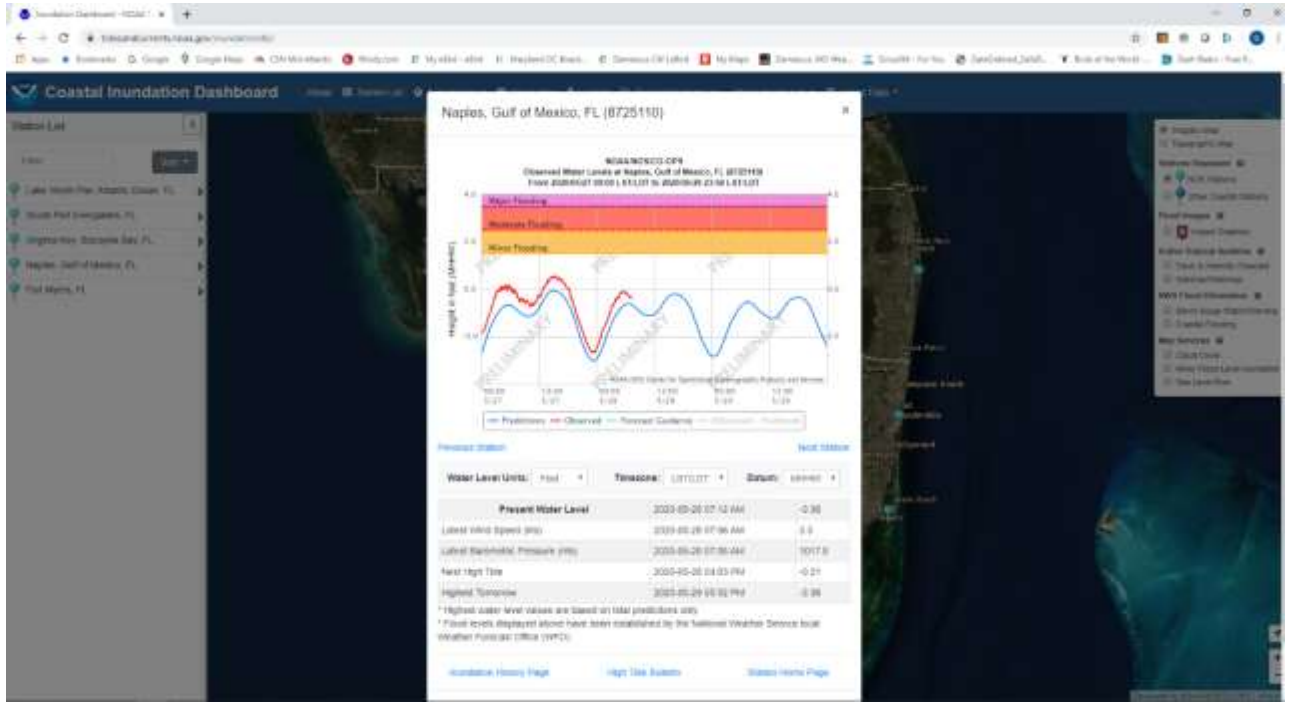
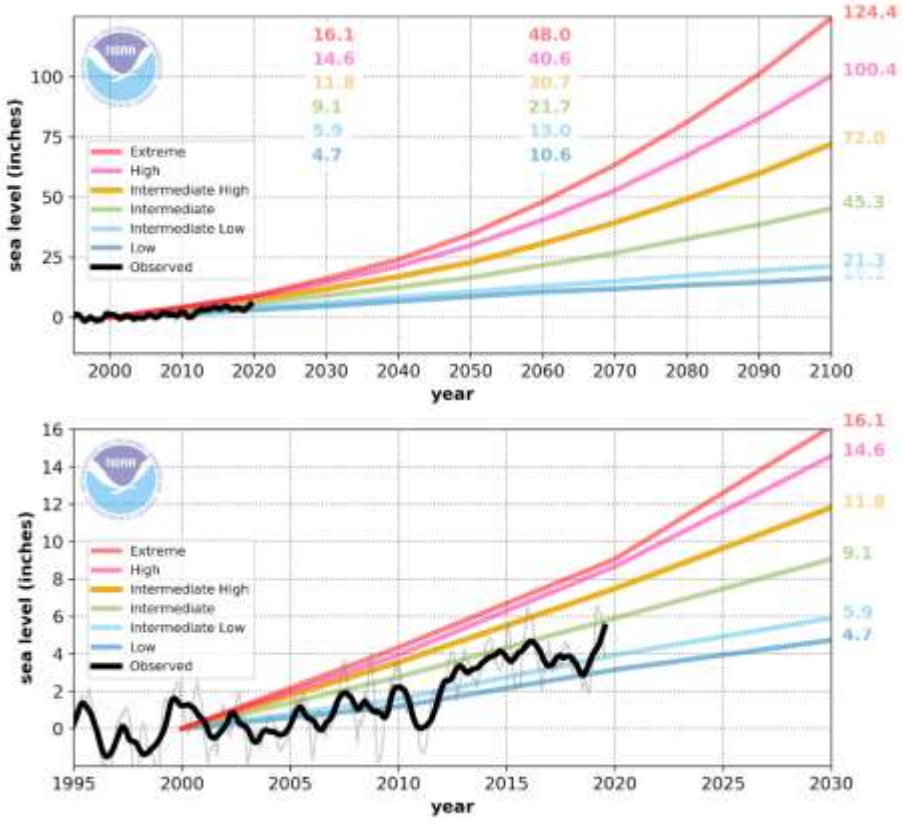
NOAA Sea Level Rise Capabilities

- Foundational observations and data analytics

Coastal Inundation Dashboard



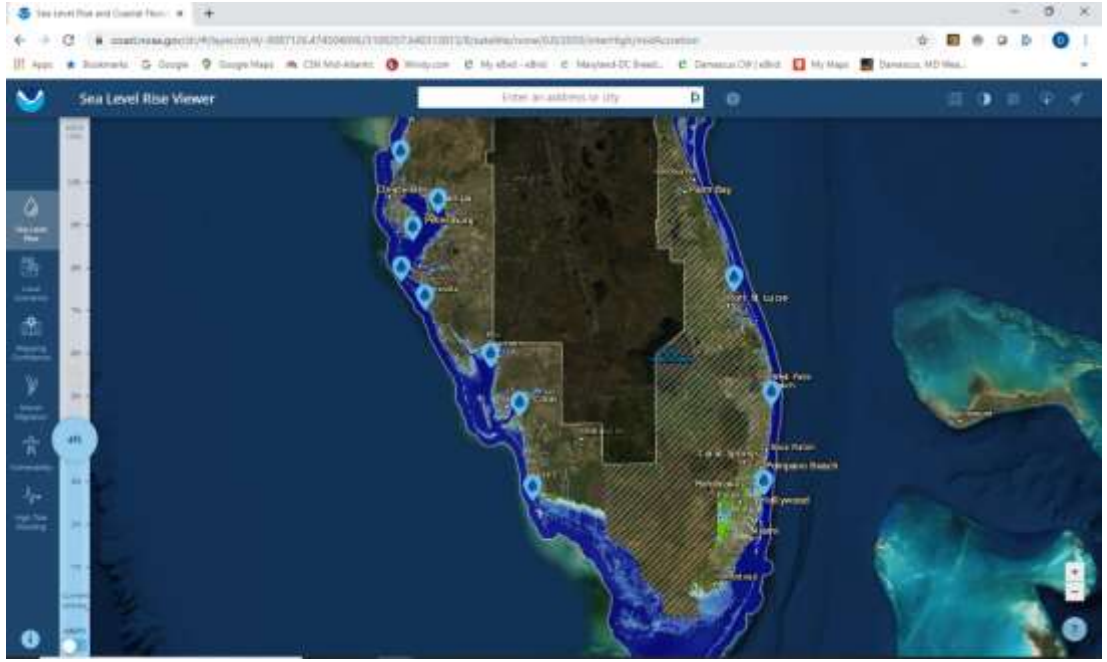
Localized SLR trends and scenarios



NOAA Sea Level Rise Capabilities

- Coastal Management Products and Training

Sea Level Rise Viewer



Digital Coast

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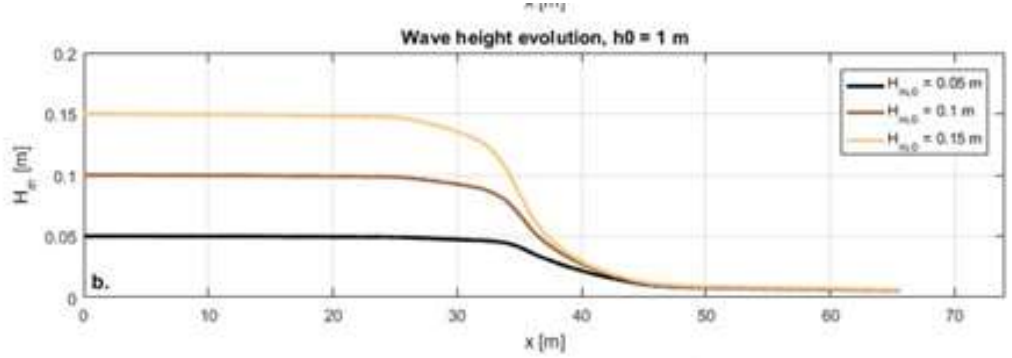
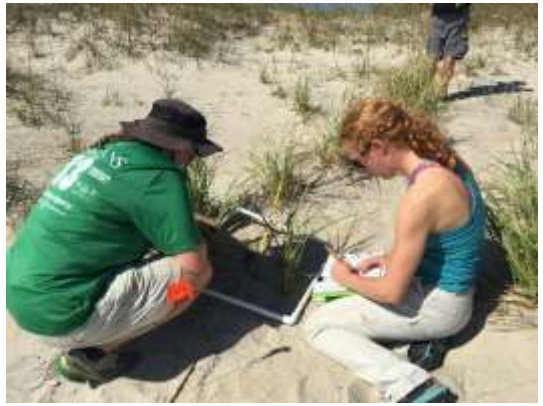
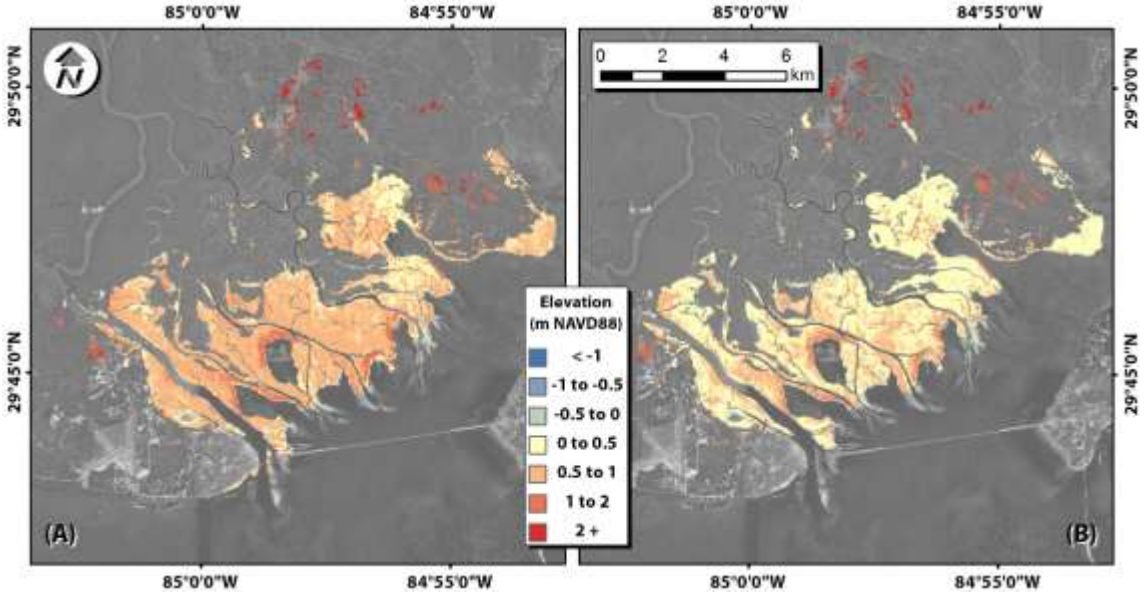
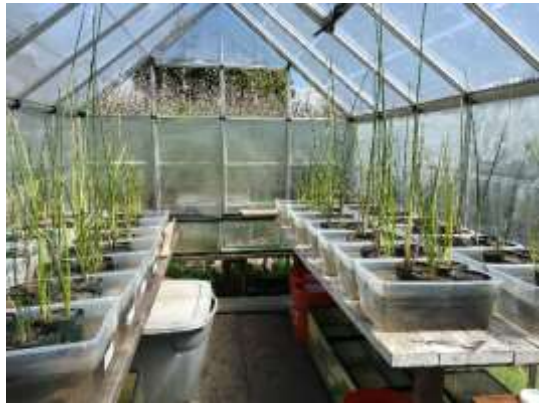
NOAA Sea Level Rise Capabilities

- Research









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Assessing the Role of Natural and Nature-Based Features in Enhancing Coastal Resilience of Urban and Natural Ecosystems in the 21st Century

- Project and Science Lead: Peter Sheng, University of Florida
- Community Coordination Lead: Michael Savarese, Florida Gulf Coast University

- Karen Thorne, Kevin Buffington, Ken Krauss: USGS
- Carol Ballard, Akintunde Owosina: SFWMD
- Noemi Gonzalez-Ramirez, Jimmy O'Brien: Riada Engineering
- Jessica McIntosh: Rookery Bay NERR
- Vladimir Paramygin: University of Florida

Marco Island

Rookery Bay National Estuarine Research Reserve

Collier County

City of Naples, Florida, On the Gulf

MIAMI

UF | UNIVERSITY of FLORIDA

South Florida Water Management District

National Wildlife Refuge System

USGS science for a changing world

Florida Gulf Coast University

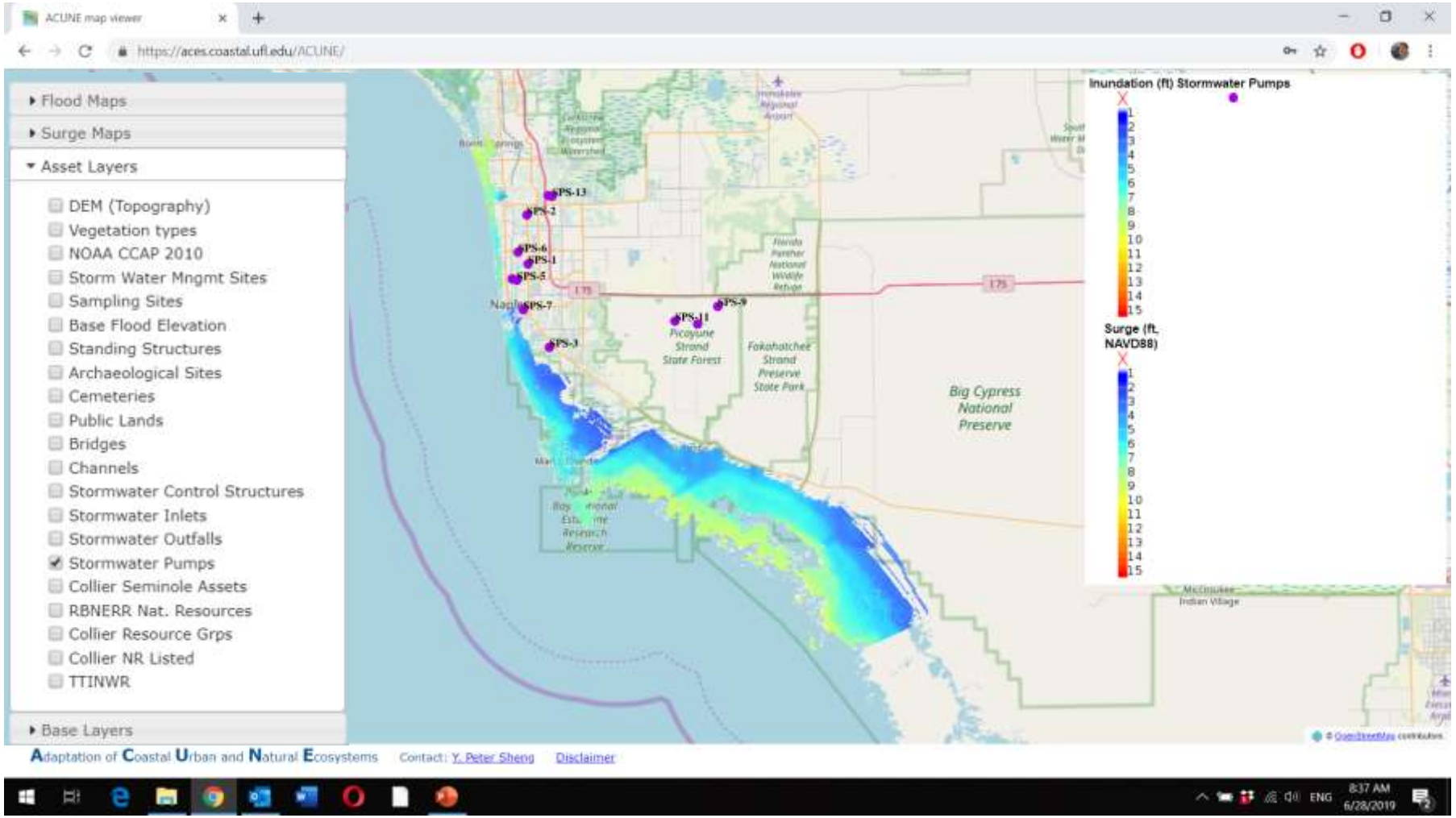
Welcome to Everglades City, FL

Project Overview

Information gaps addressed through this project

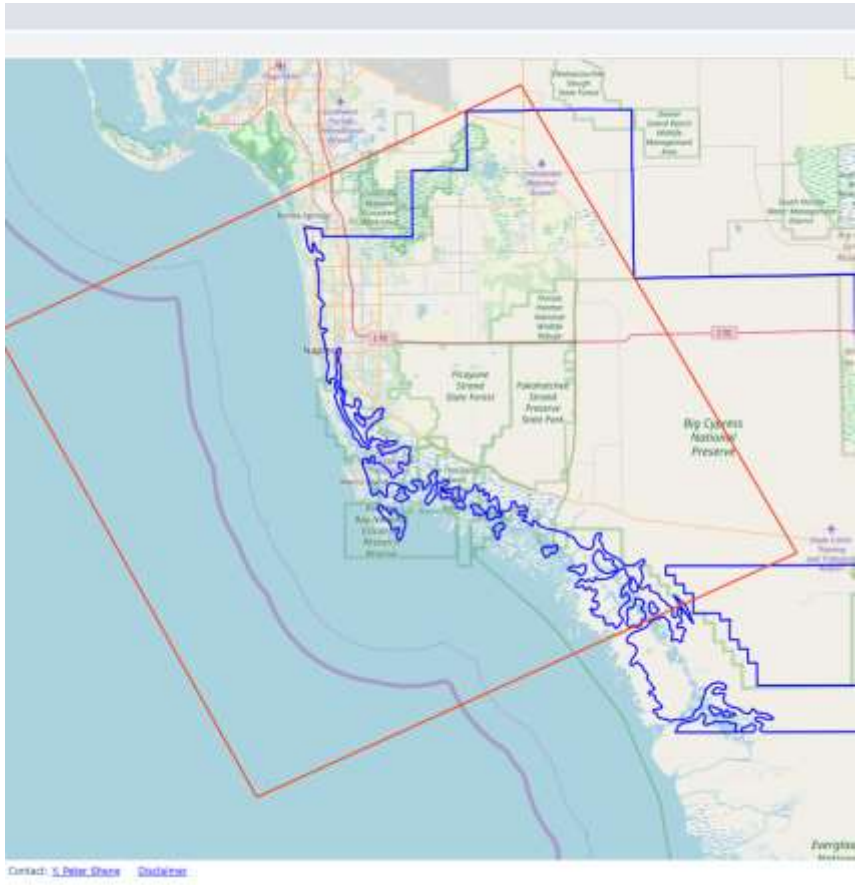
- Precipitation-induced inland flooding;
- Landward migration of mangrove due to climate change;
- Impact of more intense storms and SLR on stormwater system;
- Include wave-induced damage to properties in economic analysis;
- Rapid forecasting of high-resolution surge and flooding during user-specified storms(s);

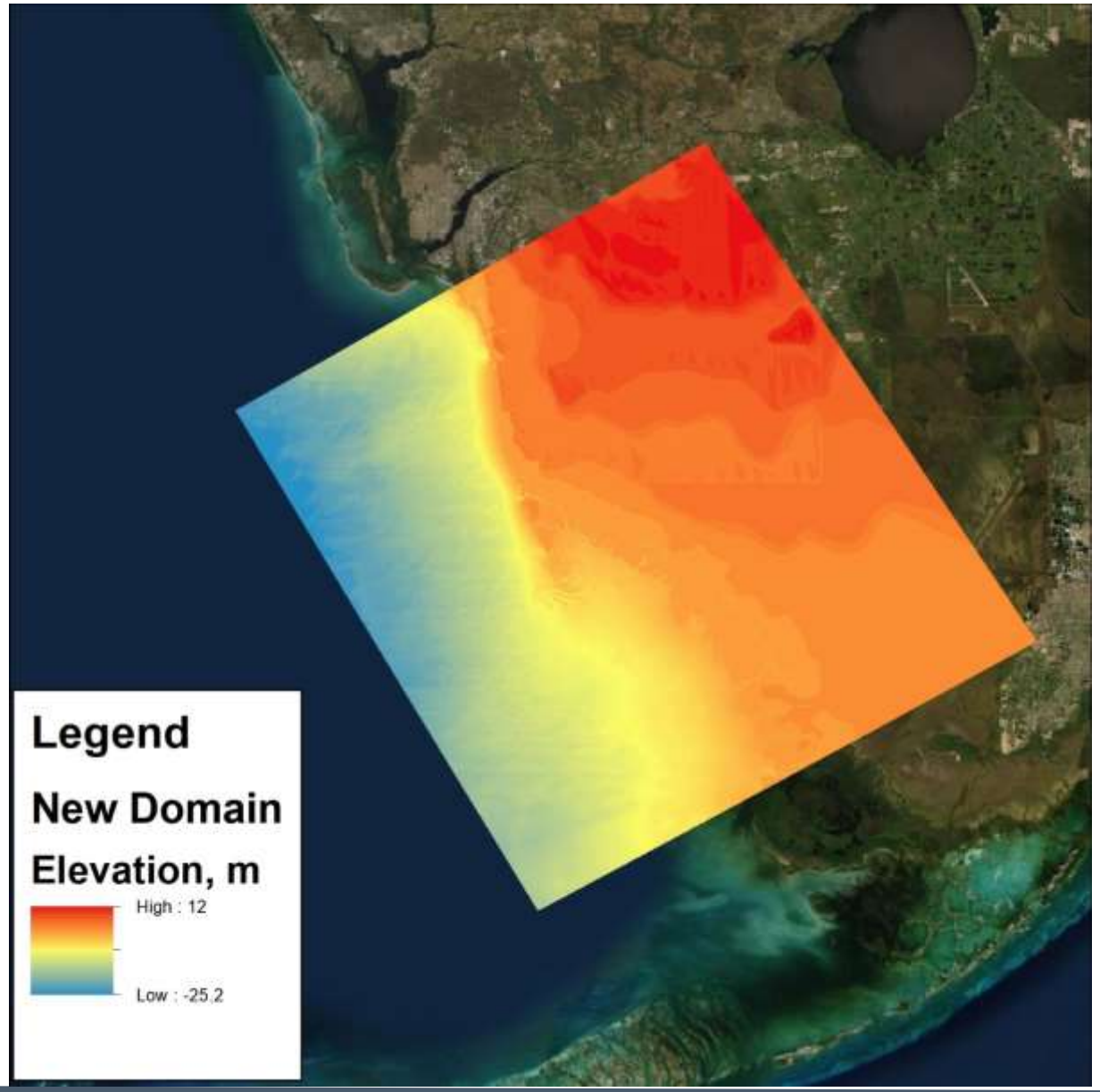
ACUNE Webtool: Example Flood Map with Infrastructures



1% flood maps with storm water pumps

Study Area



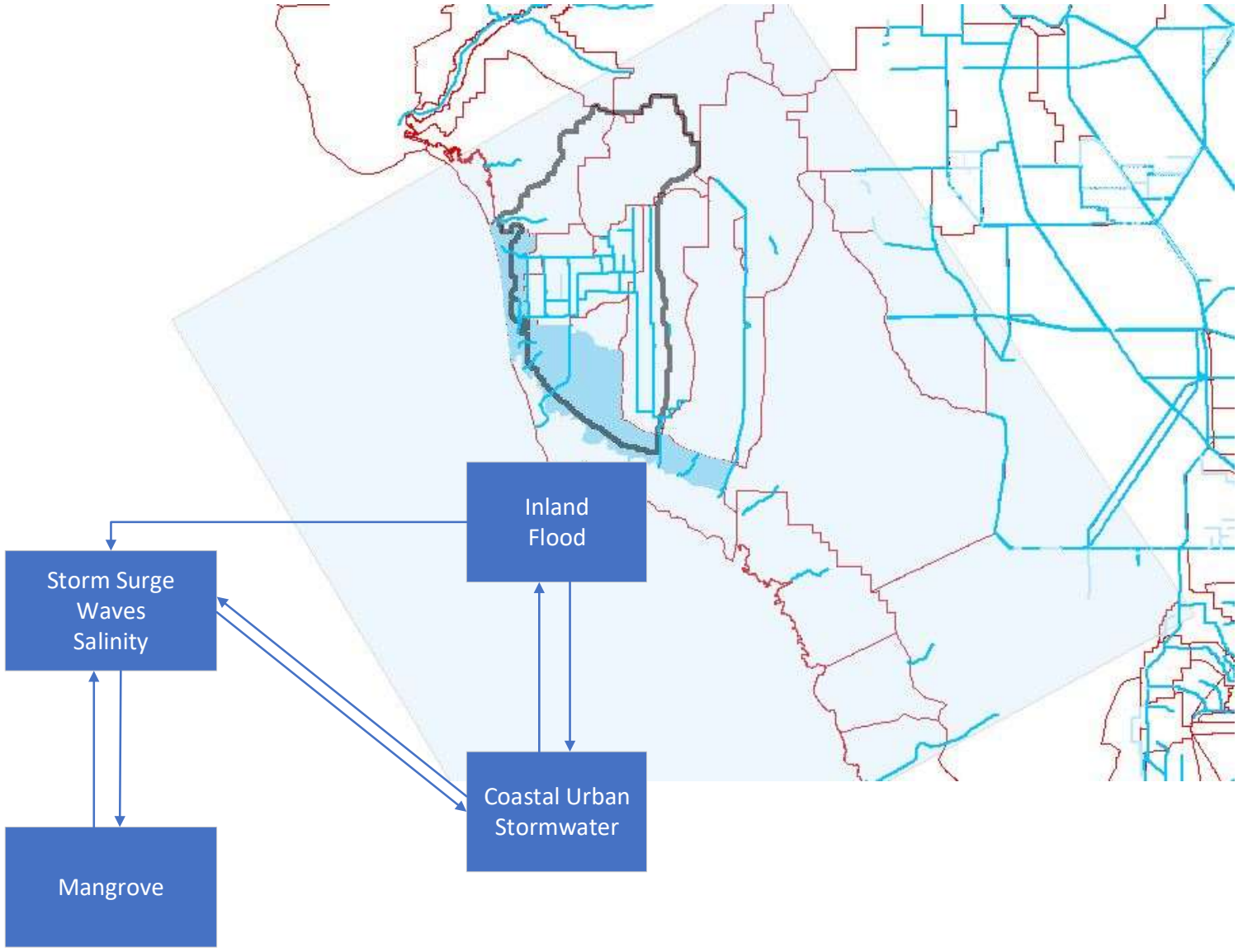


Study domain is expanded to include more inland areas, including Picayune Strand, Fakahatchee Strand, and Big Cypress National Reserve

ACUNE+ Integrating Programs, Projects and Products

Coupling tools and products from multiagency programs, converting data to information to support decision making.

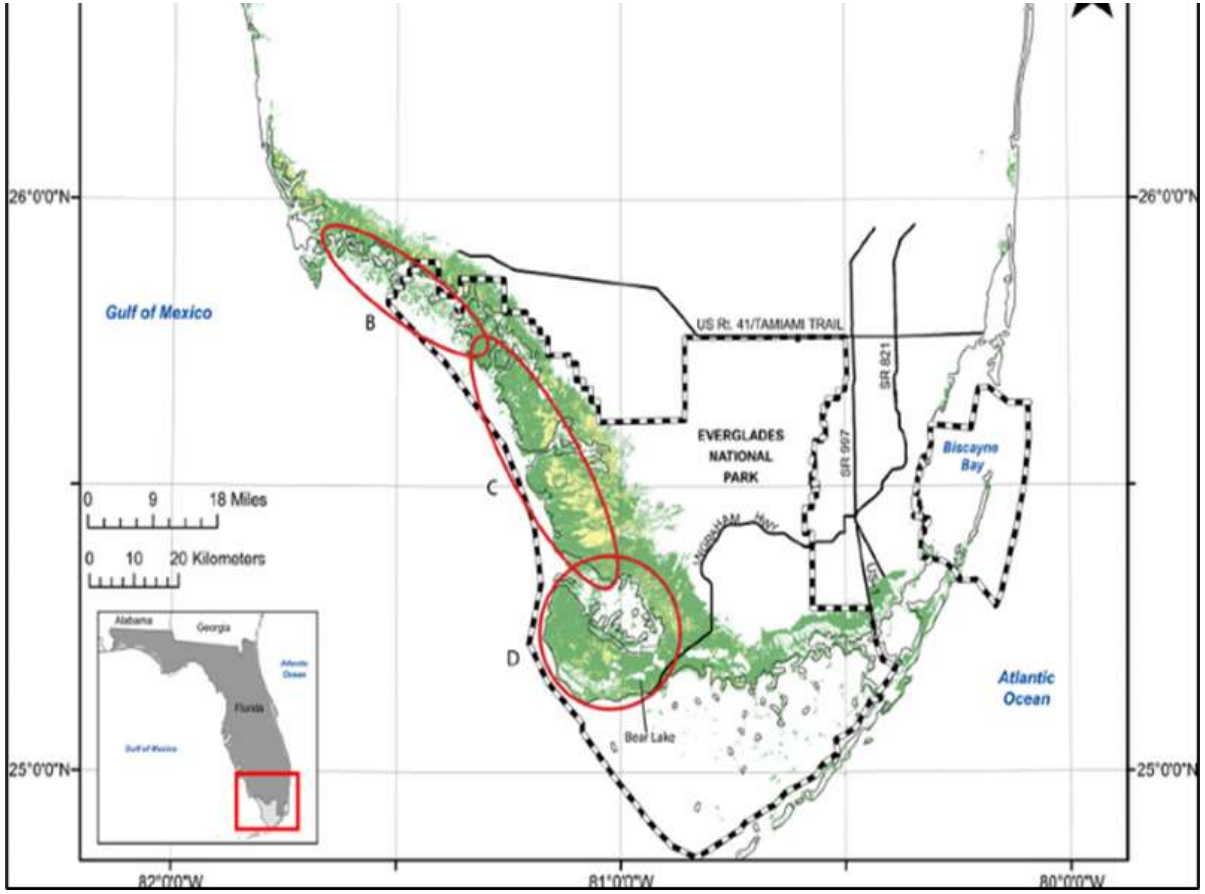
- Storms surge, waves and salinity from the University of Florida CH3D-SWAN model (used in the ACUNE project)
- Mangrove and vegetated shorelines model (being developed for this ACUNE+ project)
- Inland flood using the watershed model and urban stormwater model, both part of the SFWMD's Flood Protection Level of Service (FPLOS) Program

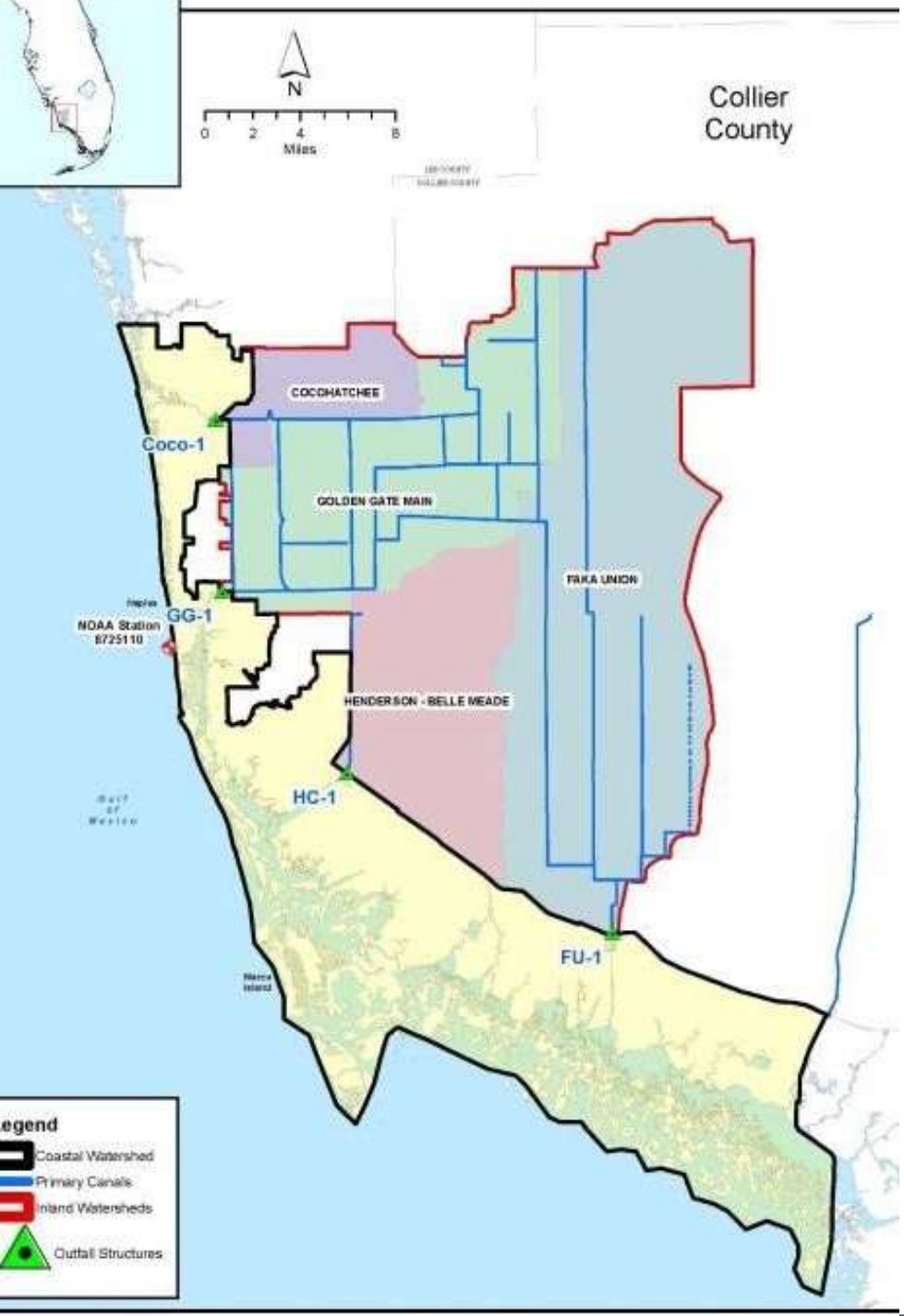


Modeling Mangrove Change

Mangrove Ecosystem Response to Climate Change (MERCC)

- Project changes in nearshore ecosystem plant communities considering
  - Sea-level rise (multiple scenarios)
    - Salinity intrusion
    - Increasing inundation
  - Hurricanes
  - Increasing temperature
  - Fire
- Time horizons: 2030, 2060, 2100
- Mangrove's capacity to reduce storm-induced property damage will change with climate change





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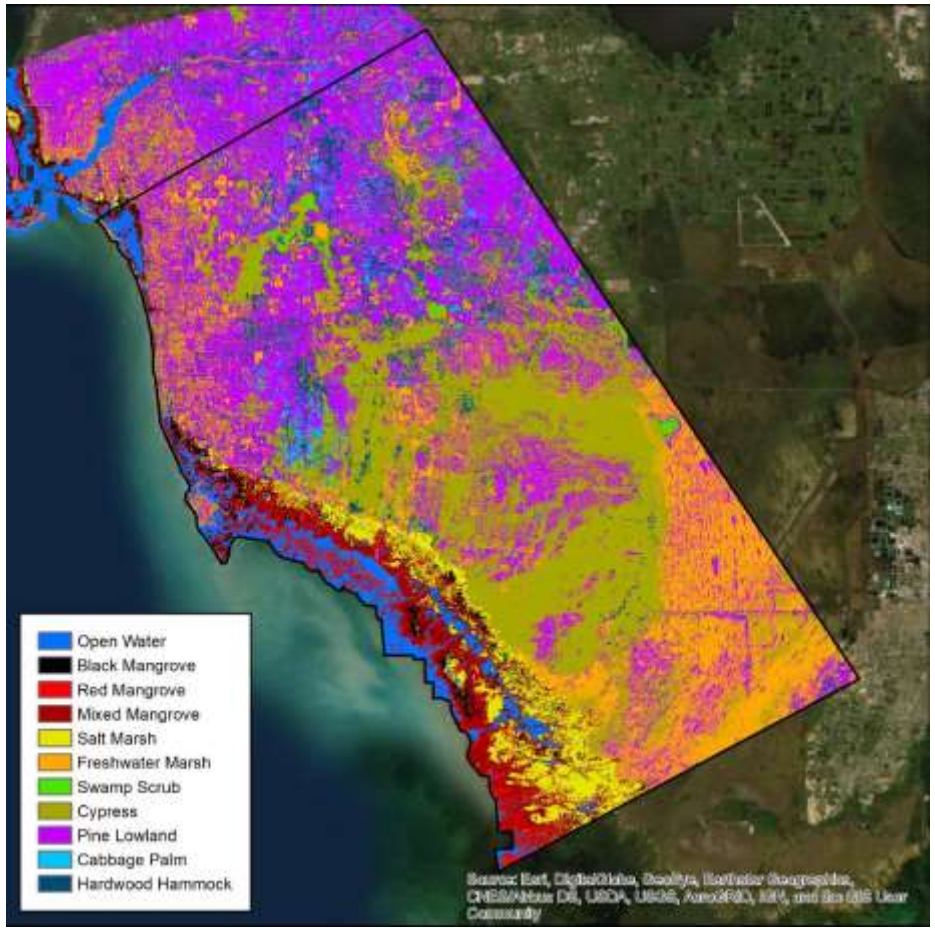
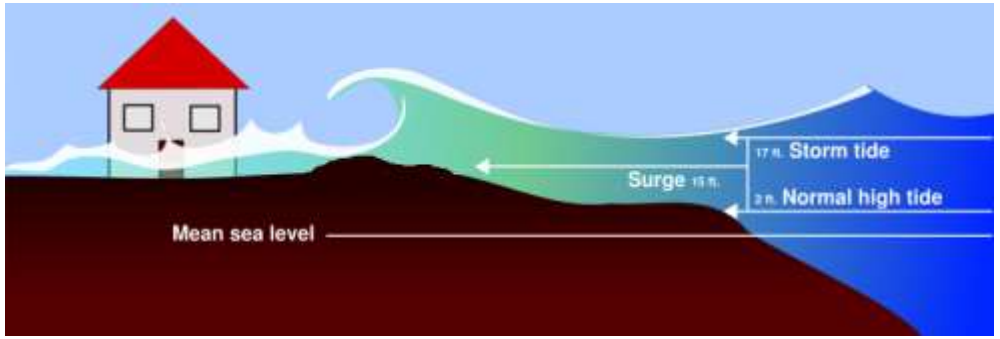
Urban Coastal Modeling

- SFWMD with Riada collaborating on an initiative to couple the inland watershed model to urban coastal watershed model
- Extending the inland flooding simulation capability to the coastline
- Adding ability to simulate urban storm water response to rainfall and storm surge
- Combined, the model enhance SFWMDs ability to evaluate coastal flooding and adaptation as part of it FPLOS and Coastal Resiliency efforts

Vulnerability to storms and sea level rise?

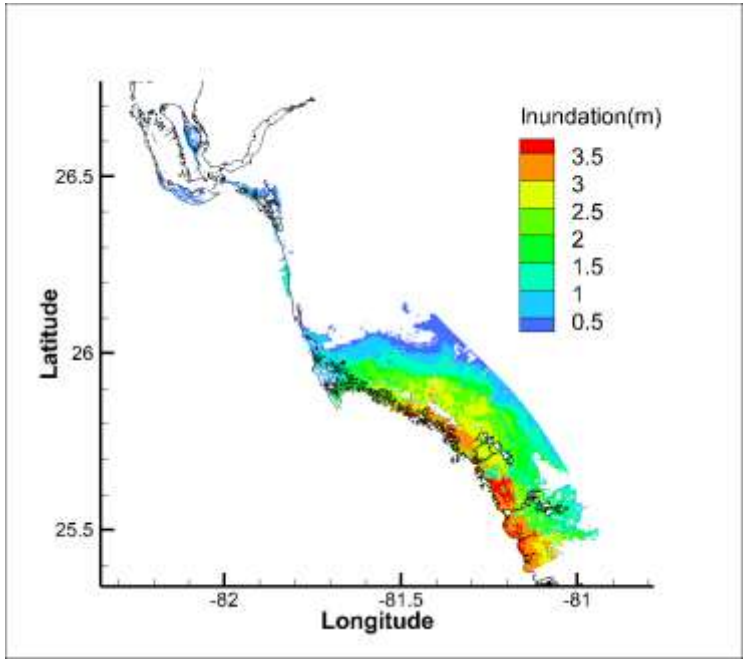


Vegetation Map

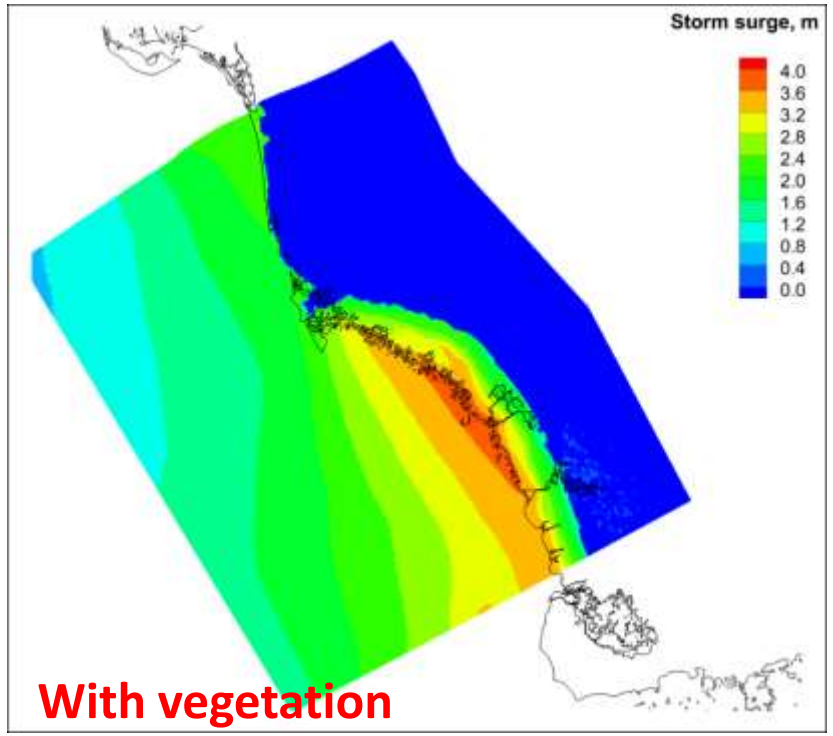


Storm Surge (1-28ft) + Tide (0-6ft) + Wave Setup (0-5ft) + Precipitation (0-4.5ft) + SLR (~1ft, 2ft, 6ft) for (2030, 2060, 2100)

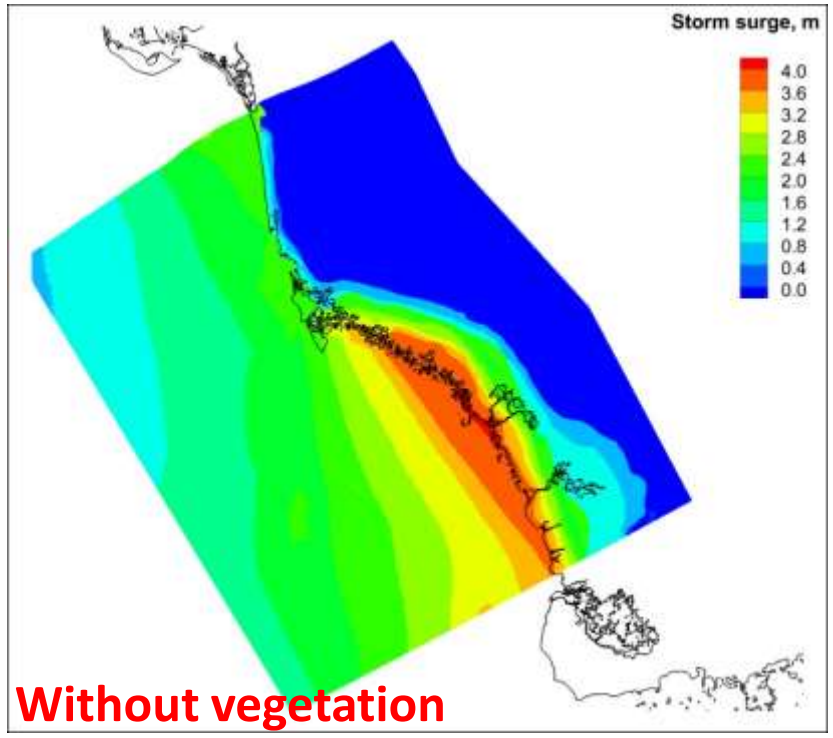
Hurricane Irma
Maximum Inundation



What the role of ecosystem in flood protection?



Inundation Volume = 11.2 km^3 (-24%)
Building loss: **$97.3M** (-7.25%)



Inundation Volume = 14.8 km^3 (+32%)
Building loss: **$105.1M** (+8%)

Ecosystem value for flood protection during Hurricane Irma

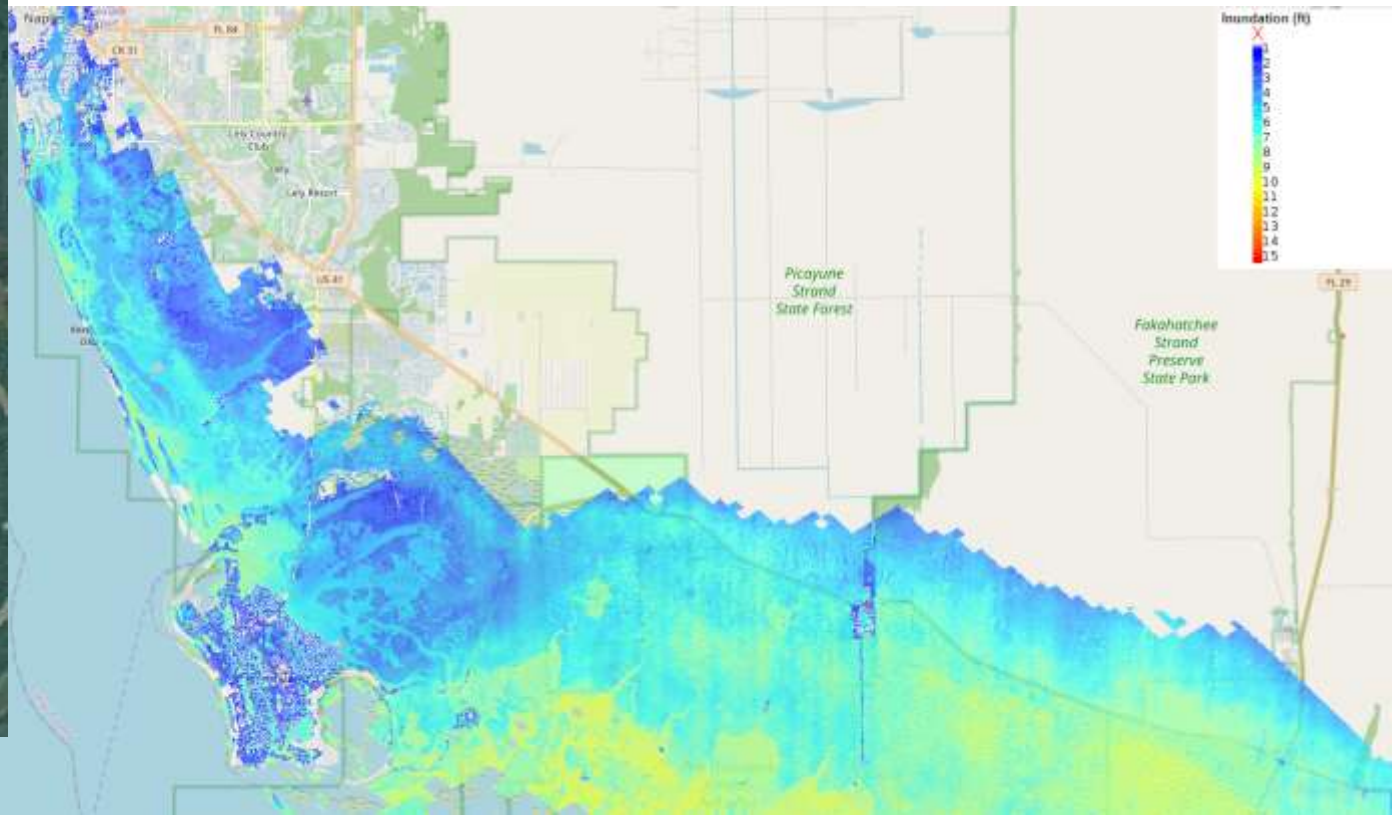
- **Mangrove/marsh reduced flood/wave damage in Collier County during Irma by 7.25% or $7.8M**

How can this inform mangrove restoration?

Using watershed boundary conditions to inform coastal vegetation models

How can this inform mangrove restoration?

Evaluating future mangrove health and restoration solutions with sea level rise and flood risk reduction



Take Home Points

- Vulnerability of coastal communities to inundation is linked to ecosystem health;
- Sea level rise exacerbates flooding, can impair ecosystem health, and will continue to worsen;
- Changes in watershed hydrology restoration can effect coastal flood vulnerability.

Next Steps

- Link coastal-inland models to predict the benefits of ecosystems in reducing inundation by king tides, storms, sea level rise and rainfall;
- Use the coastal-inland flooding model and economic model to assess the economic impacts and merits of various proposed ecosystem restoration scenarios;
- Interactive training workshops for end users to use the Web-Based Decision Support Tool ACUNE+.

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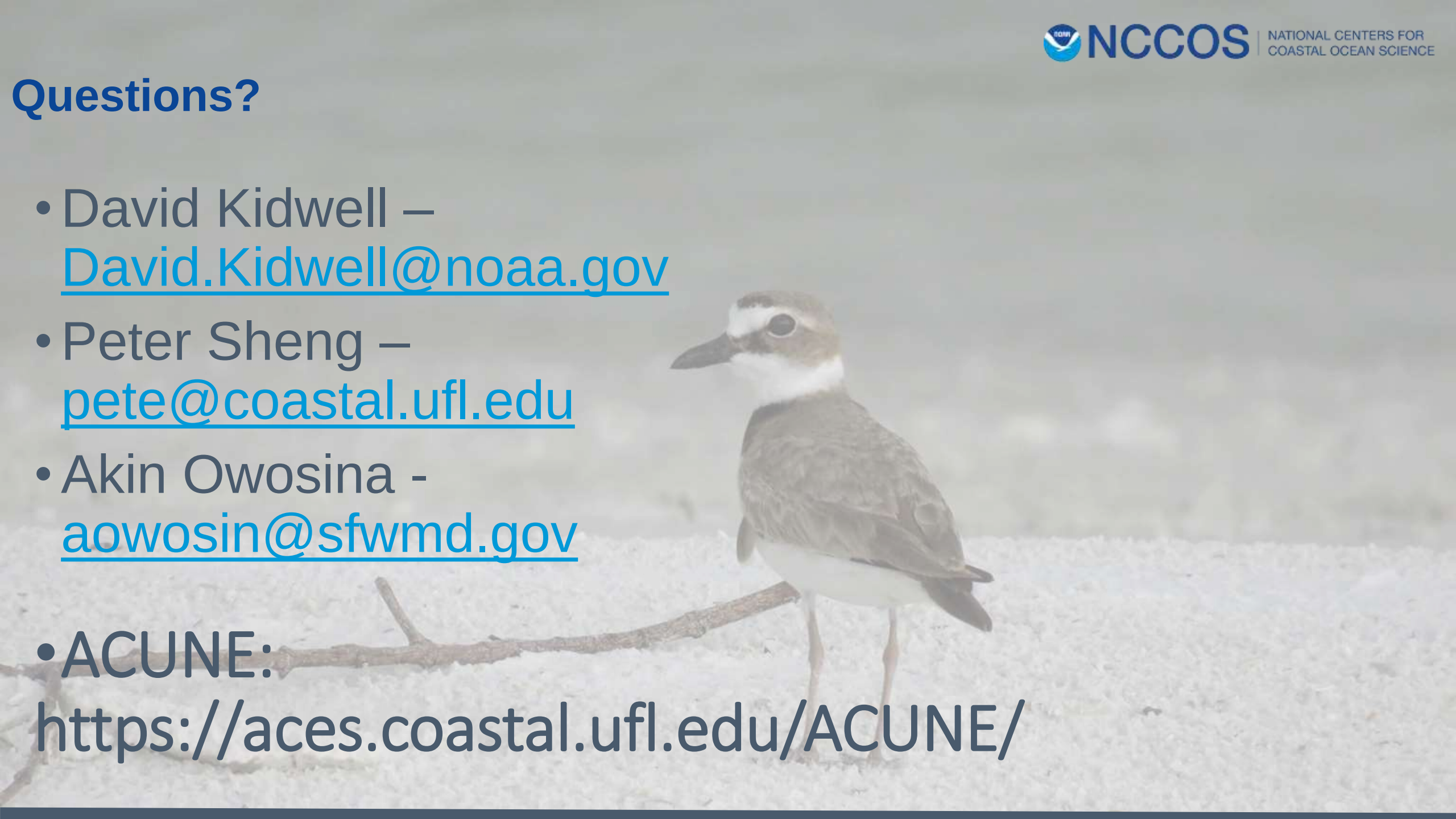
Questions?



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