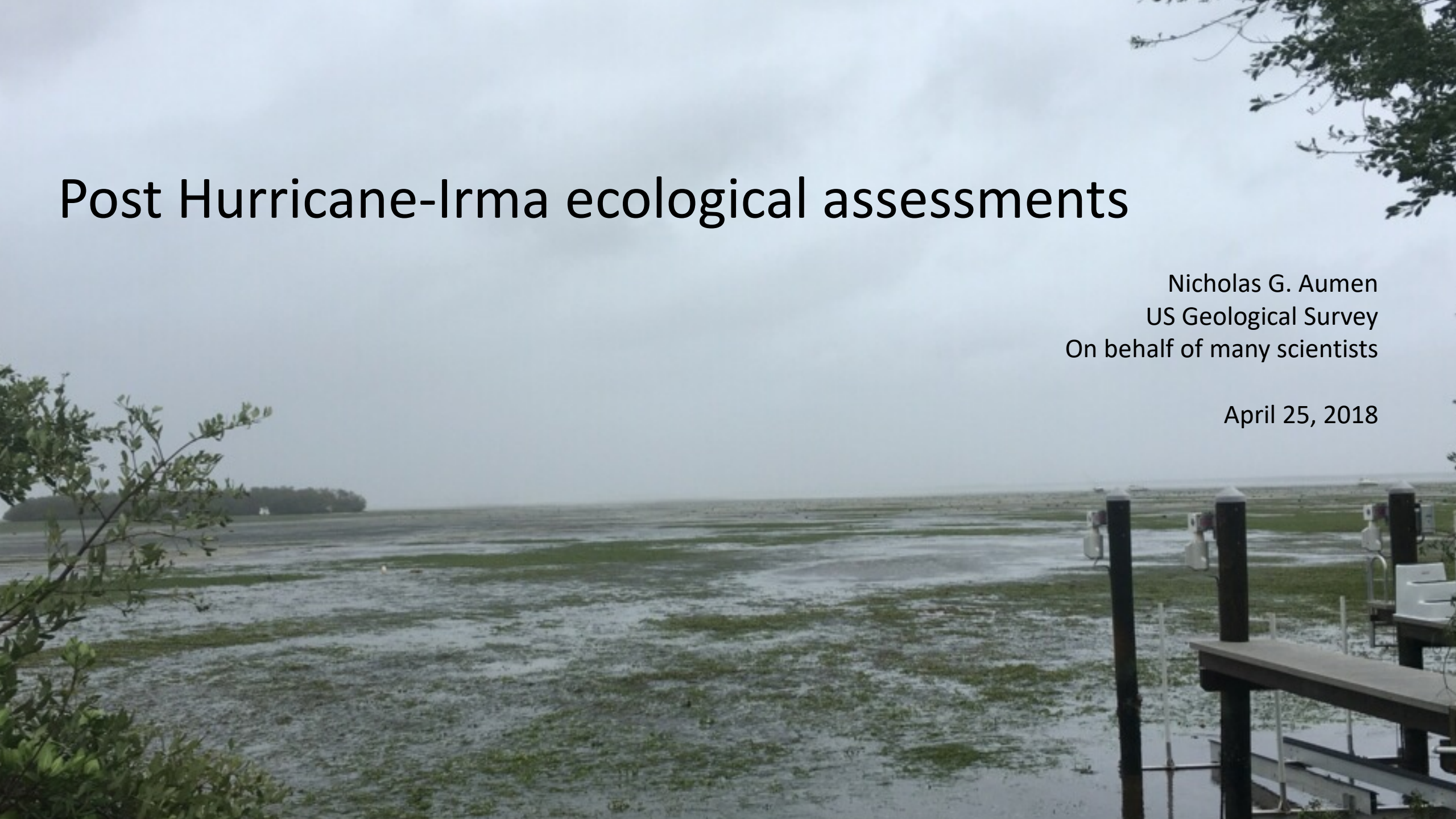
Post Hurricane-Irma ecological assessments

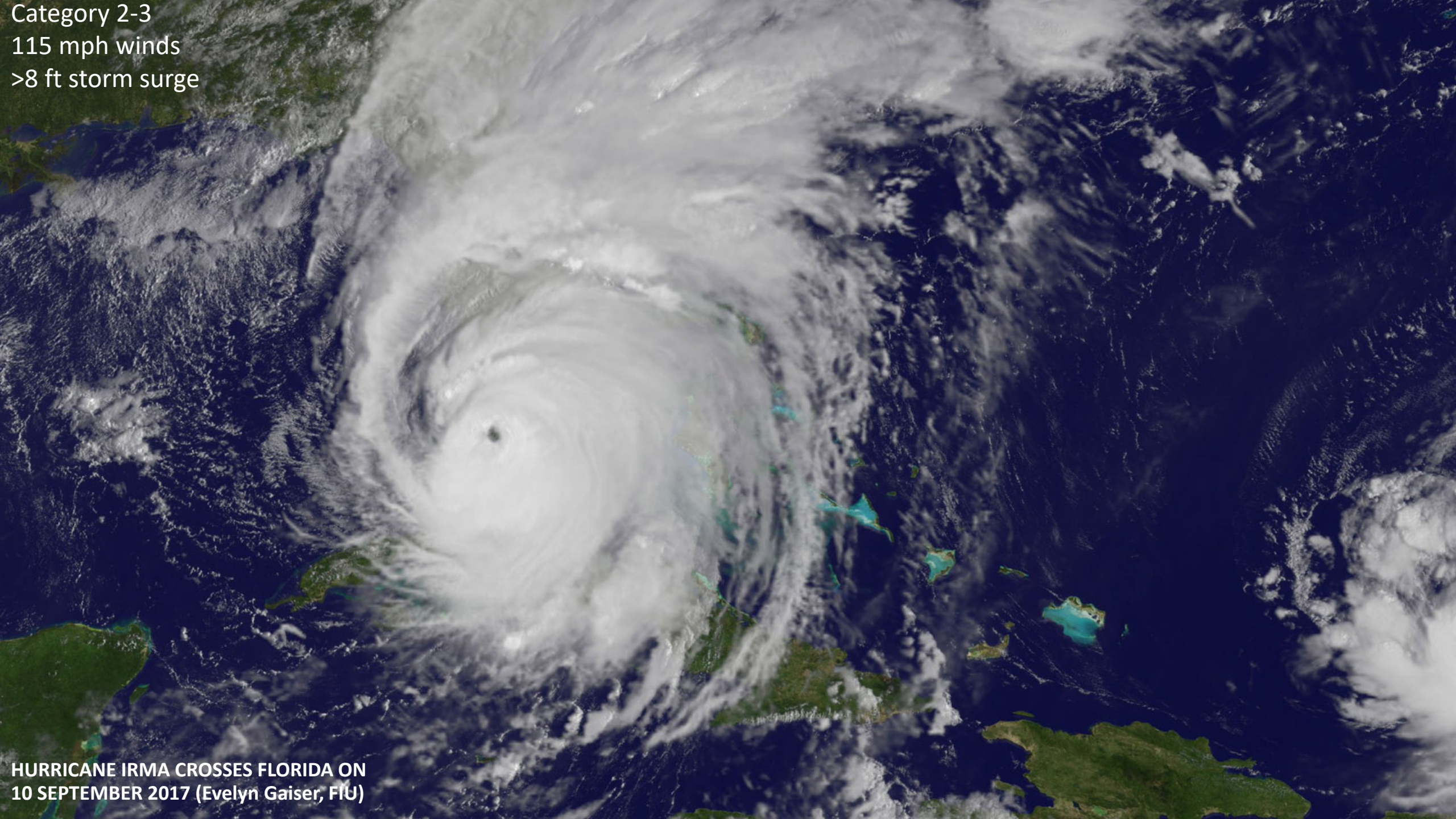
Nicholas G. Aumen
US Geological Survey
On behalf of many scientists

April 25, 2018



Caveats and comments

- The Science Coordination Group sponsored a meeting on post-Irma studies on 9/27/2017; approximately 100 individuals participated
- I have tried to focus on actual observations and data
- Much important information had to be eliminated or condensed due to presentation time constraints
- Any errors of omission or commission are mine and mine alone
- Numerous individuals, agencies, and academic institutions contributed information to this presentation
- Many thanks to all of those who took time out of their busy schedules to pull together and share this information!

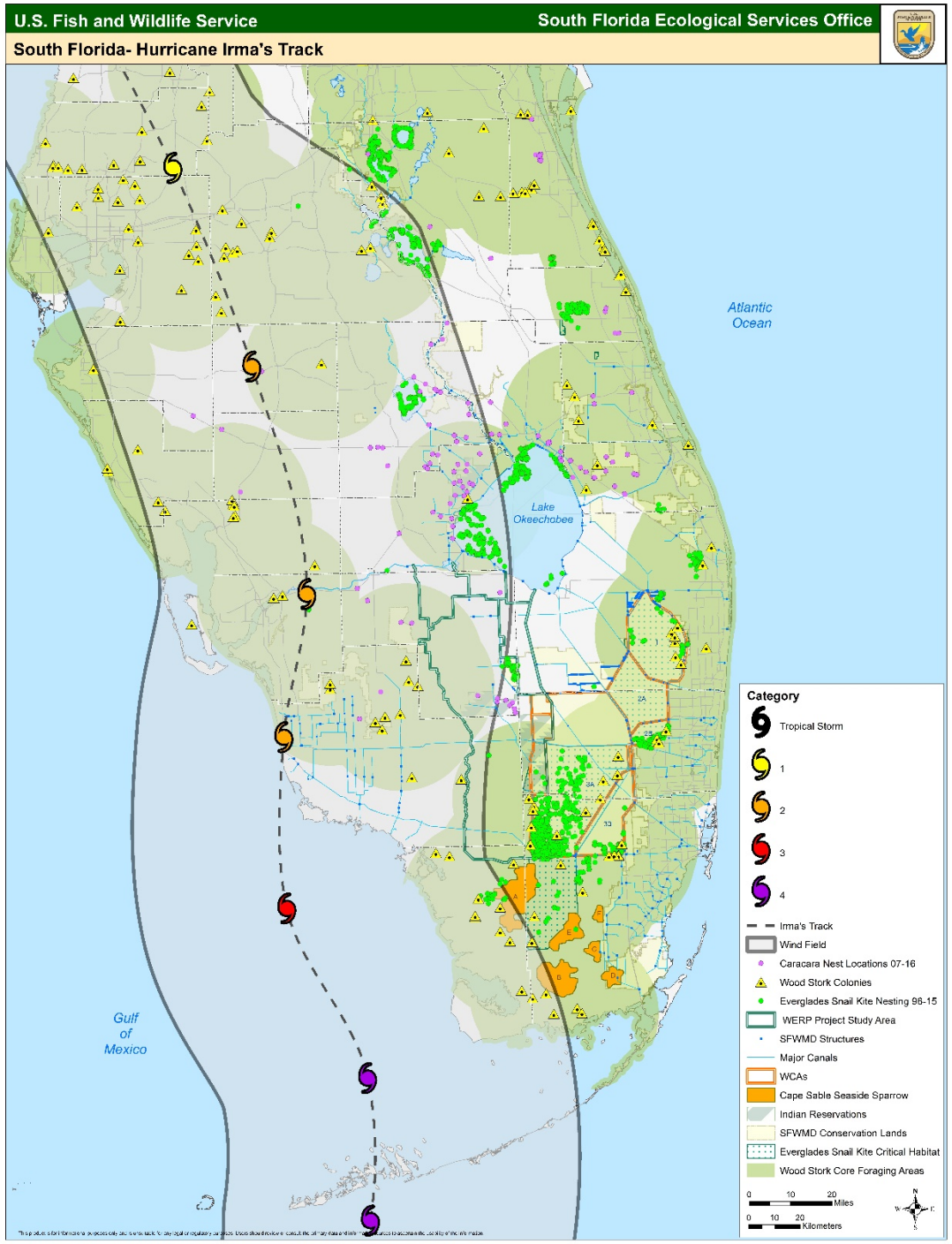


HURRICANE IRMA CROSSES FLORIDA ON 10 SEPTEMBER 2017 (Evelyn Gaiser, FIU)

Irma’s path and lateral extent of hurricane-force winds

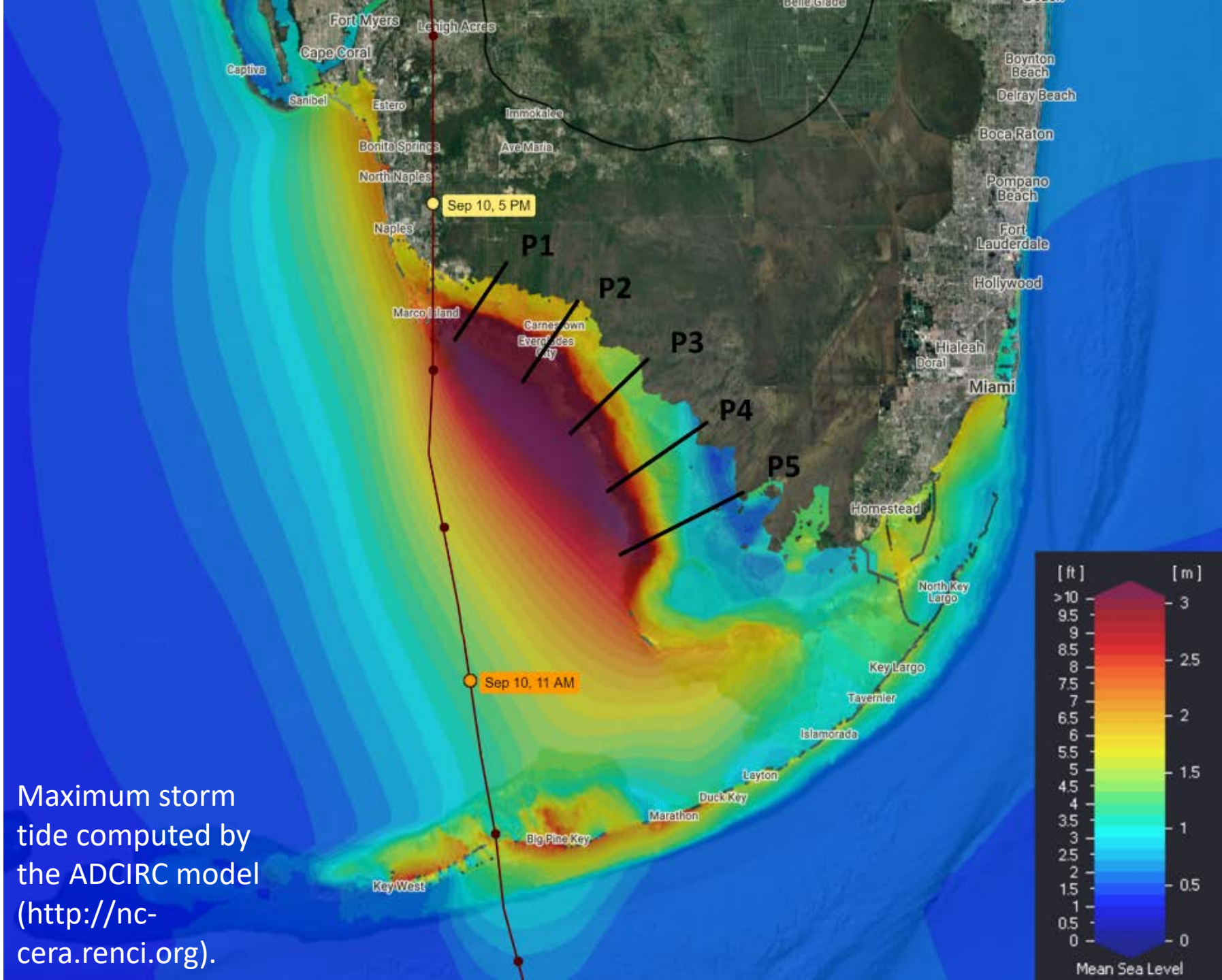
Sept. 10, 2017

Miles Meyer, FWS

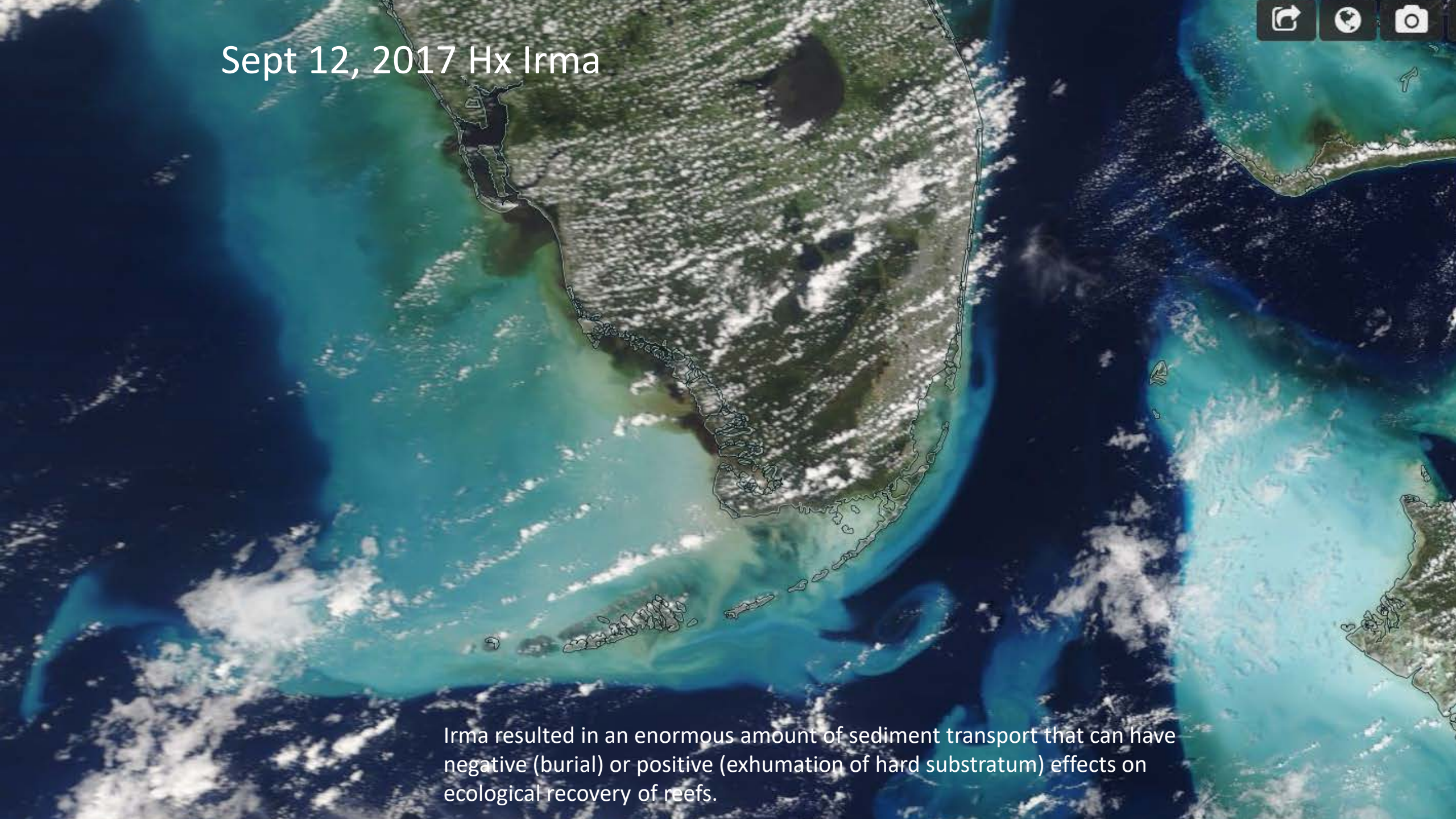


Coastal Emergency Risks Assessment models and data from staff gauges throughout the Everglades suggest a 3+ meter storm surge

(courtesy of Keqi Zhang, FIU)



Maximum storm tide computed by the ADCIRC model (http://nc-cera.renci.org).


Sept 12, 2017 Hx Irma
Irma resulted in an enormous amount of sediment transport that can have negative (burial) or positive (exhumation of hard substratum) effects on ecological recovery of reefs.

Kissimmee River restoration area

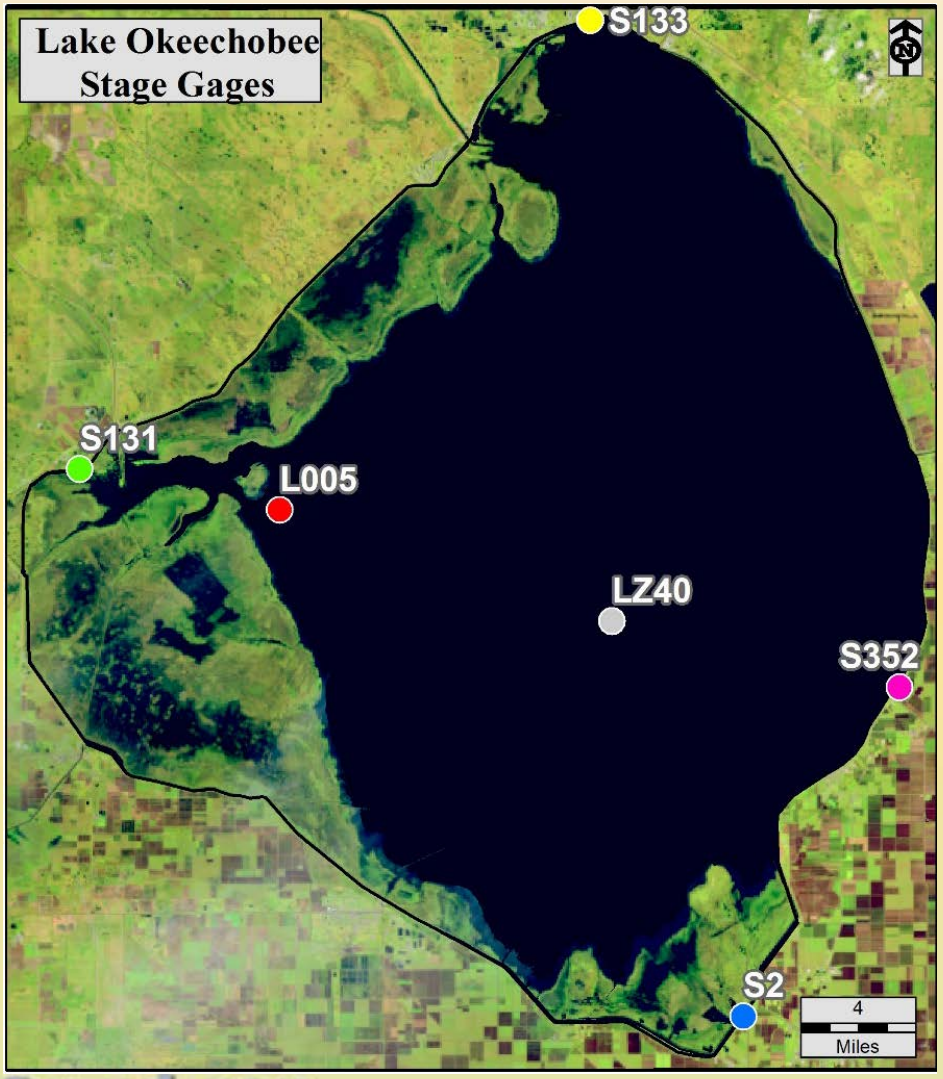
Starvation Slough (130 cfs, 5/30/17)

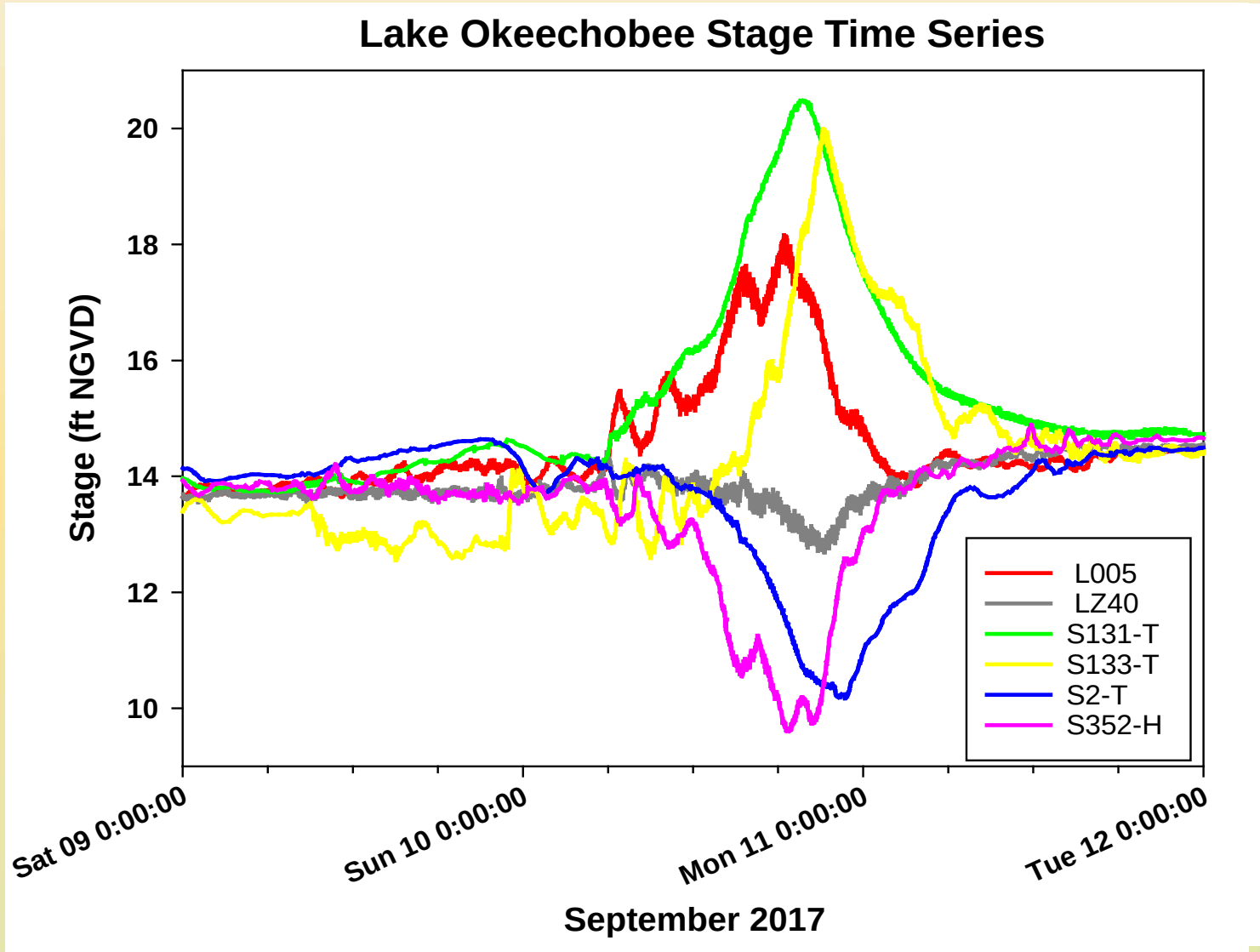
Starvation slough (7200 cfs, 9/13/2017)

Impacts

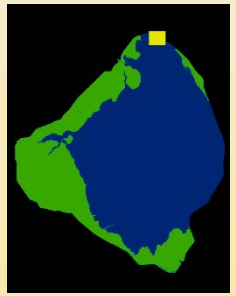
- Periods of low DO for 2 months – below 2 mg/L
- Largemouth bass, bluegill, and other sunfish were negatively affected
- Largemouth bass in particular were almost non-existent in surveys conducted after Irma
- On the other hand, bluegill numbers were very high post-Irma, possibly benefitting from increased floodplain area and refugia
- The invasive West Indian marsh grass may have been reduced by prolonged deep water and high flows during Irma

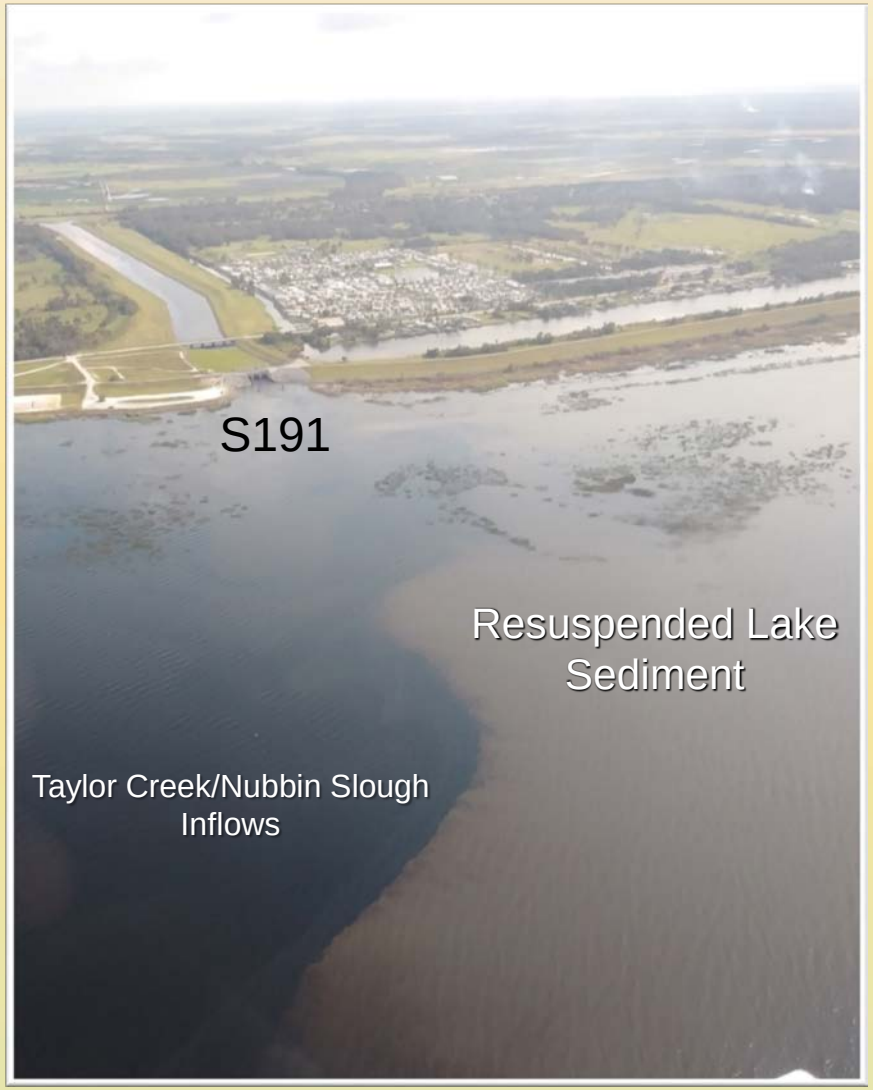
Hurricane Irma Seiche in Lake Okeechobee

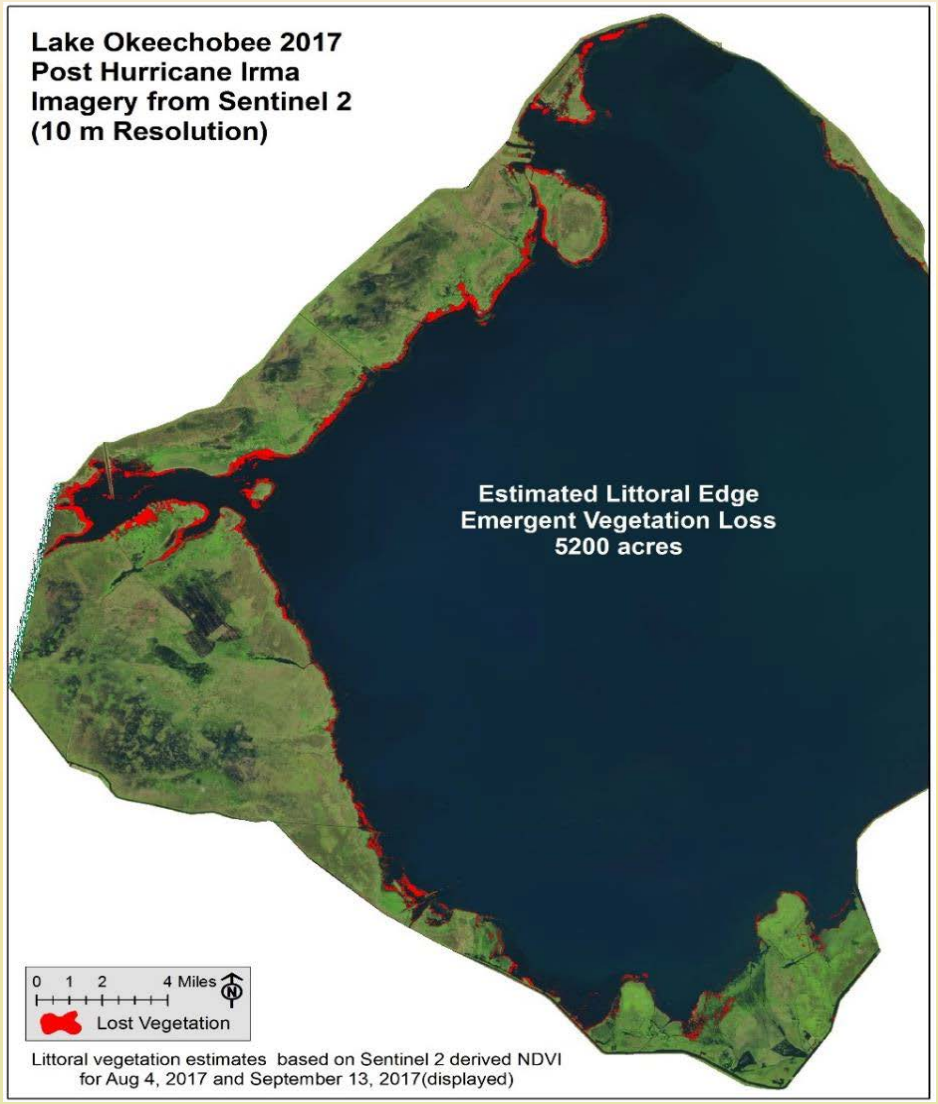




Lake Okeechobee
Impacts from Hurricane Irma

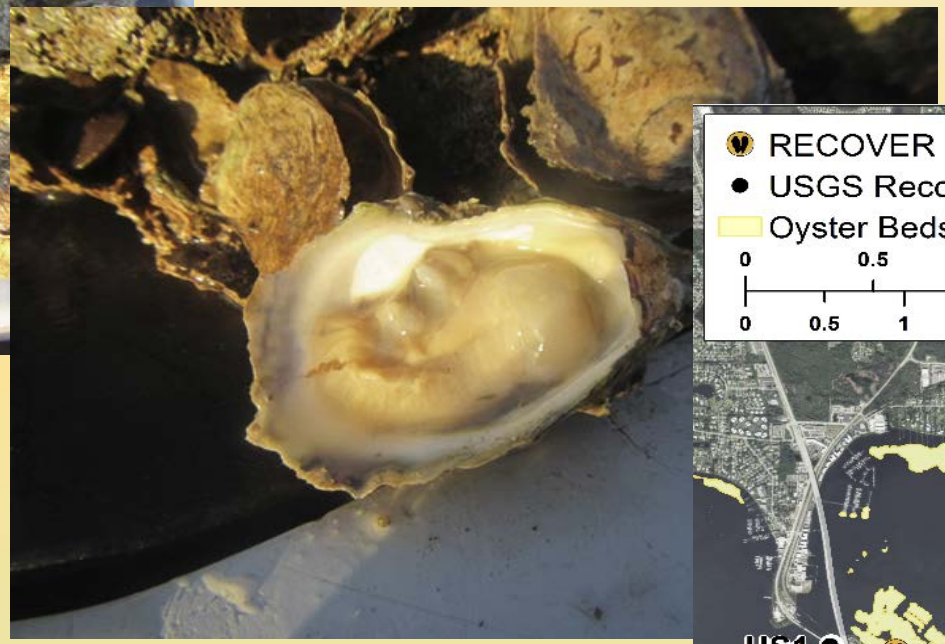




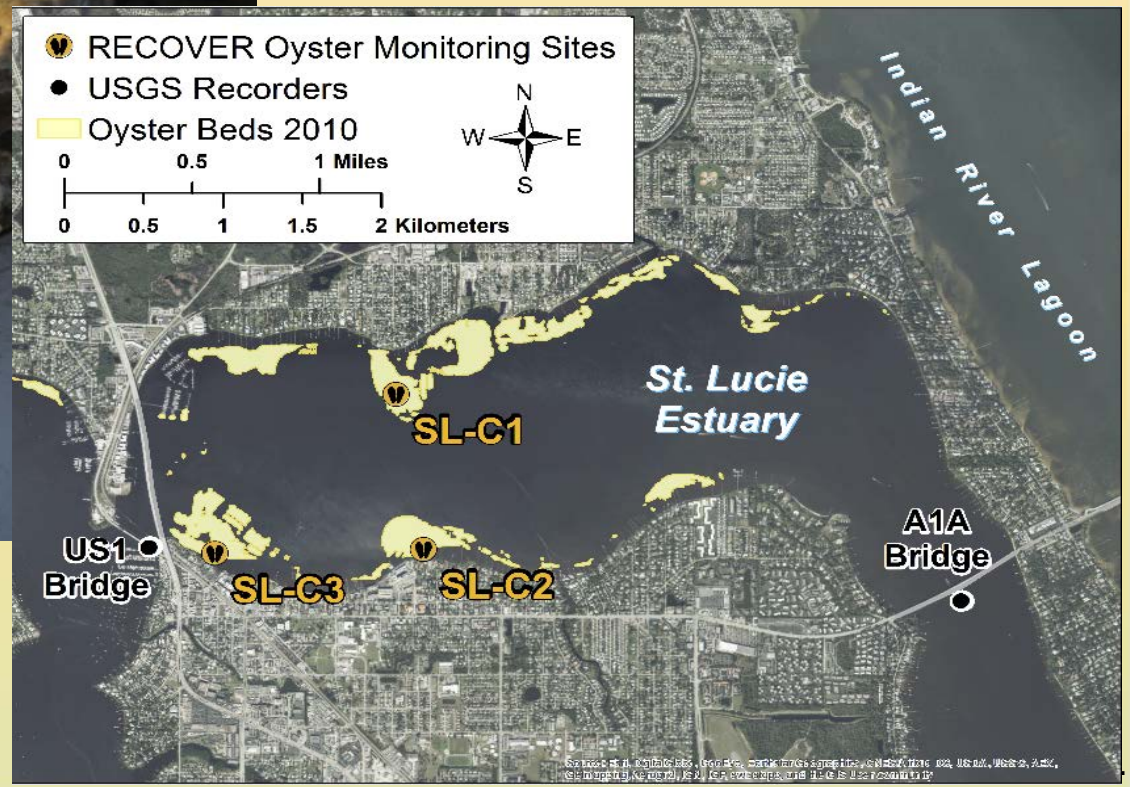


St. Lucie Estuary

Dead oysters from monitoring site in middle fork



Dying oyster



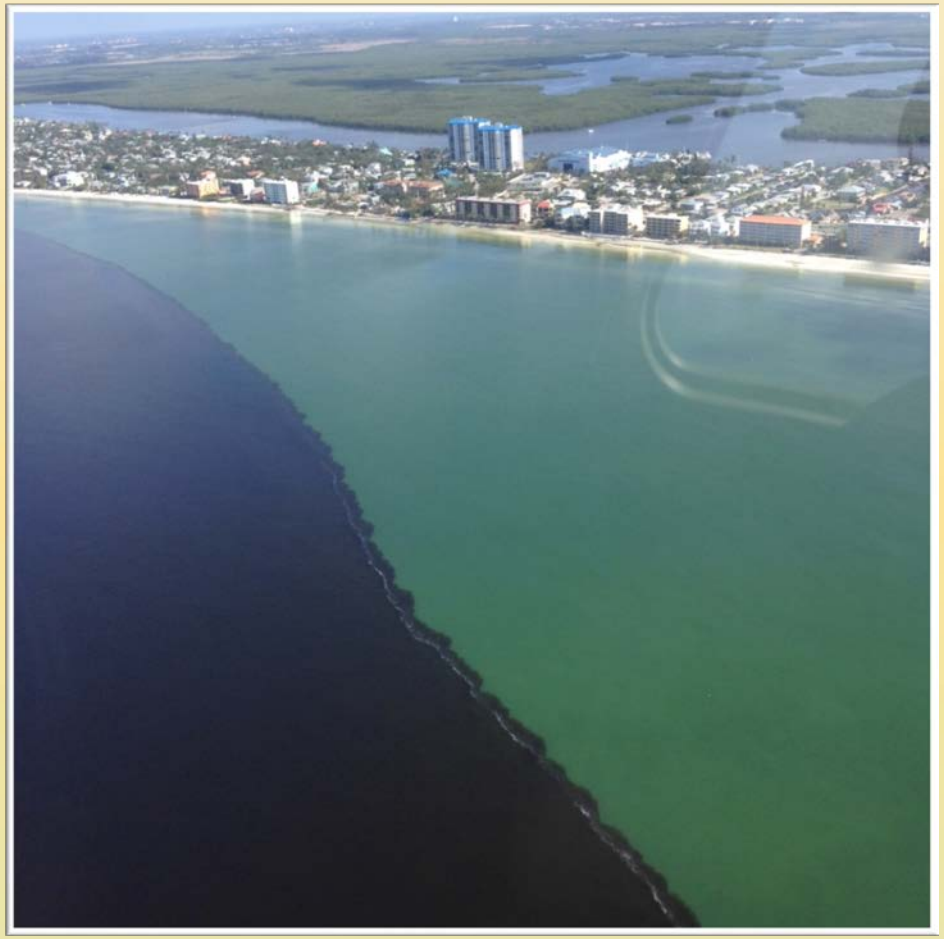
Impacts of Hurricane Irma
New Pass in Estero Bay

Coastal re-sculpting at New Pass on Estero Bay

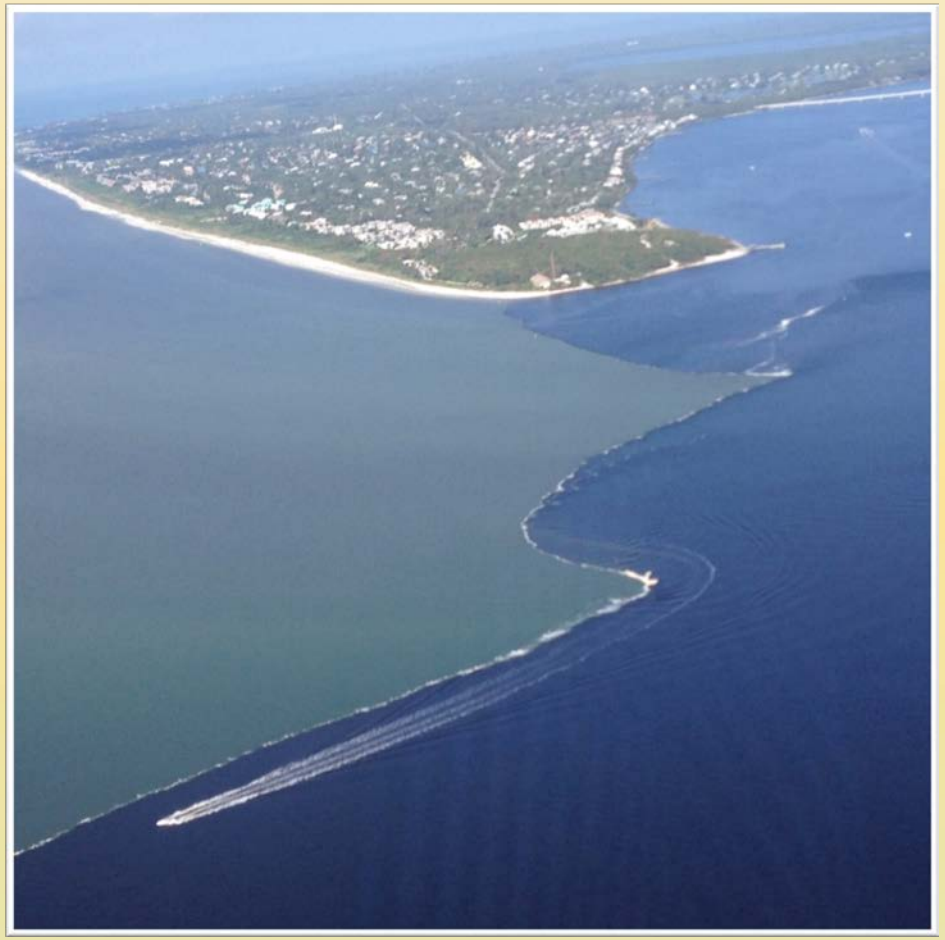
Photographs provided by:
James Douglass, PhD
Assistant Professor,
Florida Gulf Coast University

Caloosahatchee Estuary
Local Basin Watershed Discharges
(No Lake Okeechobee Releases)

Ft. Myers Beach



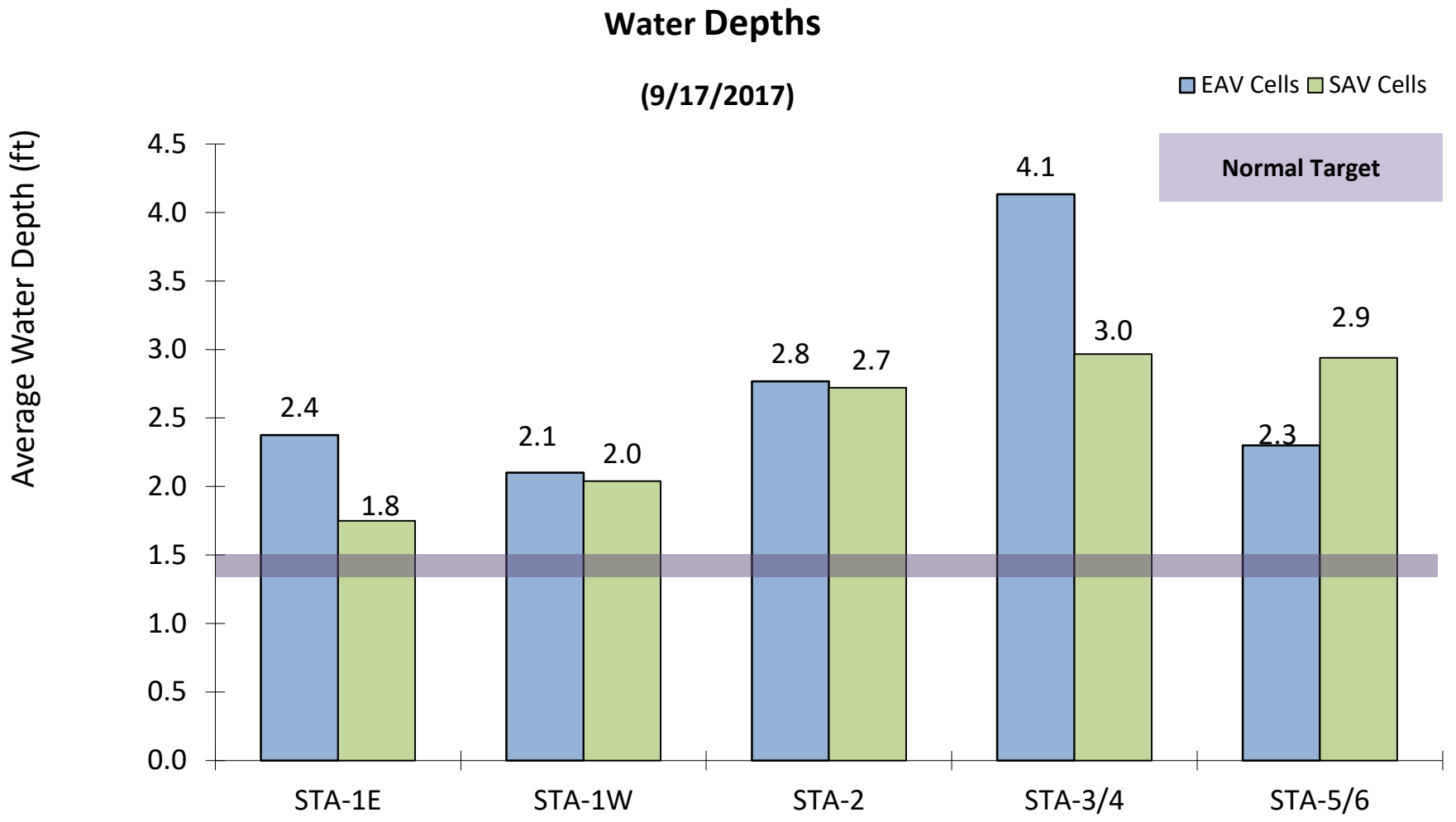
Sanibel Island



Photographs taken September 18, 2017

Everglades Stormwater Treatment Areas

- STAs treated ~200,000 ac-ft inflows associated with Hurricane Irma
- STA water depths after Hurricane Irma are above target but not as high as June depths

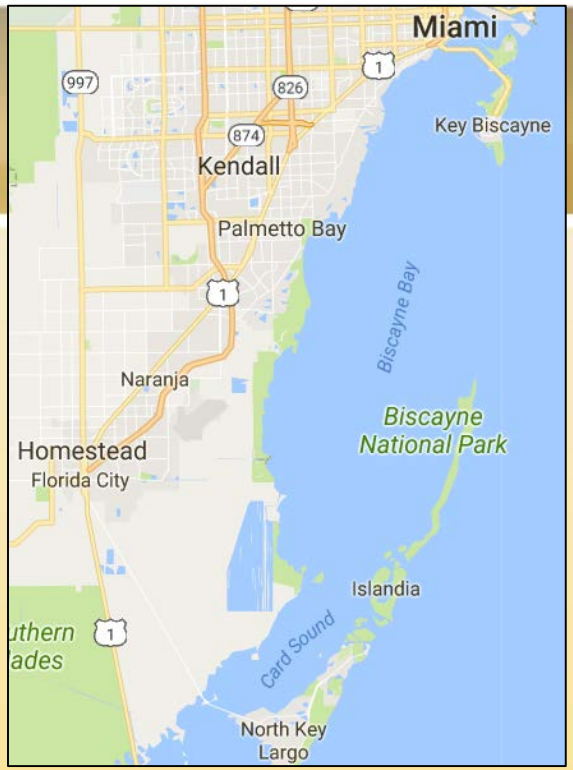


Includes preliminary data

Impacts from Hurricane Irma
Biscayne Bay / Card Sound

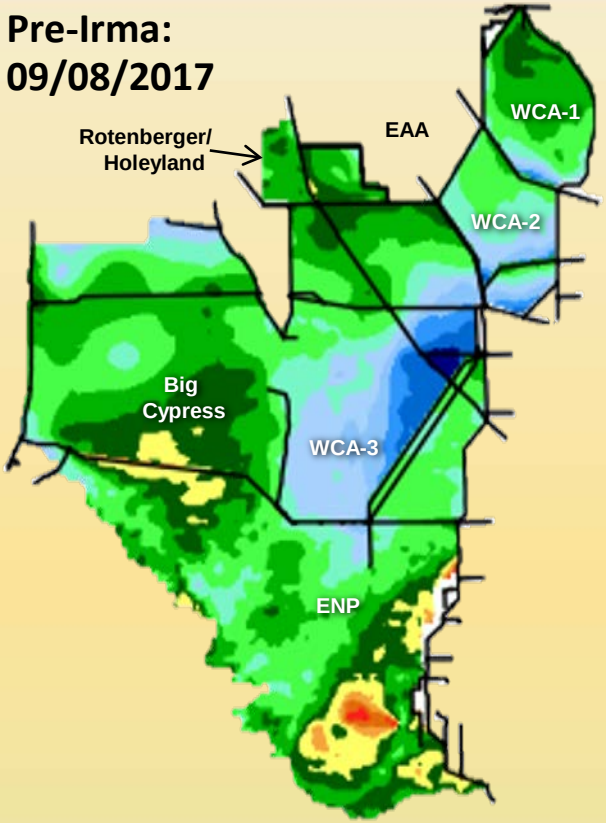
Patches of Seagrass ripped from roots and floating into Biscayne Bay from Card Sound

Photographs taken September 20, 2017

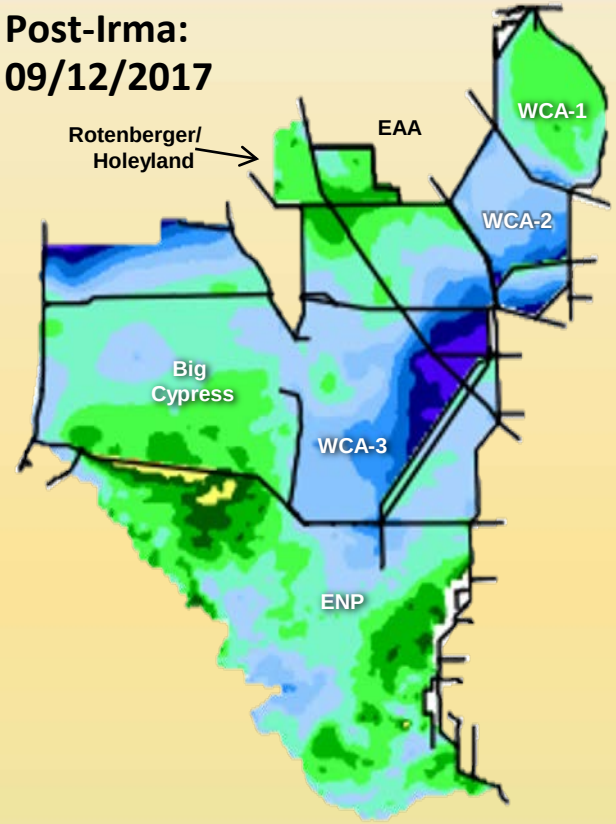


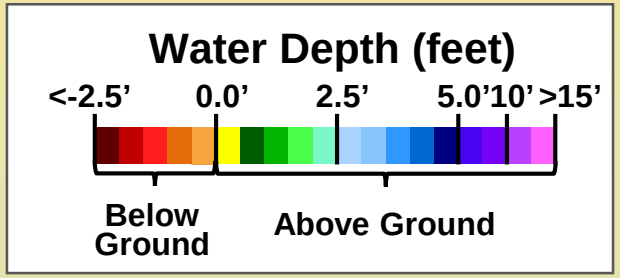
Everglades
Water Depth Maps – Hurricane Irma

Pre-Irma:
09/08/2017



Post-Irma:
09/12/2017





Flood waters

- Highest on record - new bridges allowed emergency ops

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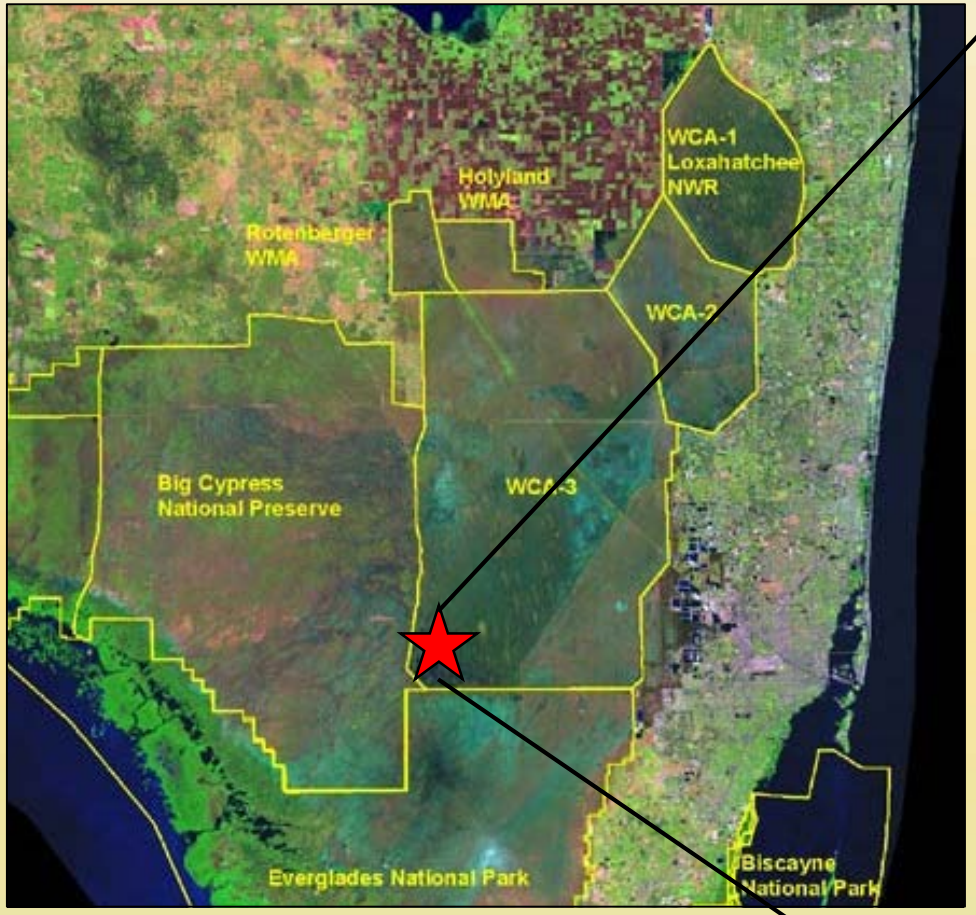
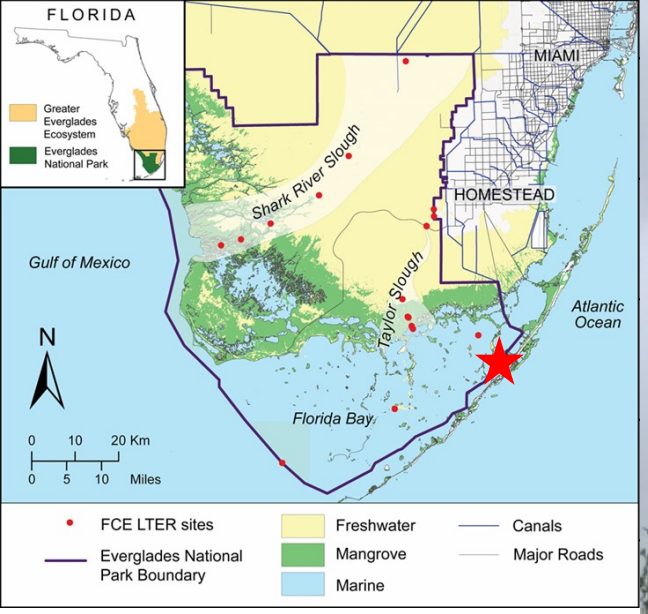
Photo: E. Gaiser

Wood Stork Colony, WCA-3A

Hurricane Damage



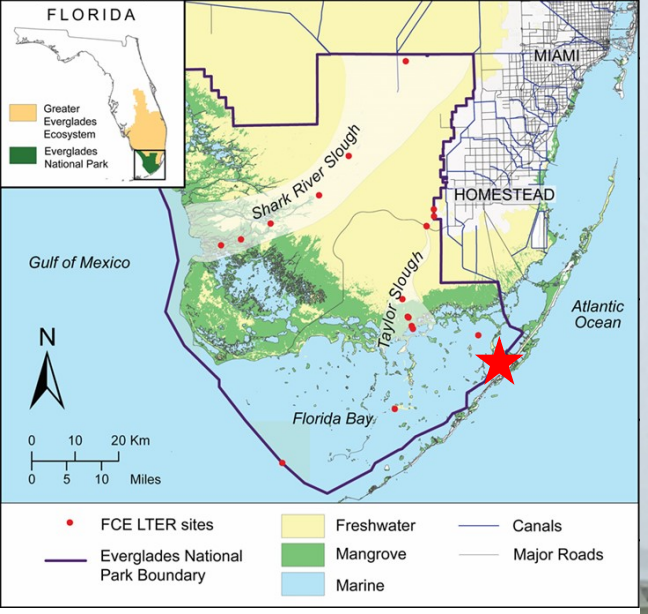


Florida Bay

09-10-17

Prior to the storm's passage there was no standing water between the Key Largo Interagency Science Center and Pelican Key in Florida Bay.

(photo courtesy of Tom Frankovich, FIU)



Florida Bay

09-10-17

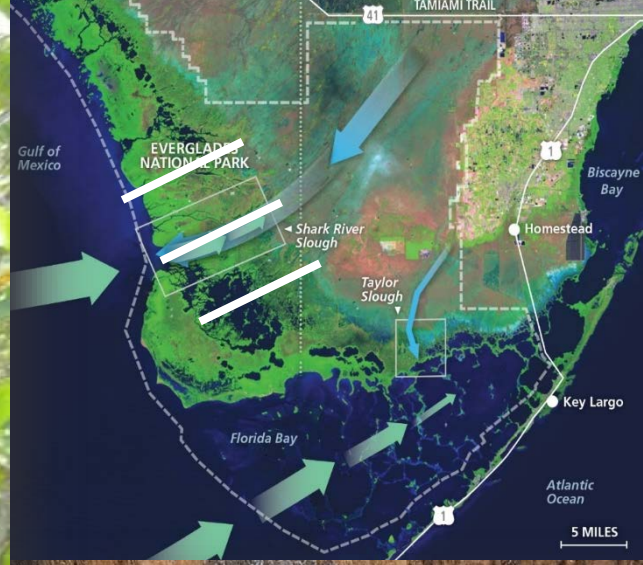
Prior to the storm's passage there was no standing water between the Key Largo Interagency Science Center and Pelican Key in Florida Bay.

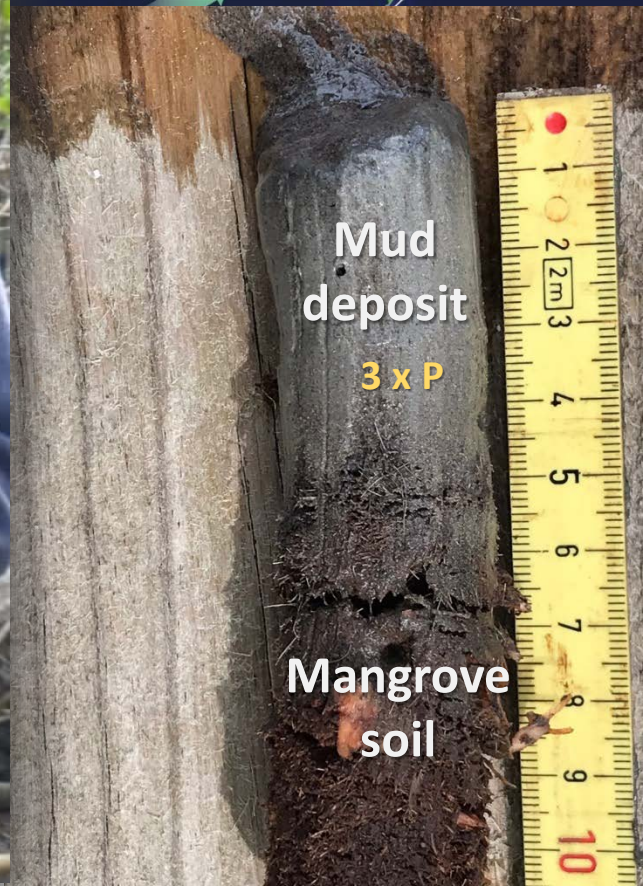
(photo courtesy of Tom Frankovich, FIU)

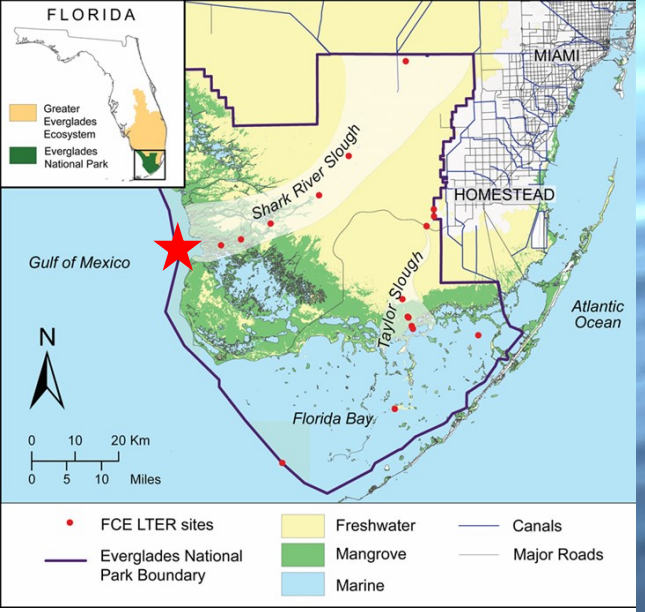
Storm Deposit

- Up to 10 cm of Gulf of Mexico mud
~ 100 years of forest accumulation

Photos: J. Briehgraupt







Shark River

We are tracking over 200 fish throughout the Everglades and documenting impacts on their movements and feeding behavior.

(photo courtesy of Jennifer Rehage, FIU)

Impacts of Hurricane Irma on the Everglades

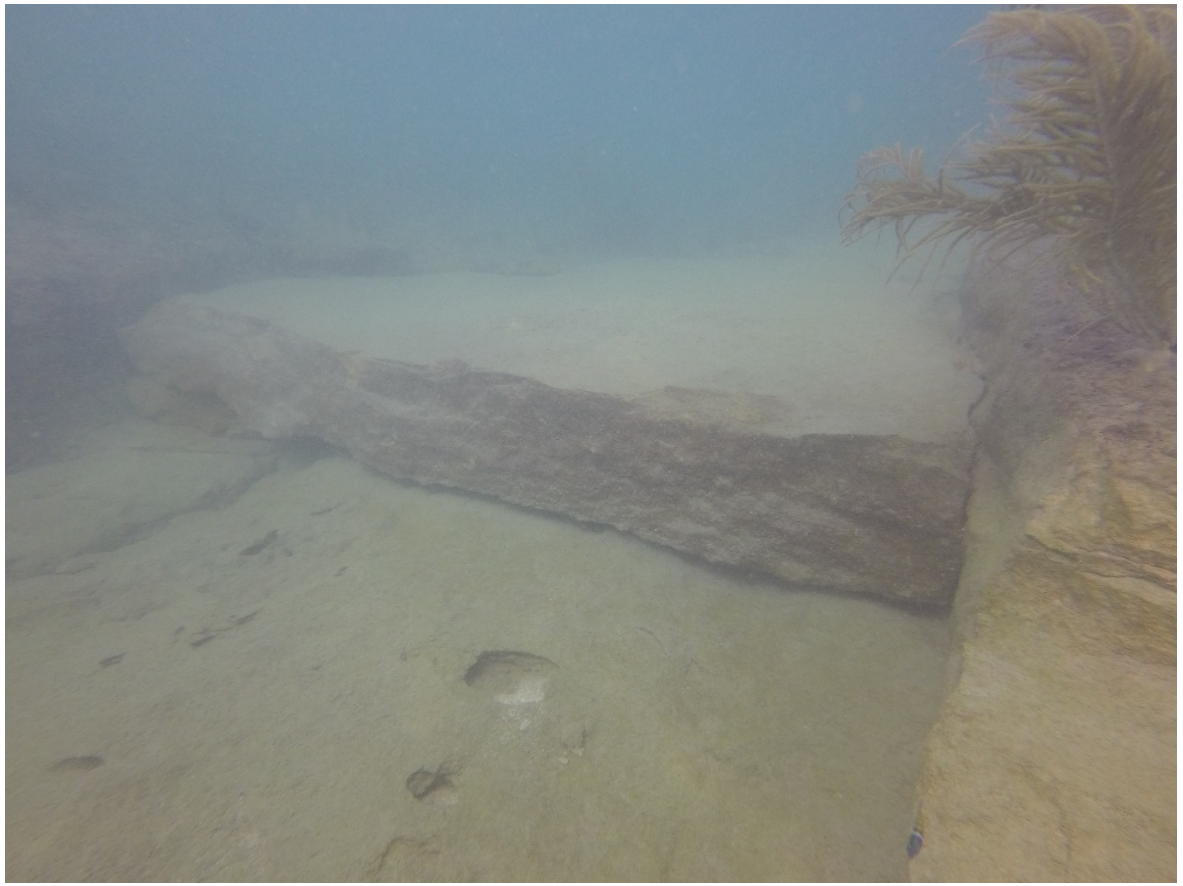
- **What was the extent of the storm surge?**
  - Mangroves significantly attenuated the >6 ft storm surge and trapped a storm deposit up to 10 km inland. We need to measure the extent of this deposit to improve storm surge models.
  - The storm deposit should facilitate forest recovery as it did after H. Wilma, and improve the forest's resilience to saltwater intrusion.
- **What was the impact of storm winds?**
  - The riverine forest was defoliated while the scrub forest remained intact. Windrows apparent throughout the marsh.
  - Over $150k in replacement costs requested to FEMA and funding agencies.
- **What was the impact of rainfall/runoff?**
  - We are assessing impacts of massive rainfall and runoff on water quality and coastal algal bloom dynamics.
  - Our consumer array should help track effects of the storm on mortality, behavior and feeding.

Offshore reefs

- Joanna Walczak, DEP
- Joss Voss, HBOI

Initial results

- Large slabs of Anastasia reef flipped over, killing thousands of Gorgonian corals
- Tires and other debris washed offshore
- Nearshore Staghorn coral patch scoured badly; none of the large coral colonies on the St. Lucie reef are alive anymore (already impacted by disease)
- NOAA, FDEP, FWC, and others are coordinating a Florida Reef Tract-wide assessment of storm injury and coral disease status
- Water quality samples are being collected monthly at 115 sites from Port of Miami to St. Lucie Inlet



Input from ECISMA (Everglades Cooperative Invasive Species Management Area)

- Tegus hunkered down. Even with high water levels, the population seems intact. May be starting early brumation
- Post-Irma debris movement may cause invasive plants and animals to appear in new areas. ECISMA may try to monitor debris storage sites
- Evidence that citizens surrendered invasive species pets pre-Irma knowing that they could not take them to shelters or on an evacuation
- Defoliation may increase visibility of invasive exotic species

Impacts on Snail Kites

- A total of 48 nests failed due to Irma; 44 of these nests in Lake Okeechobee, the others in WMAs and WCAs
- The nests were determined to be failed by a UF survey crew
- They estimated they observed about 25% fewer kites than on previous visit on Sept. 6
- Lots of dead willow and cattail, which are where nests were located
- Very high lake levels likely exacerbating impacts

Summary

- Irma had significant ecological impacts, not unexpected from a storm of this magnitude
- Major surge on SW coast and in Lake Okeechobee
- Surge on SW coast caused mangrove canopy damage, but deposited significant amounts of new sediment inland
- Hurricanes are a natural feature of south Florida and are a part of ecological succession. But, do human impacts affect the way the Everglades responds to natural events?

Source information

- South Florida Water Management District (https://www.sfwmd.gov/science-data/irma-eco-effects)
- Evelyn Gaiser and colleagues, Florida International University
- Marla Hamilton, Miles Meyer, US Fish and Wildlife Service
- James Douglass, Florida Gulf Coast University
- Joanna Walczak, Florida Department of Environmental Protection
- Joss Voss, Harbor Branch Oceanographic Institute
- Everglades Cooperative Invasive Species Management Area