

From Arboreal to Benthic Communities: The ABCs of land-to-ocean biodiversity observations



Land to Ocean Biodiversity Observations



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Coastal and freshwater ecosystems support some of the highest biodiversity in the world



Over 75% of aquatic ecosystems are **endangered**

Our **life** and **economy** depend on freshwater supply and healthy coastal ecosystems



South Florida Water Management District

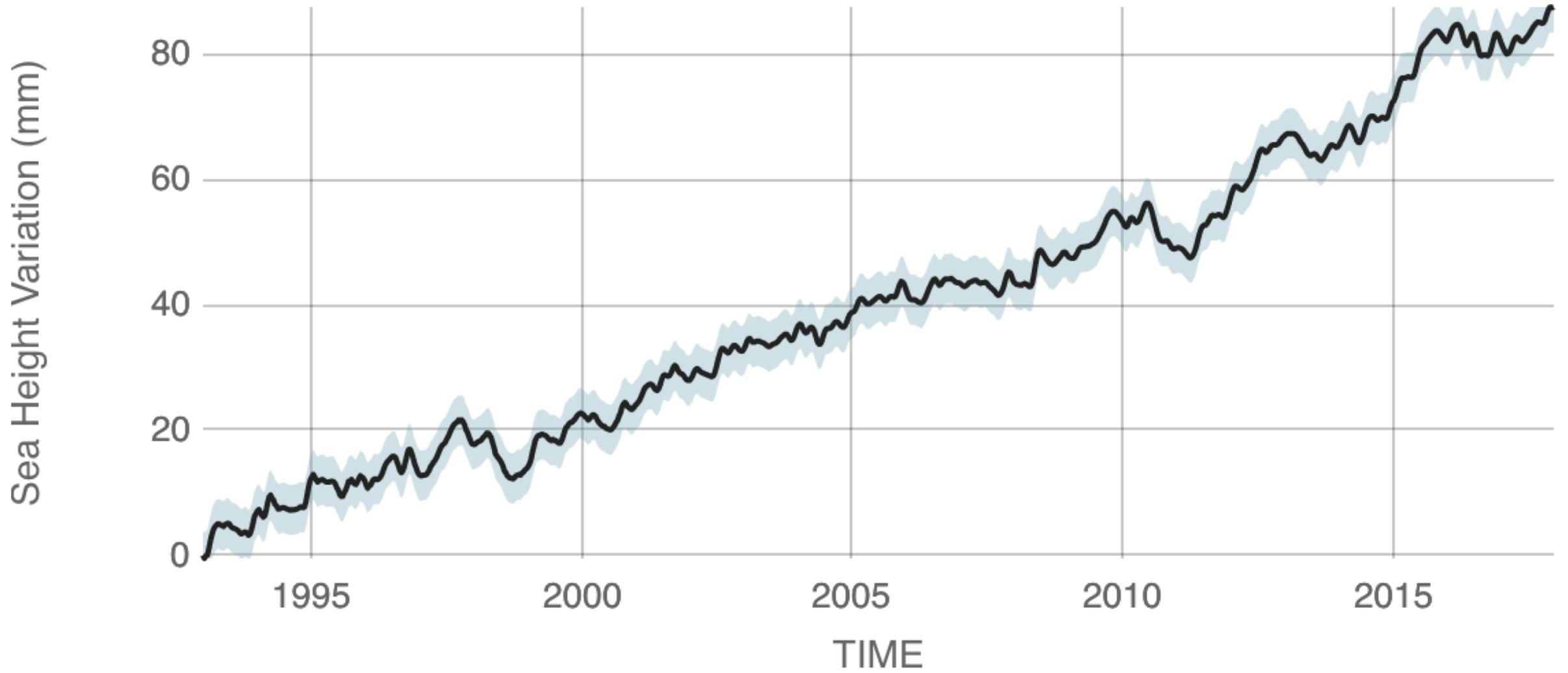


National Park Service



One billion more people by 2030

Another billion more by 2050



Source: climate.nasa.gov

[Nasa.climate.gov]



The ABCs of land-to-ocean biodiversity observations

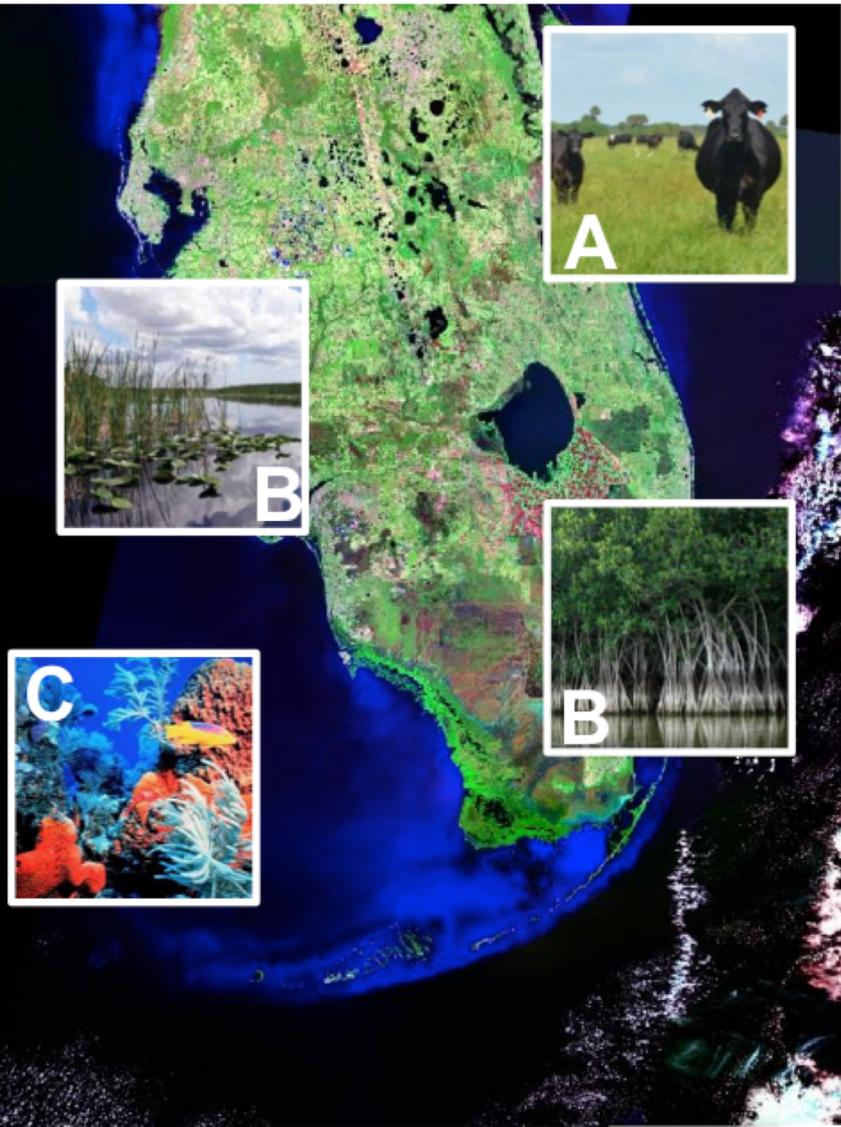
Scoping study for land-to-ocean airborne remote sensing campaign

- Imaging spectrometers
- LiDAR
- Other...?

Airborne missions designed to explicitly address the needs of **linked** terrestrial, aquatic, and benthic ecological research

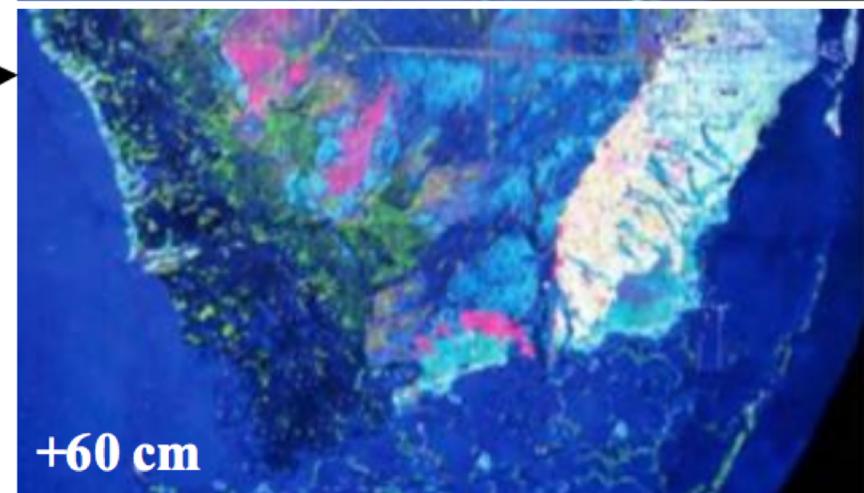
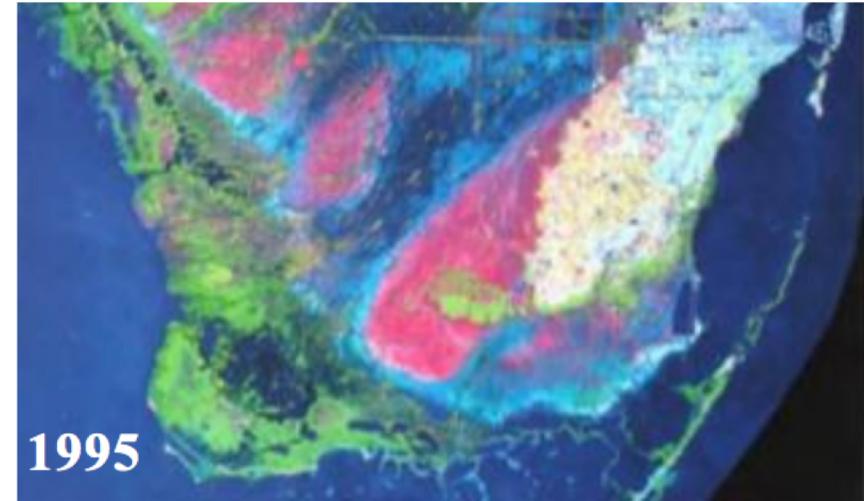
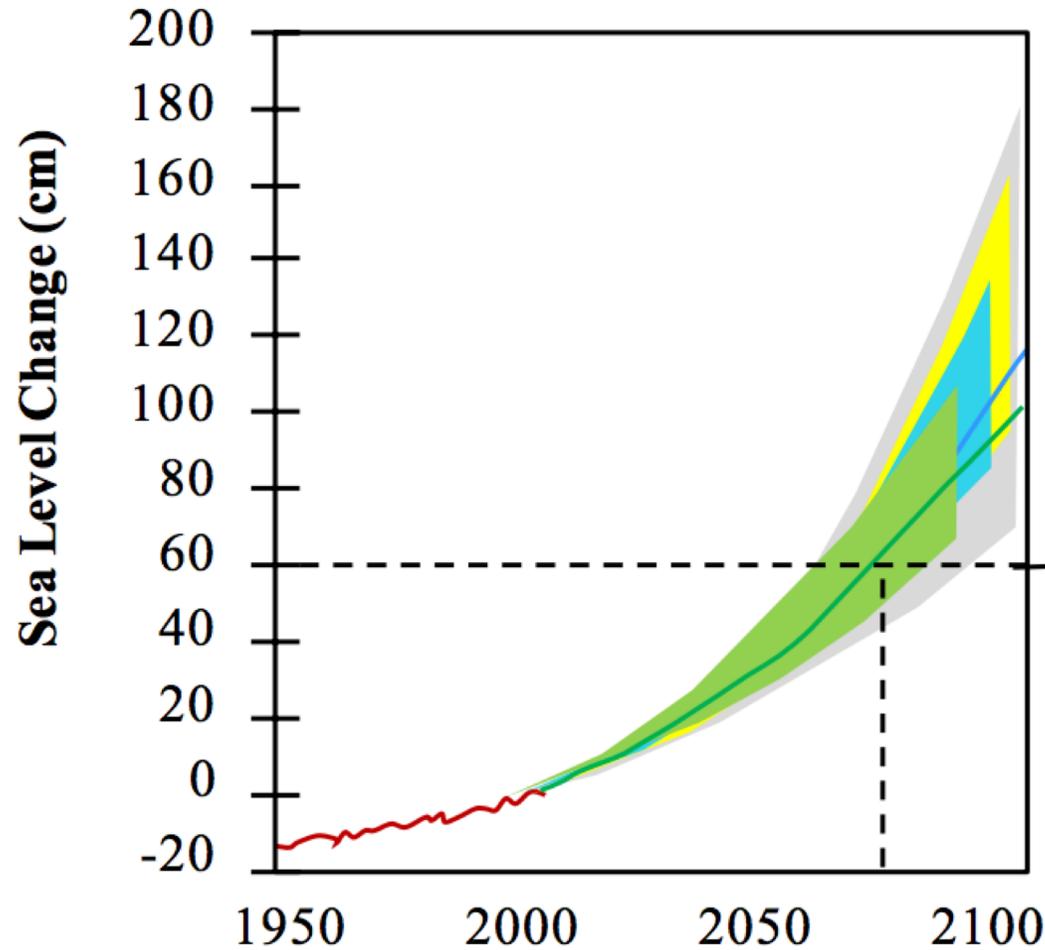
- Observations strategies
- Calibration correction & algorithm requirements
- Complementary field & satellite data, numerical models & simulations

South Florida: A Major Sub-Tropical Land-Ocean Domain



- Substantial ecological, community, taxonomic and genetic diversity
 - 68 federally listed species
 - 422 state listed species
- Everglades National Park
 - 3rd largest wilderness area in US
- Florida Keys National Marine Sanctuary
 - One of the largest MPAs in the country
 - Over 6,000 species
 - Only living barrier reef in N. America
- Complex social-ecological system

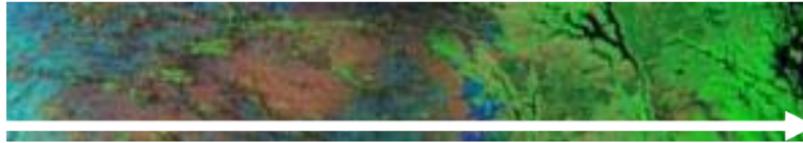
South Florida: A Major Sub-Tropical Land-Ocean Domain



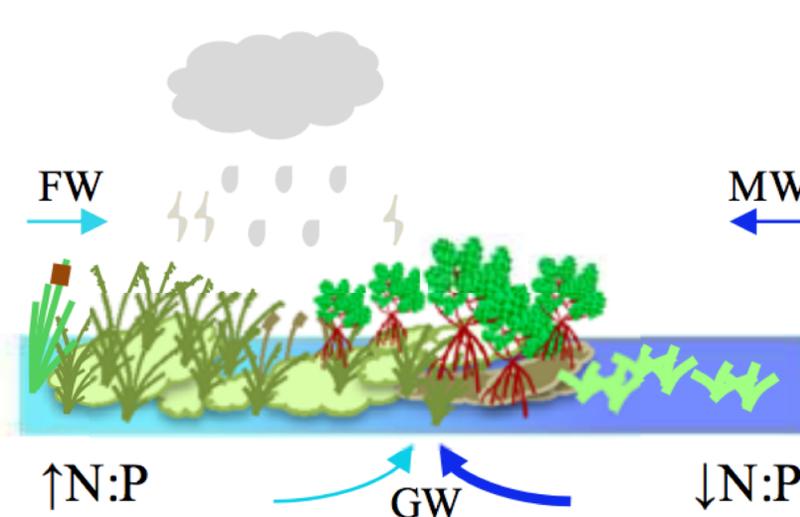
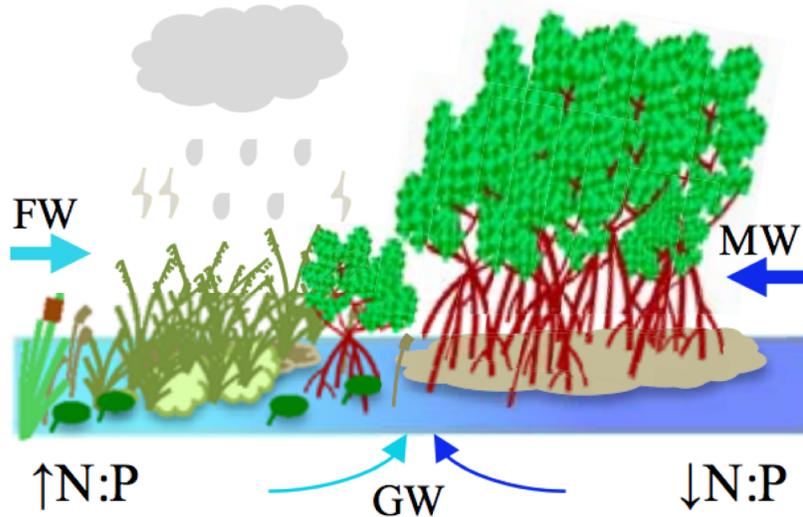
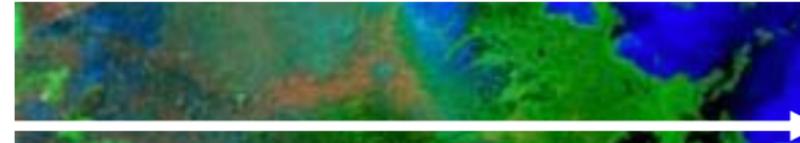
The Florida Coastal Everglades

The balance of fresh-marine water determines fundamental ecosystem structure and shape of the coastal gradient

Shark River Slough (SRS)



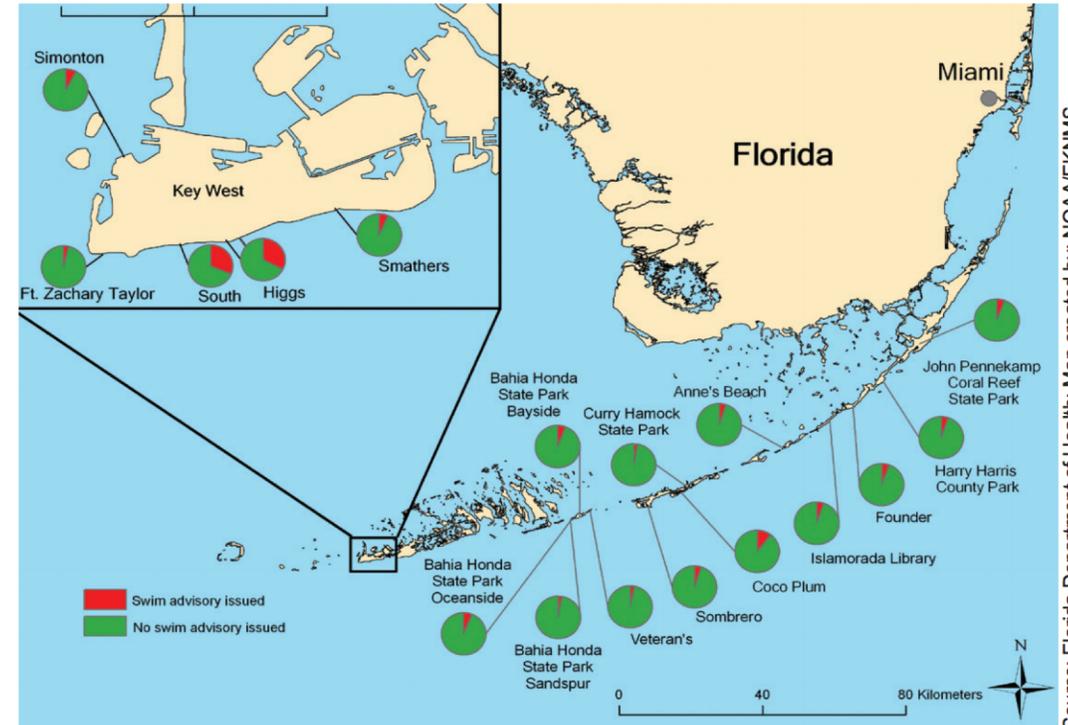
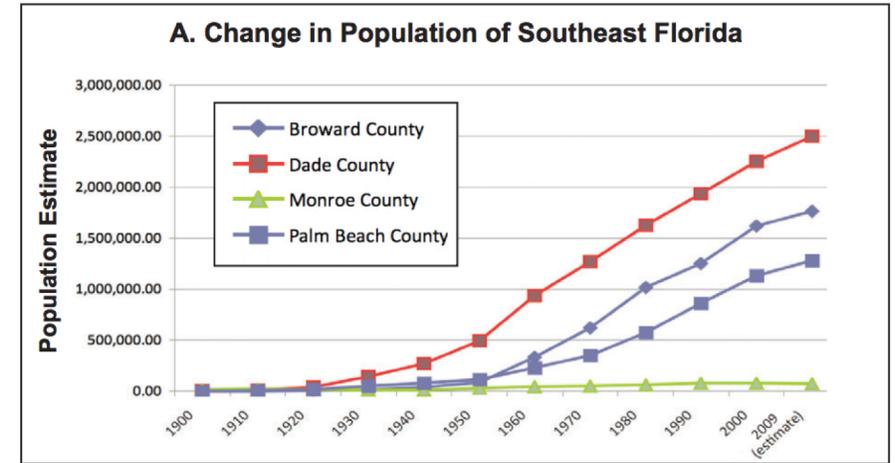
Taylor Slough (TS/Ph)



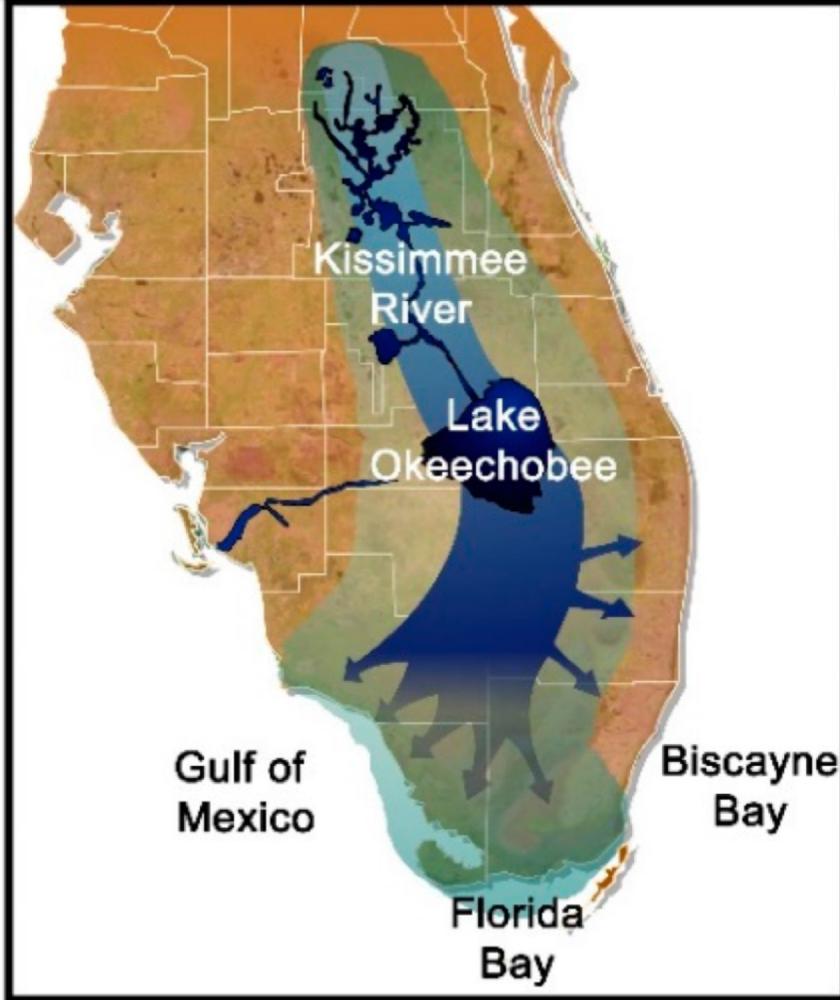
Florida Bay and the Florida Keys National Marine Sanctuary



Jim Fourqurean dives near Shark Bay to research the extensive seagrass meadows
Credit: Dr. Gary Kendrick



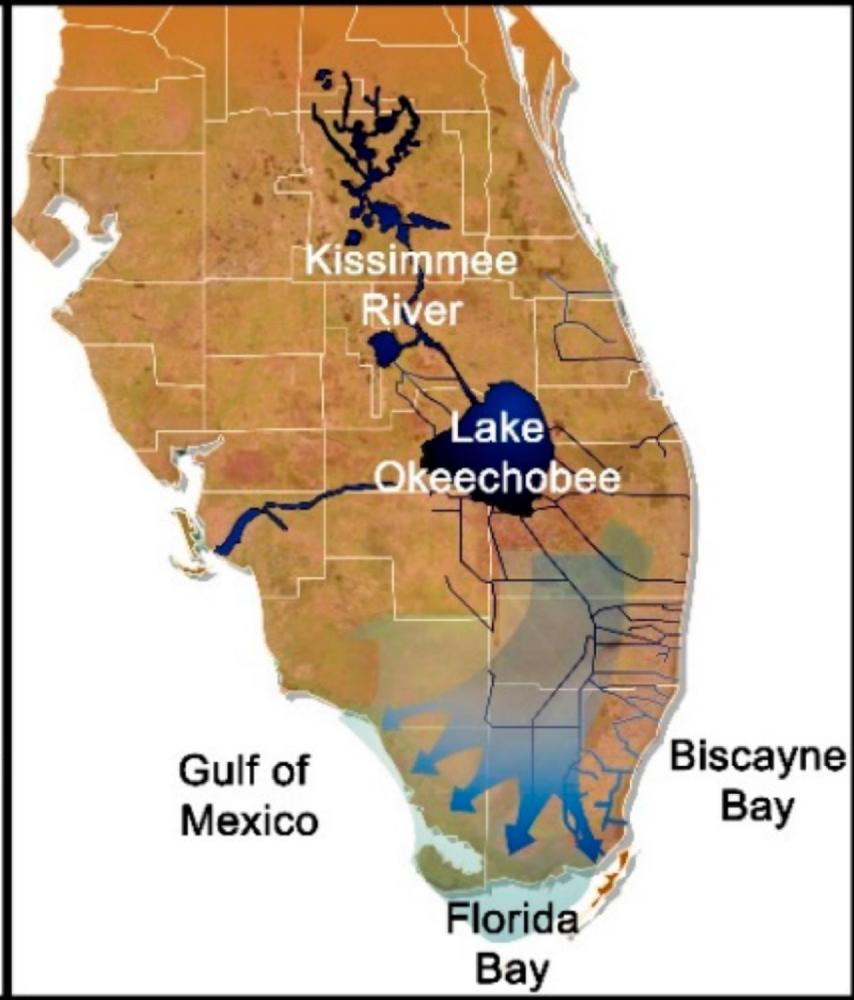
Source: Florida Department of Health; Map created by: NOAA/FKNMS



Historic Flow



Current Flow



The Plan (CERP) Flow

An aerial photograph of a mangrove wetland. A dark, winding waterway cuts through a dense, green forest of mangrove trees. The waterway leads from the foreground towards the horizon, where it meets the open ocean. The sky is filled with scattered white and grey clouds. The overall scene is a vast, natural landscape.

Remote sensing enables us to consider land
and adjacent marine ecosystems as part of a
continuum

- Science questions
- Observation strategies
- Complementary field and satellite data, numerical models, and simulations

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James Fourquean - FIU

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Daniel Gann - FIU

Stephanie Bohlman - UFL

David Lagmasino - NASA GSFC

Marc Simard - NASA JPL







abundance present traits
species organisms
ecosystem
richness
functional number types
per occupy within area count
distribution landscape intersecting kinds associates
unit communities supporting set inhabit patch quantity biological habitat
otherwise density breadth essential families utilize transit
different depth



What managers want

- Species are really important as a working definition for biodiversity management for many agencies
- Extinction, extirpation and invasion across administrative borders
- Mangrove biomass and carbon accounting and invasive species
- Monitor the effects of levee removal and restoring environmental flows on water quality, vegetation community and biodiversity
- Connecting marine and land processes.
- Understanding the impacts of disturbance (extreme events)



Stakeholder Science Questions

- Community assemblages and succession, trophic interactions
- Effects of geophysical on biodiversity
- Effects of biodiversity on geophysical
- Biogeochemistry/Aquatic-terrestrial linkages
- Change (climate and long term)
- Disturbance (human, natural, combined)
- Restoration & management
- Observing biodiversity and remote sensing science



Mission Definition

Management-relevant focus that is based on advanced observational science and modeling.

Targeted, well-timed multi-sensor airborne campaigns can be used to meet three complementary agendas:

- 1. Understand the drivers and flows of biodiversity** across a large watershed under dual pressures of human impacts resulting from activities to deliver water and food security and changing climate, sea level, and sea chemistry.
- 2. Advance remote sensing science** to enable biodiversity observations across the land to ocean continuum.
- 3. Scale** observations to assess and **inform management decisions** and conservation approaches from the plot to the landscape scale.



Mission Concept and STM

Sensor Suites

Imaging Spectroscopy
VIS/NIR/SWIR & IR
b - 2m/ t - 10m

LiDAR
b - NIR/t - BG

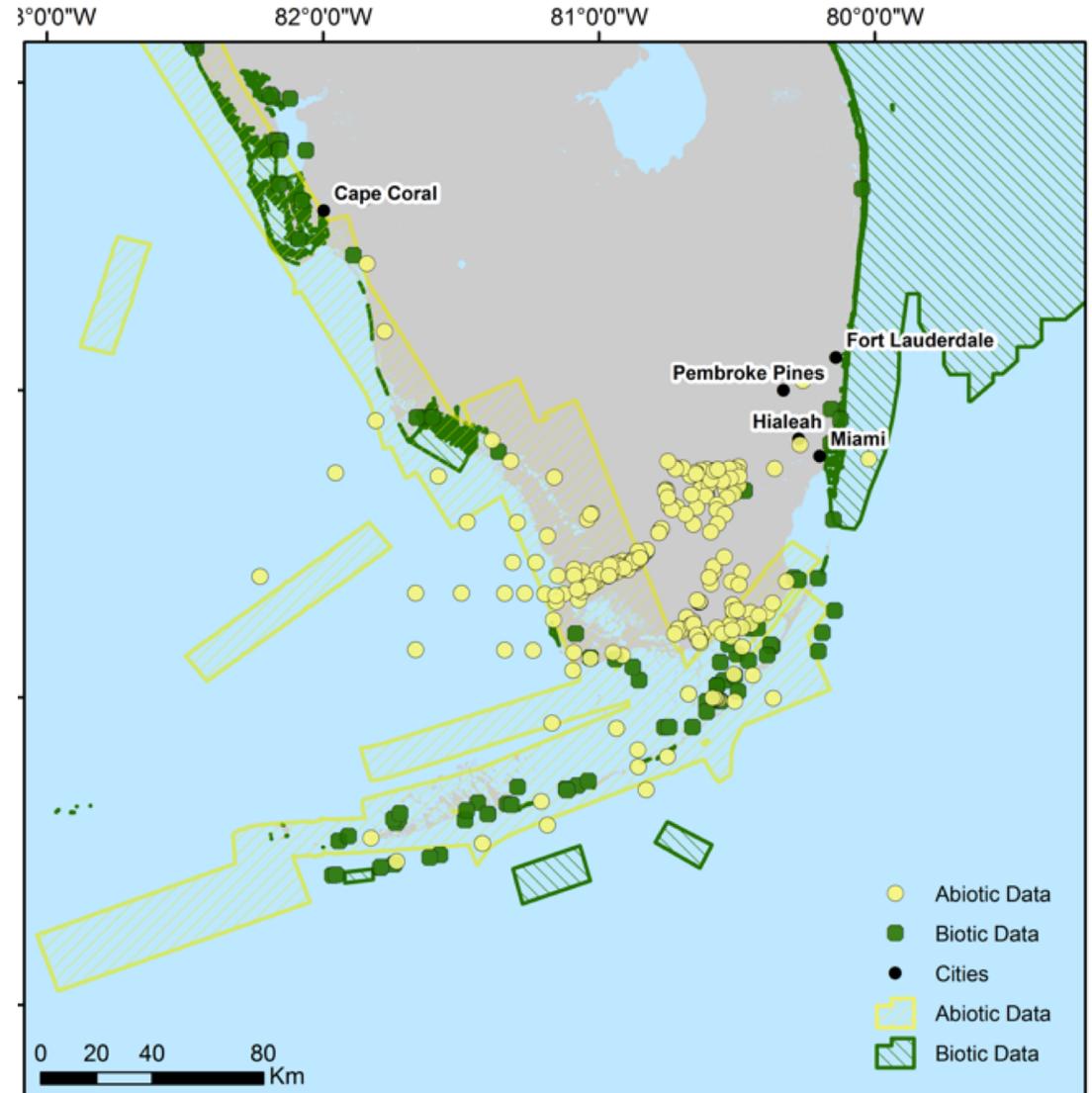
InSAR

Acquisition

Baseline: 2 campaigns/ year for 3 years
Threshold: 2 campaigns for 1 year

Field Data

Marine Biodiversity Observation Network
South Florida Water Management District
NOAA AOML
Water Quality Monitoring Program
Everglades LTER
Mangrove Monitoring



Let's fly Florida!

Airborne campaigns across the land-ocean continuum will enable innovation in biodiversity observations and applications

The ABC LOBOs campaign will provide a new opportunity to model partnership across GEO efforts

MBON, FWBON, GLOWS and Geo-Wetlands

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