



Institute of
Environment

Effects of rising seas and recent hurricanes on coastal wetlands in the lower Florida Keys

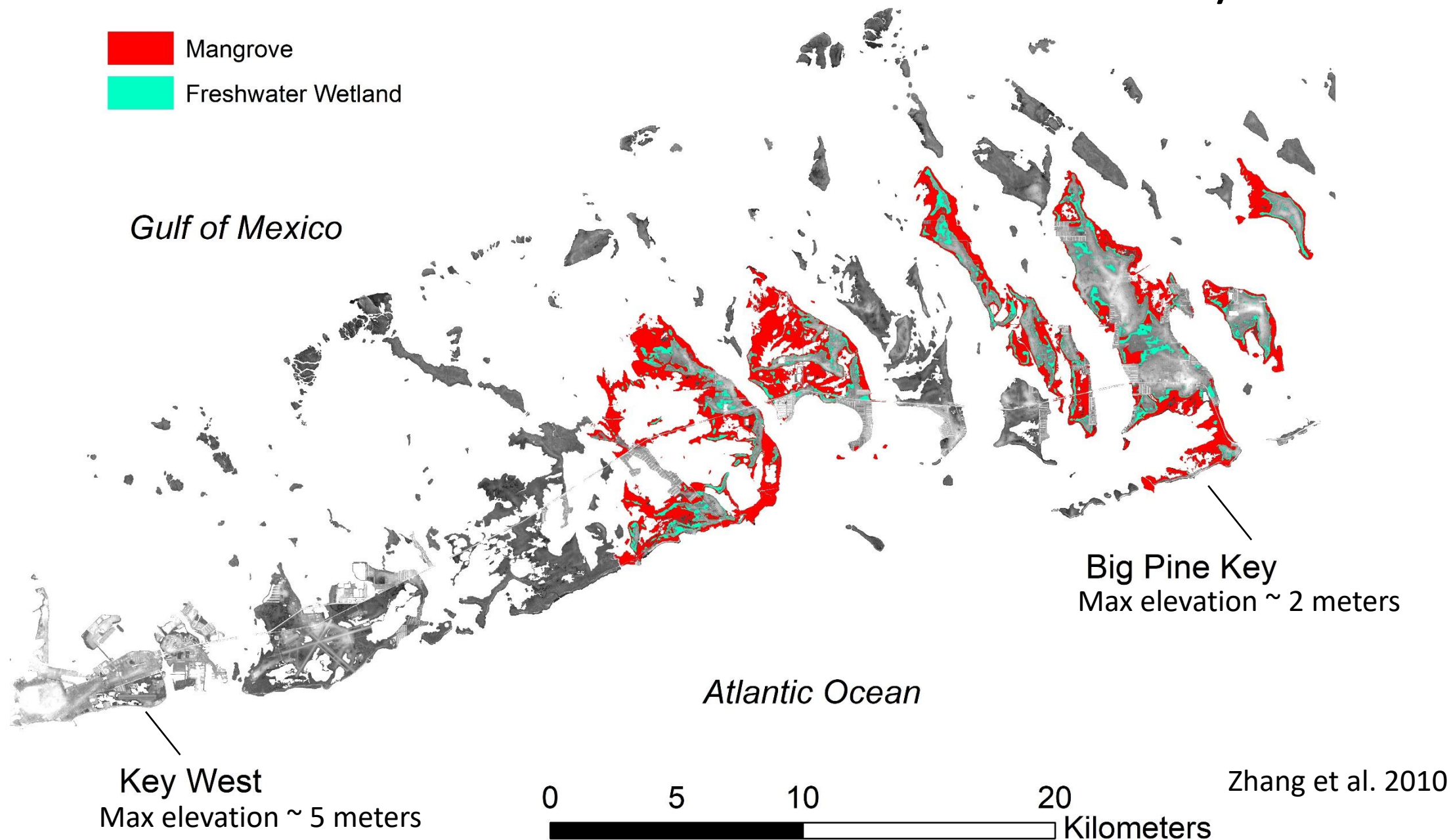
Danielle E. Ogurcak and Michael S. Ross
Florida International University, Miami, FL



Ocean Imaging

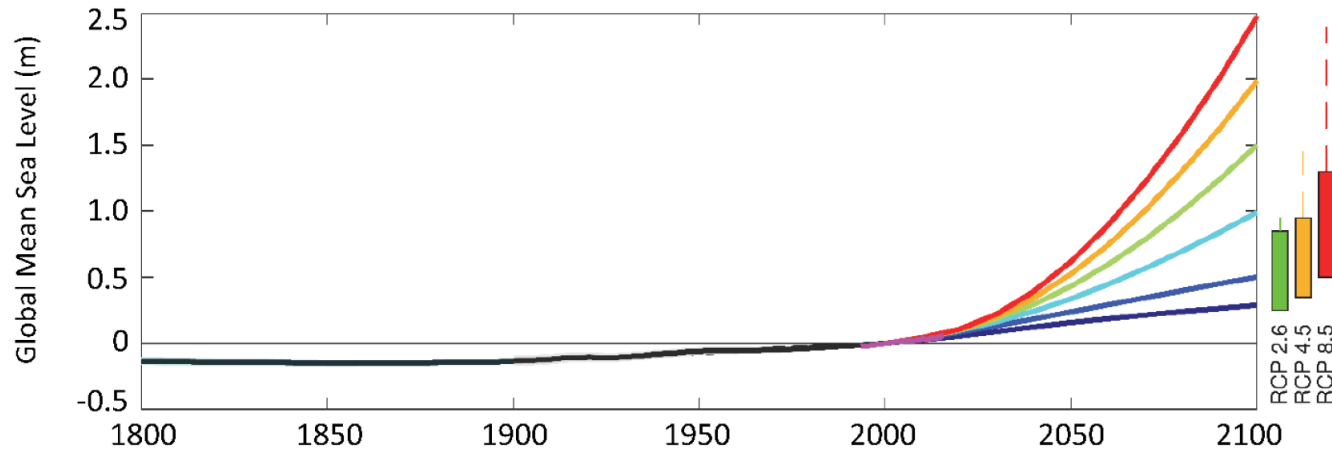


Coastal Wetlands on 8 of the lower Florida Keys



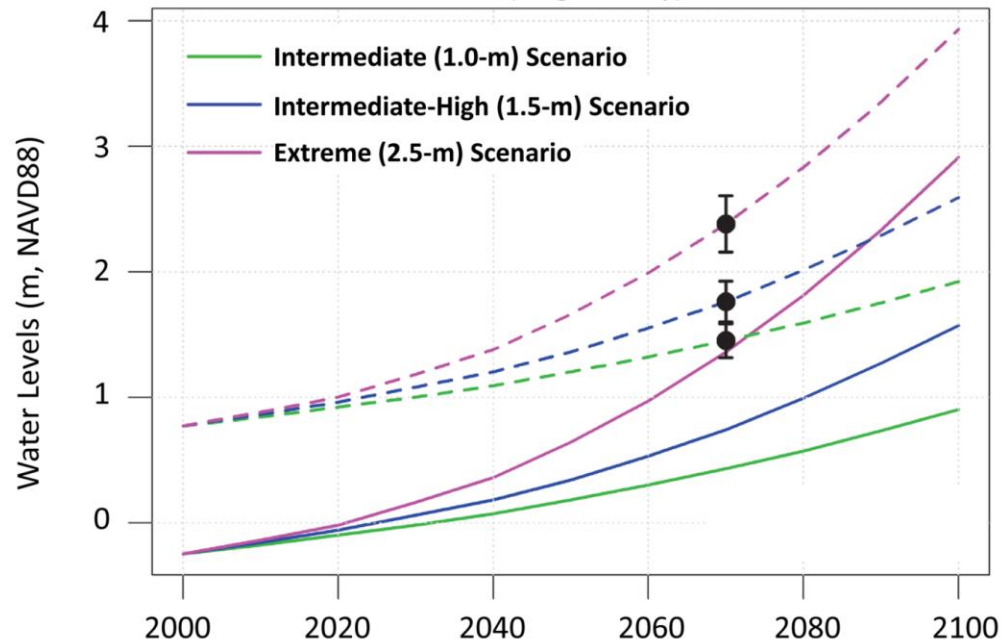
Predicted increases in sea level rise and frequency of Cat 3 - 5 hurricanes in the 21st century

NOAA Global Mean Sea Level (GMSL) Scenarios for 2100

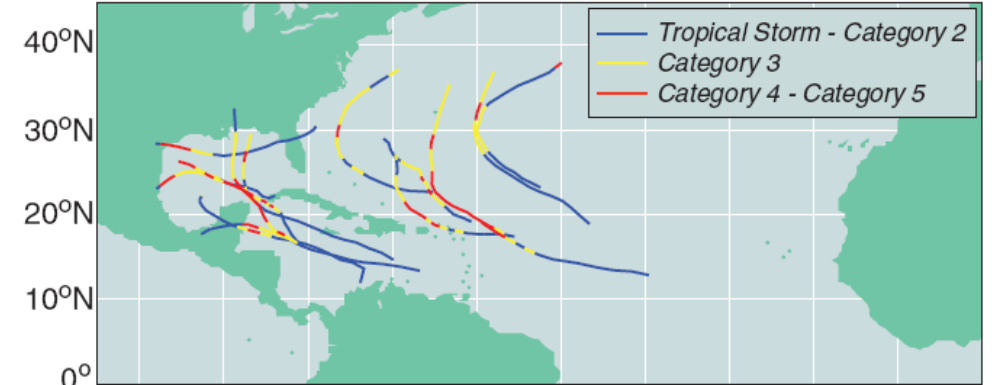


RSL Rise and Extreme Water Levels:
Miami (Virginia Key), FL

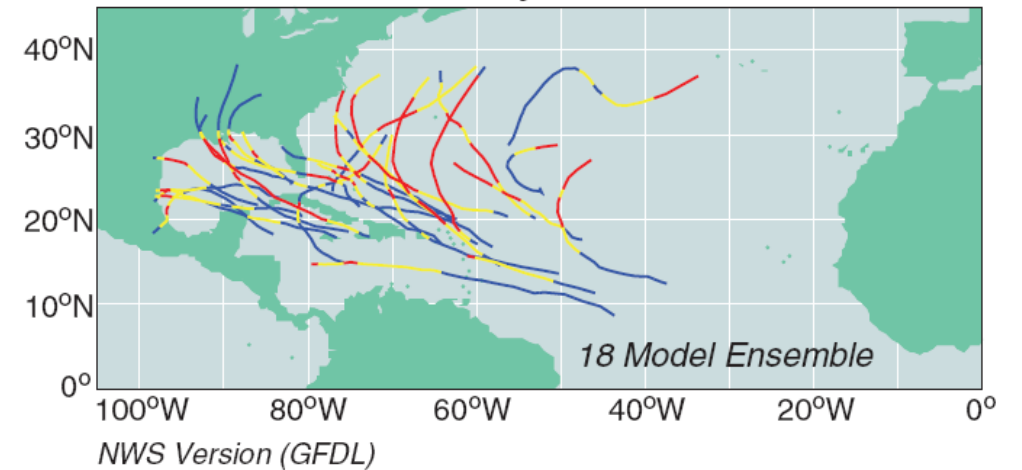
Sweet et al. 2017



Control Climate



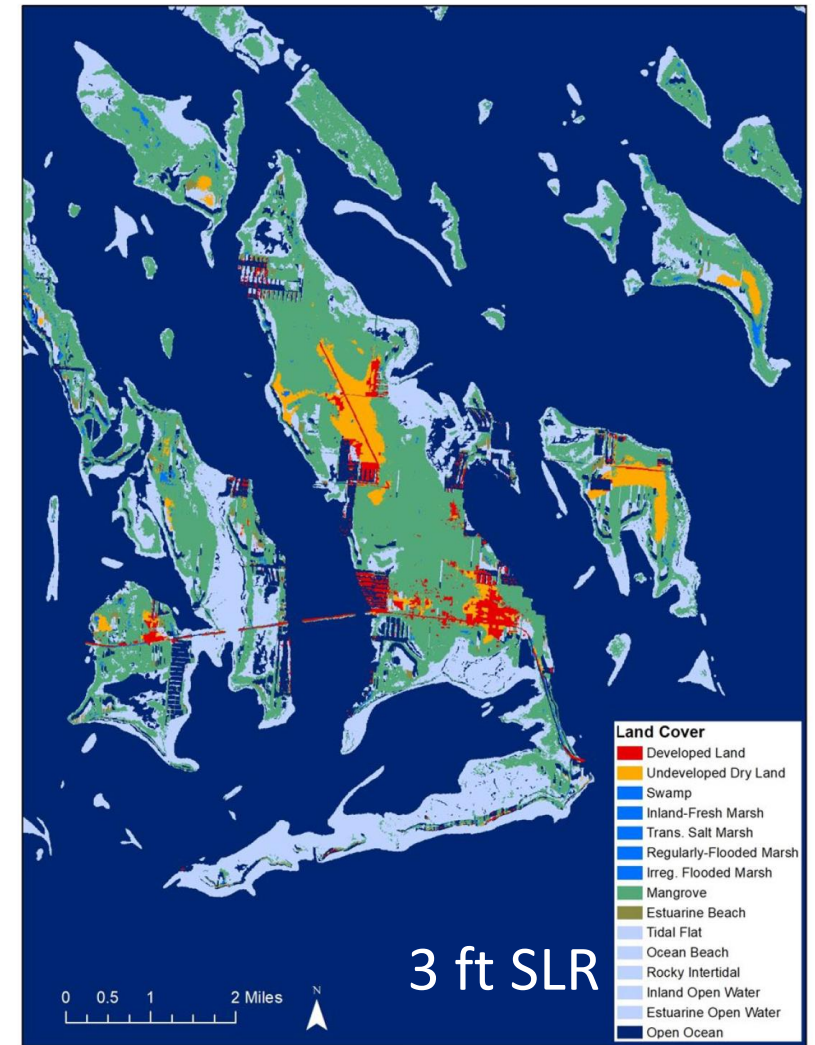
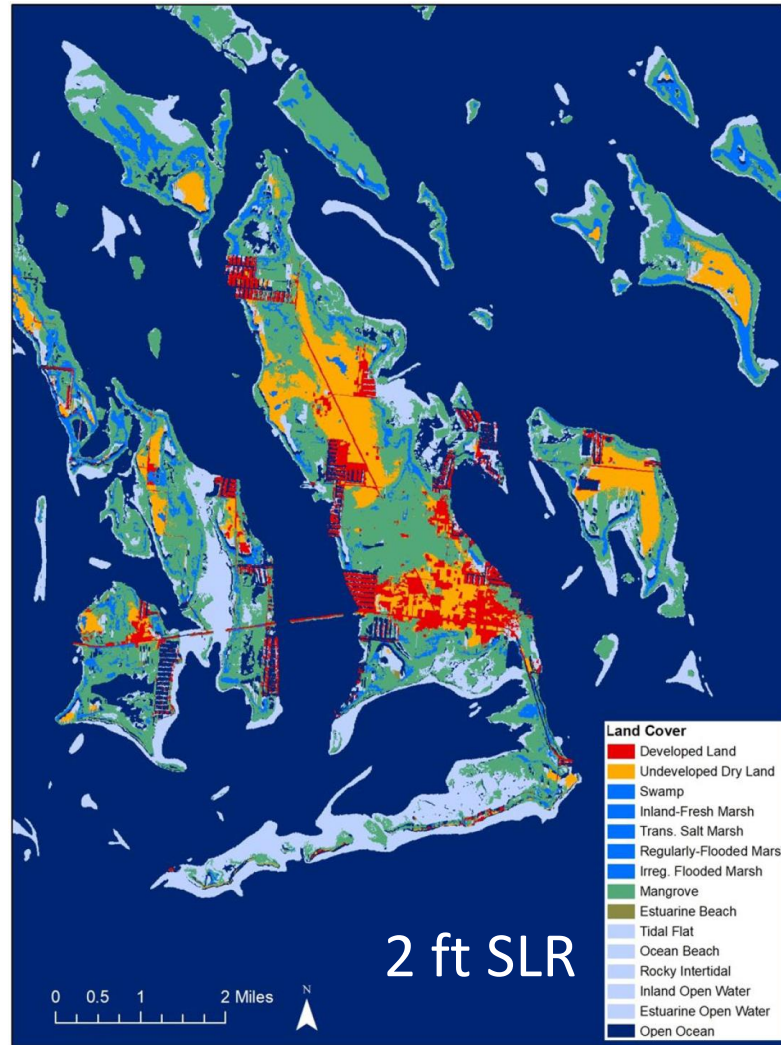
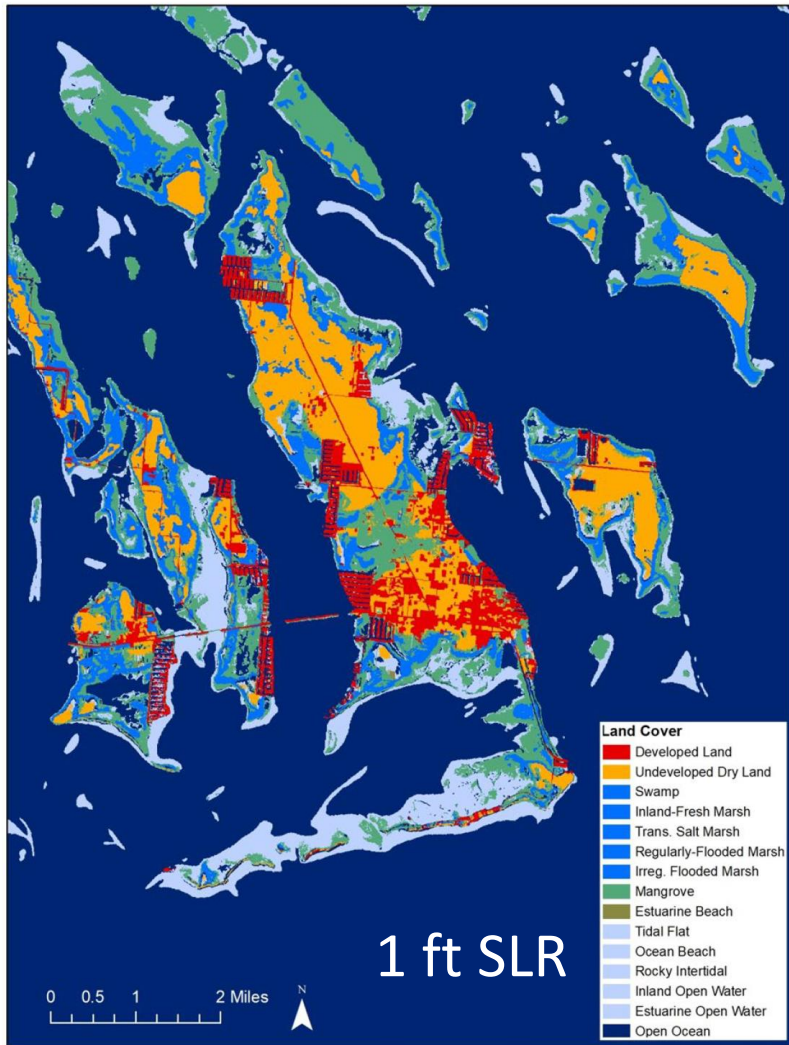
Late 21st Century Warmed Climate



Bender et al. 2010

2018 SLAMM Modeling Results

Warren Pinnacle Consulting, Model runs at Stetson University



Miller & Traxler, USFWS, GEER 2019

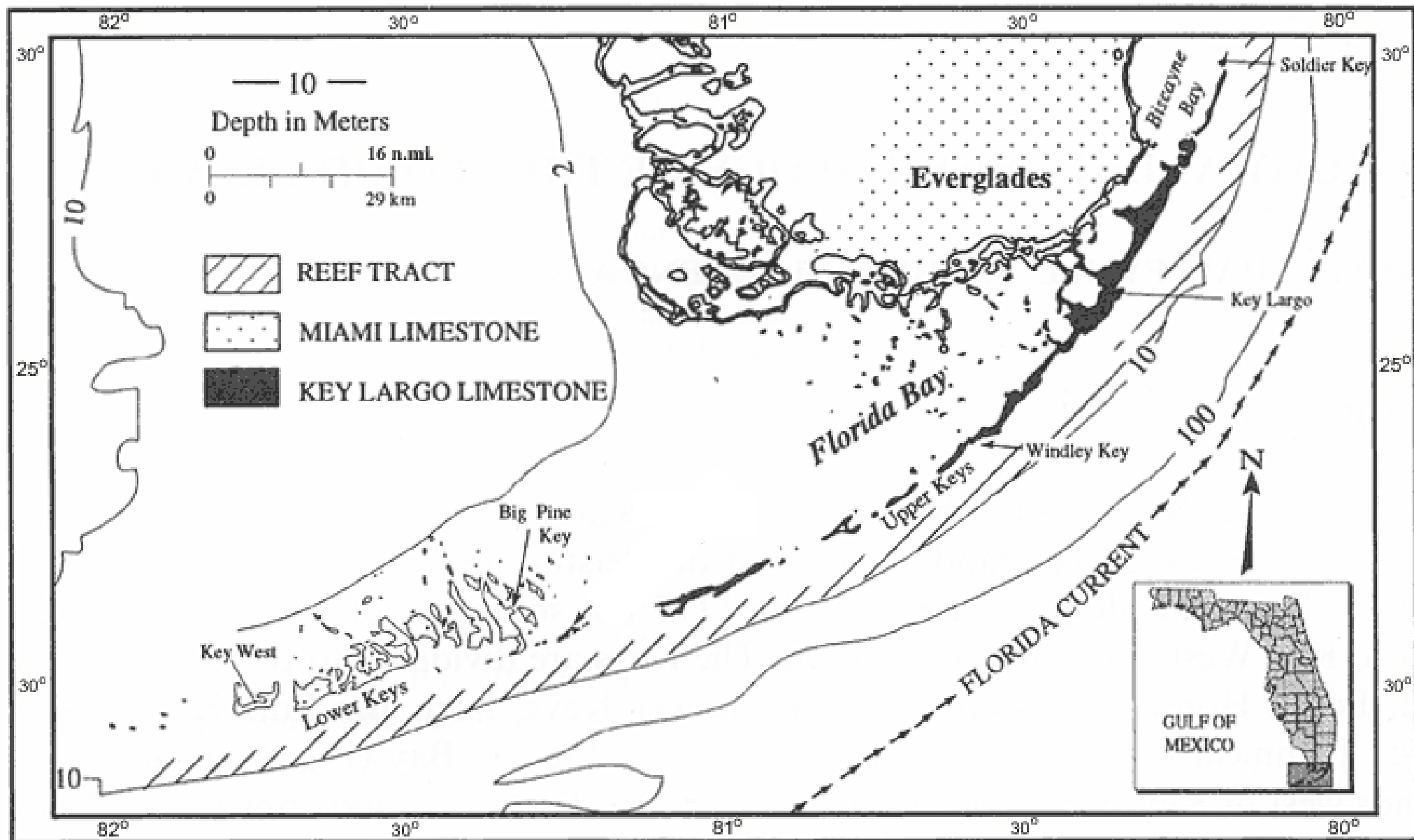
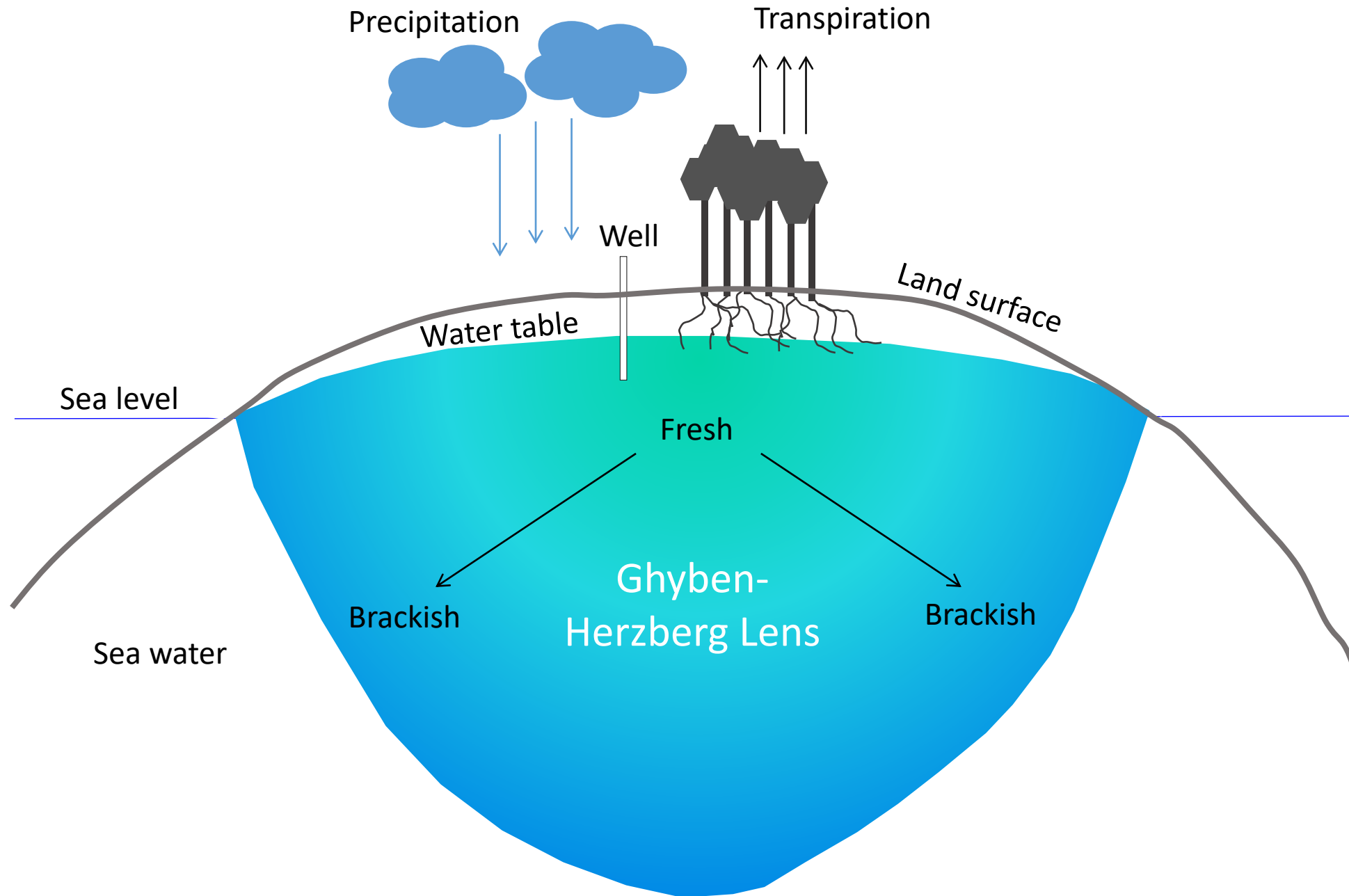
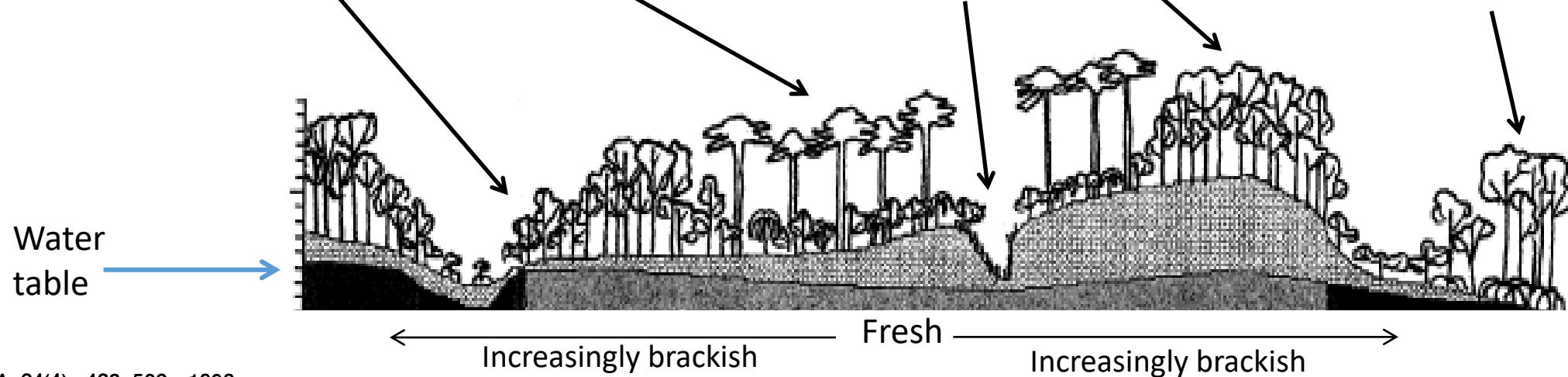


Fig. 5-1. Map showing the Florida Keys, their lithology, and location relative to mainland and reef tract. (Halley et al. 1993)

Conceptual Model of Freshwater Lens



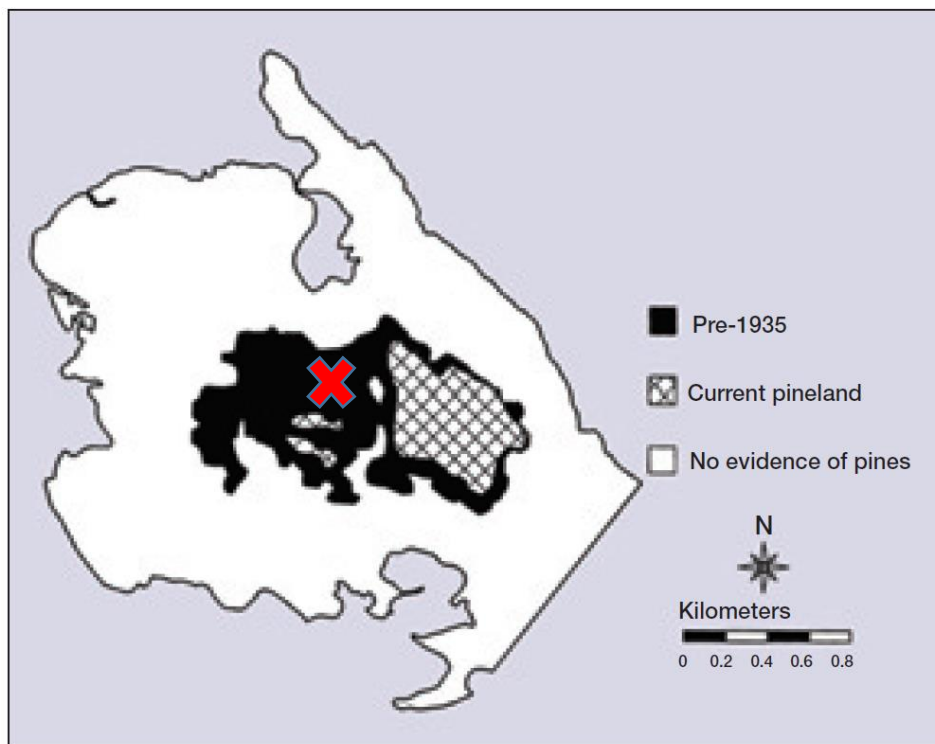
Coastal Forest Communities of the Lower Florida Keys



BIOTROPICA 24(4): 488–502 1992

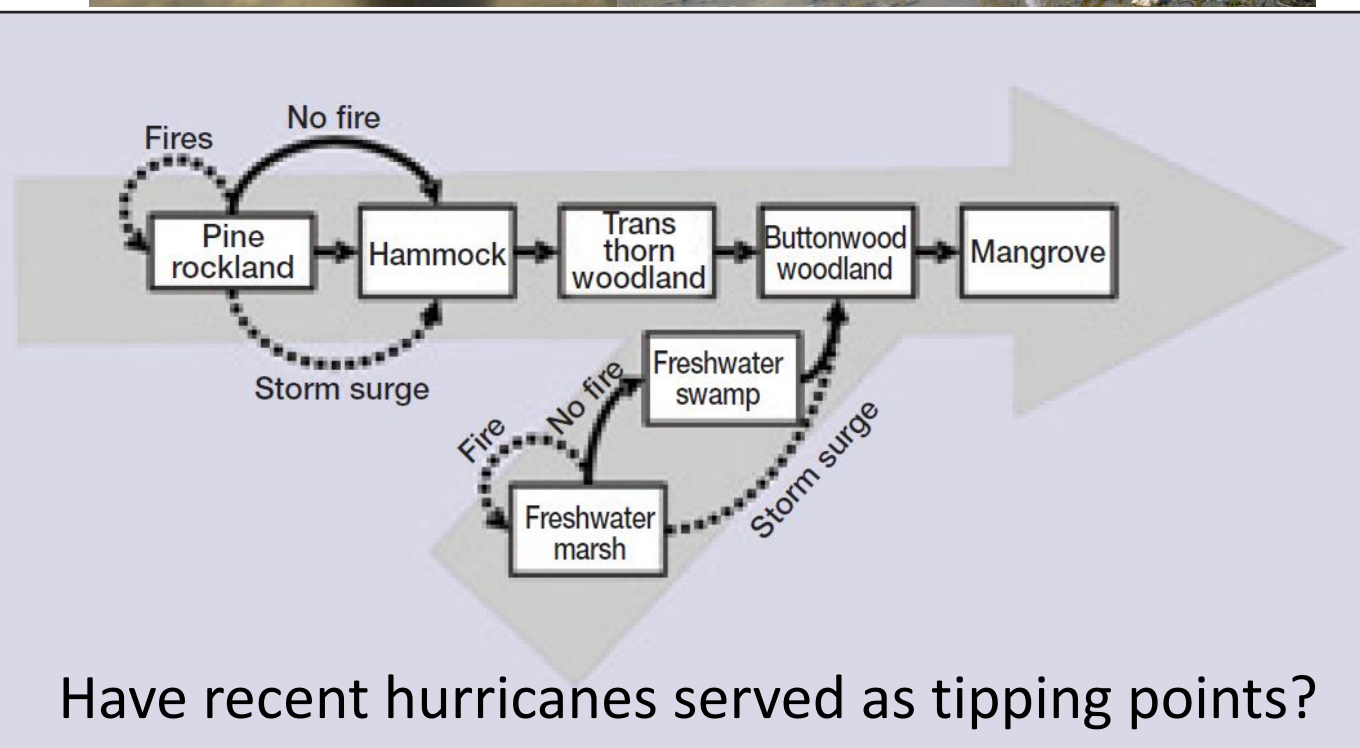
Ecological Site Classification of Florida Keys Terrestrial Habitats¹

Michael S. Ross, Joseph J. O'Brien, and Laura J. Flynn

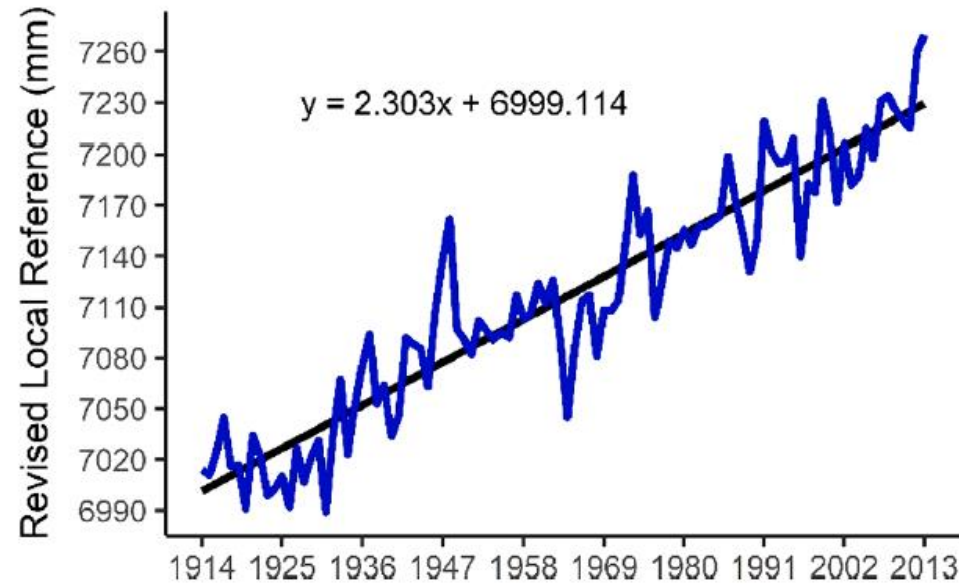


Disturbance and the rising tide: the challenge of biodiversity management on low-island ecosystems

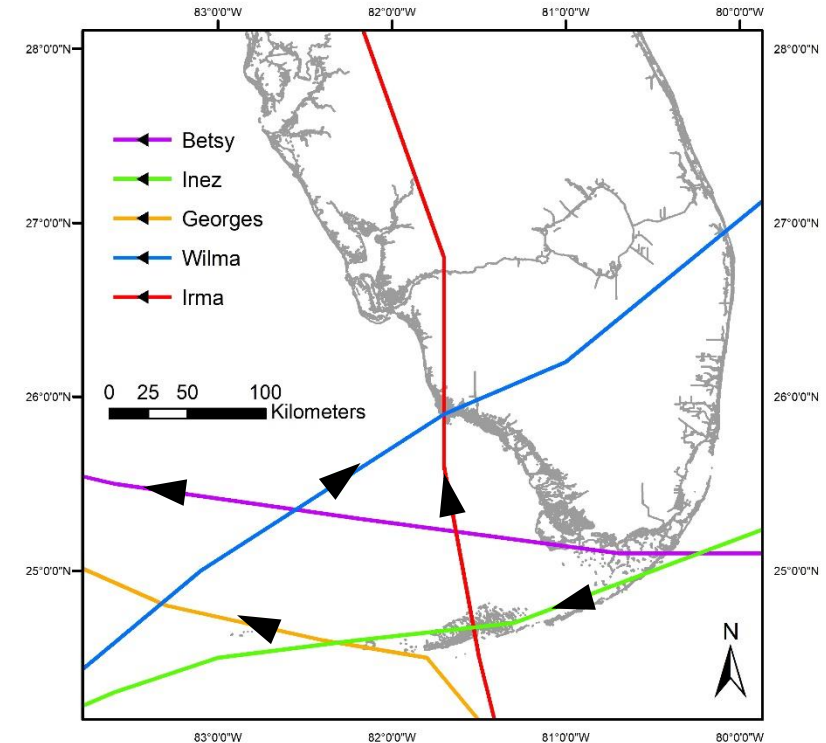
Michael S Ross^{1*}, Joseph J O'Brien², R Glenn Ford³, Keqi Zhang⁴, and Anne Morkill⁵



Annual Sea Level at Key West Tide Gauge (1913 – 2013)



Major Hurricanes Impacting the Lower Keys (1965 – 2019)



Betsy 1965: Cat 3 storm at landfall in Key Largo, 125 mph winds on Big Pine Key, surge of 2.7 m documented at Sugarloaf Key

Inez 1966: Cat 3 storm, with 150 mph winds estimated on Big Pine Key, above normal tides (1.5m)

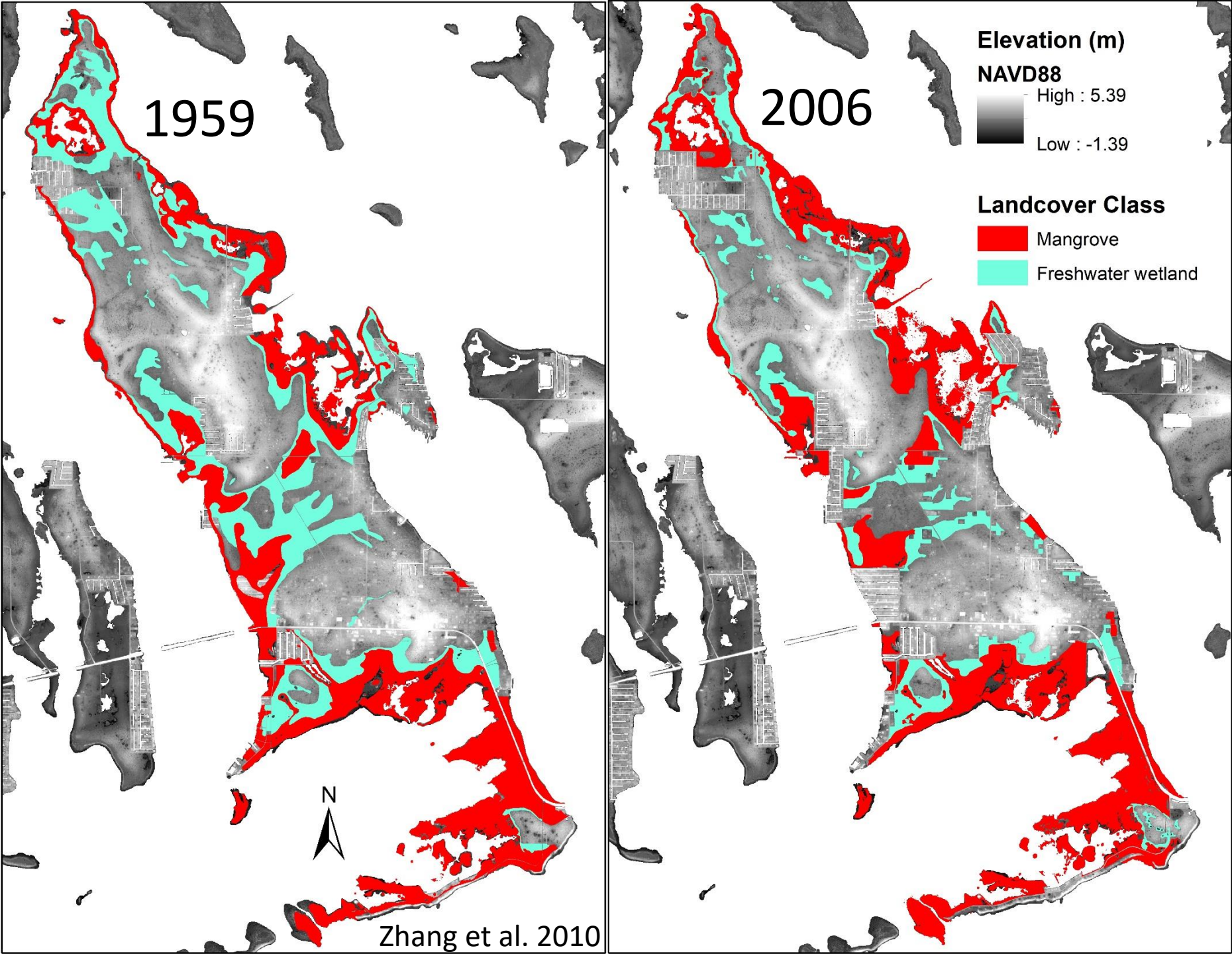
Georges 1998: Cat 2 storm at landfall in Key West, 90-100 mph winds, storm surge from Atlantic of 5 - 6 ft

Wilma 2005: Cat 3 storm at landfall near Naples, 110mph winds , 2 storm surges – first from the Atlantic of 4 - 5 ft, second from Florida Bay of 6 - 8 ft, highest surge in Florida Keys since Hurricane Betsy (1965) (NOAA NWS).

Irma 2017: Cat 5 storm at landfall in Cudjoe Key, 130 mph winds, storm surge 2.4 m above MHHW (Cangioli et al. 2018)

Big Pine Key

Landcover Class	Change in acres 1959 to 2006
Mangrove forest	282.56
Mangrove scrubland	-219.20
Freshwater marsh	-106.21
Supratidal scrub	-463.29



Hurricane Wilma (October 24, 2005) persistent impacts

Pine mortality on Cudjoe Key as
seen from black mangrove scrub

2010



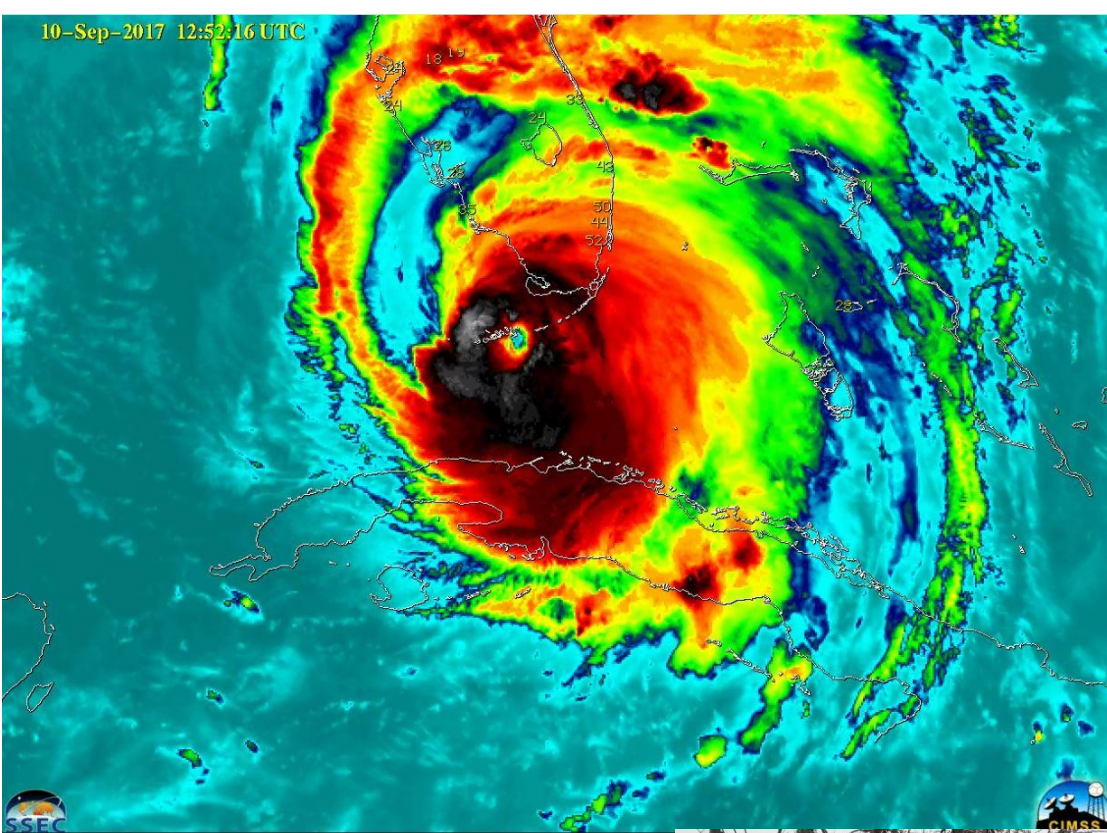
Buttonwood mortality in supratidal
scrub wetland on Sugarloaf Key

2010



10-Sep-2017 12:52:16 UTC

Hurricane Irma (September 10, 2017)



GOES-16 ABI Infrared
imagery of Hurricane Irma
landfall in the Florida Keys
(cimss.ssec.wisc.edu)




Irma Track

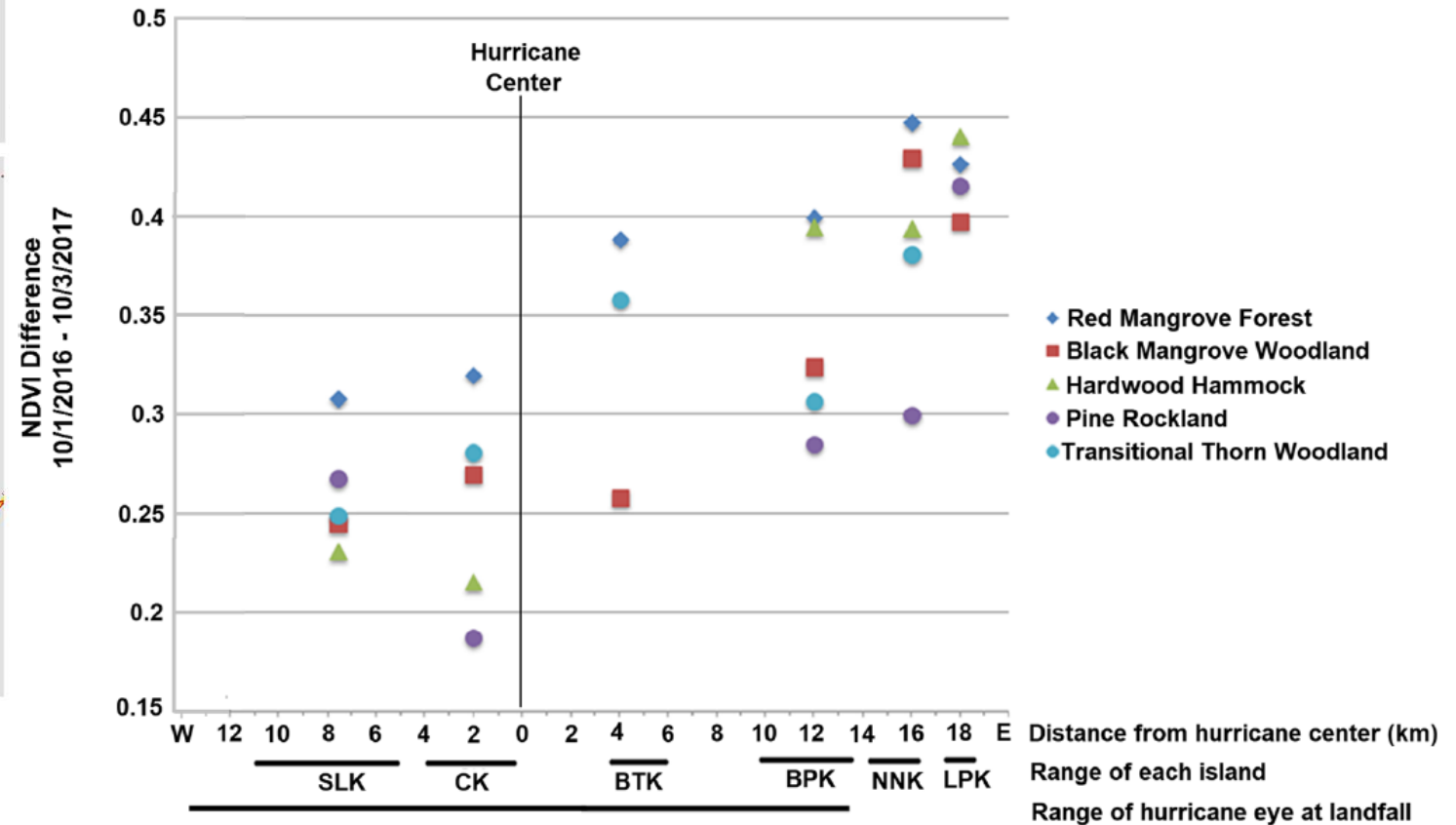
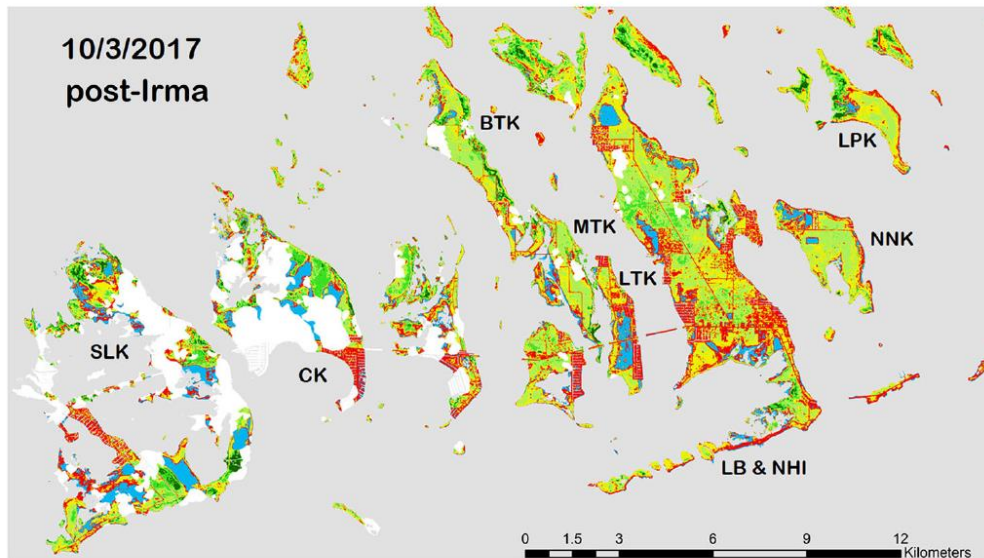
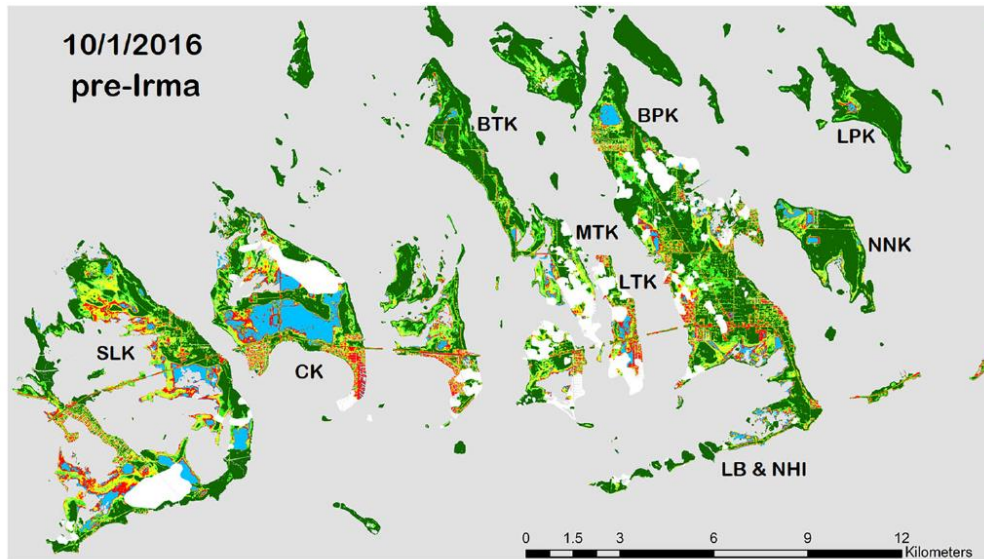
Key West

Big Pine Key



Satellite Image-Based Time Series Observations of Vegetation Response to Hurricane Irma in the Lower Florida Keys

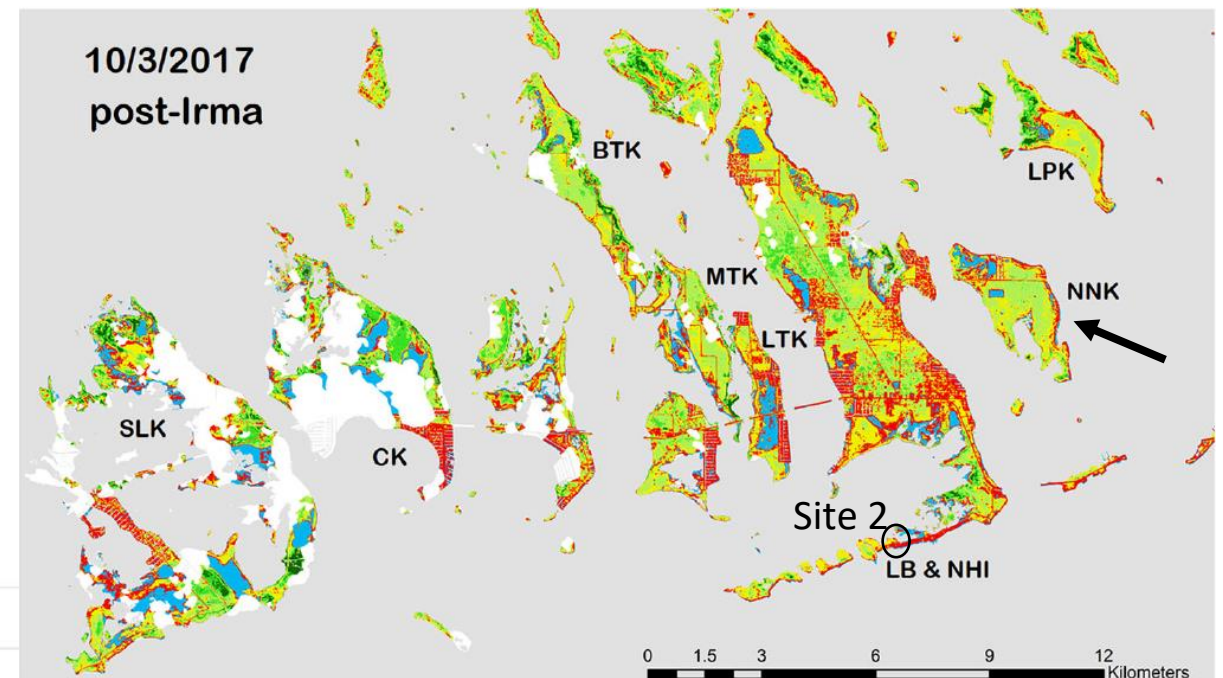
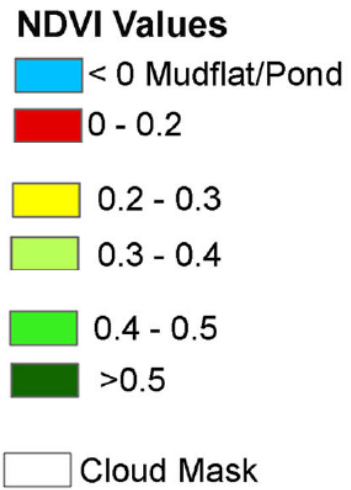
Jan Svejksky¹  · Danielle E. Ogurcak² · Michael S. Ross³ · Alex Arkowitz¹



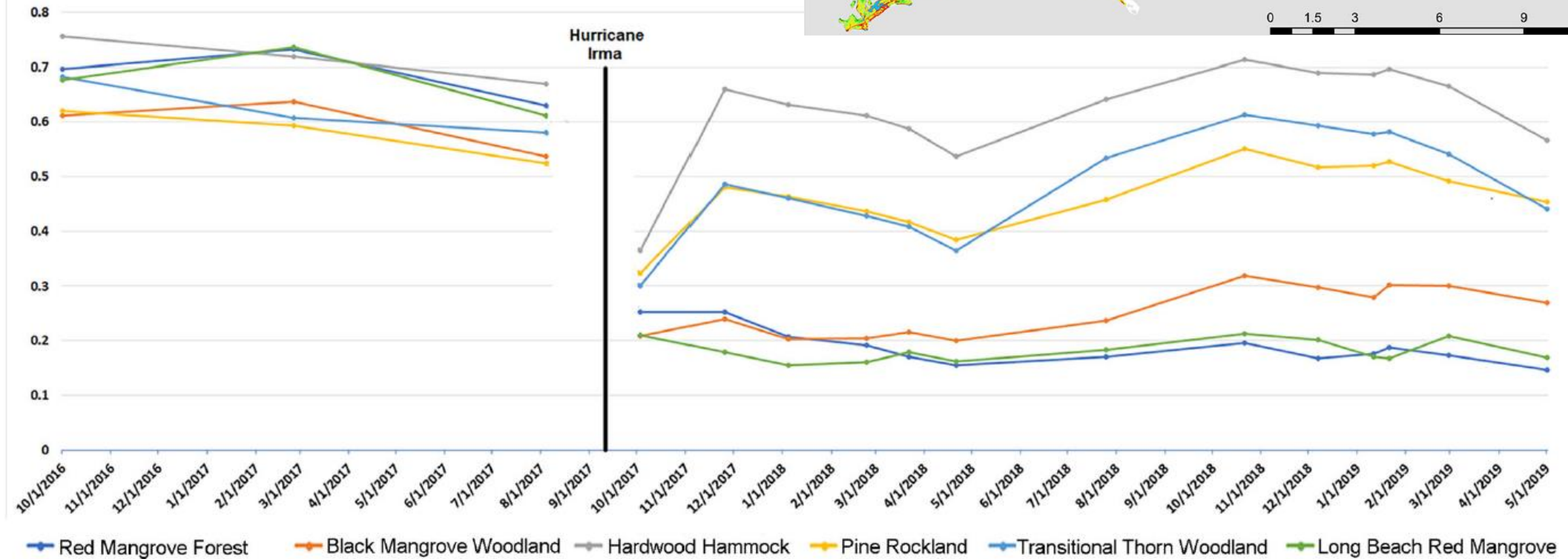


Site 2

Svejkovsky et al. 2020



Mean NDVI per vegetation class on No Name Key



Mangrove colonization of upland forests?



Next Steps:

- Continued monitoring of recovery of established mangrove forests and scrublands
- Tree-level mapping of mangrove presence within other community types in lower Keys

An aerial photograph of a coastal region. A winding river flows from the top center towards the bottom right, eventually meeting the ocean. The river's banks are lined with dense, dark green vegetation. To the right of the river, there is a large, irregularly shaped area of land covered in thick, reddish-brown vegetation, possibly mangroves. The ocean is visible on the left and right sides of the image, with a lighter blue-green hue. A thin, straight line, likely a road or railway, runs vertically through the center of the image, crossing the river.

Thank you!

For more information contact:

Danielle Ogurcak (dogurcak@fiu.edu)

Michael Ross (email: rossm@fiu.edu)

Jan Svejksky (email: jan@oceani.com)

Keqi Zhang (email: zhangk@fiu.edu)