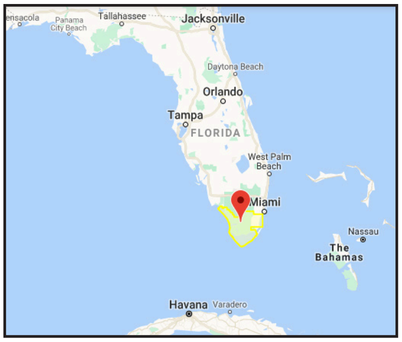
Florida Coastal Everglades LTER

Photo credit: Steve Davis

The Florida Coastal Everglades (FCE) LTER program encompasses the subtropical freshwater wetlands, mangrove swamps, and shallow seagrass communities along the two main drainages of Everglades National Park. Fresh and marine water sources are variable in this coastal oligotrophic landscape, and interact with biogeochemical processes and human actions to modify coastal ecosystem structure, functions, and services. Since 2000, the FCE LTER program has transformed scientific understanding of the origins of coastal ecosystem productivity, particularly how nutrients regulate ecosystem response to disturbances such as tropical storms, droughts, cold snaps, shifts in freshwater management, and sea level rise.

By pairing sustained long term measurements with experiments, socio-economic studies, and modeling, the FCE LTER program fosters a mechanistic understanding of ecosystem function that influences restoration policy [Product 1]. The program is especially poised to address how the chronic stress of sea level rise affects ecosystem resilience and how disturbance legacies, social-ecological feedbacks, and regional freshwater allocation decisions may modify stress responses.



Over

90 investigators

30 institutions represented

70 graduate students

Coastal	Principal Investigator: John Kominoski, Florida International University (FIU Institute of Environment)	Est. 2000 Funding Cycle: LTER IV	National Science Foundation Program: Biological Sciences / Division of Environmental Biology

Key Findings

Hidden origins of coastal productivity. Contradicting classical estuary models, FCE LTER research demonstrated that marine nutrient supplies (rather than freshwater nutrient supplies) control coastal productivity gradients via daily tides, episodic storm surges, and hidden groundwater upwelling. Saltwater intrusion amplifies marine pulses by increasing connectivity to the sea and liberating phosphorus from limestone. Sea level projections based on long term data were refined, painting a better picture of how water quality will be affected by shifts in freshwater supply management [2].

Disturbance interactions define coastal gradients. Long term data reveal that multiple types of disturbances — including cold snaps, fires, droughts, floods, and tides — play a strong role in shaping coastal ecosystems. Tropical storms can be beneficial by connecting upstream and downstream food webs and dispersing mangrove propagules into disturbance-generated canopy gaps. They also deliver phosphorus-rich mineral deposits that promote mangrove transgression, increased soil elevation relative to sea level, and more rapid mangrove wetland recovery [4].

Sea level rise may decouple carbon sources/ sinks. Rising seas can stimulate the inland transgression of mangroves and amplify carbon gains (as observed in historic carbon budgets based on long term flux data, paleoecology, and remote sensing). However, FCE LTER studies, experiments, and models show that carbon losses can exceed increases where saltwater invades freshwater marshes, resulting in abrupt elevation loss (collapse) that further promotes saltwater intrusion [3].

Donor controlled food webs. Coastal food webs are subsidized by episodic and seasonal connections to upstream detrital food supplies. However, top coastal estuary predators show great individual variation in their ability to capitalize on this subsidy — a finding that has been applied in comparative cross-site research [5].

Photo credits: Sylvia Lee (top); Jennifer Rehage (bottom)

Synthesis

Fate of massive coastal carbon stores is uncertain. Florida Coastal Everglades LTER has led and participated in comparative cross-site studies in subtropical and tropical karstic freshwater wetlands, mangrove forests, and seagrass communities — showing that carbon storage in mangrove forests far exceeds that of terrestrial woodlands [6]. The fate of these massive stores of coastal "blue carbon" will depend on how managers mitigate water quality impacts of regional land use change and how they respond to the warming, acidifying, and salinizing effects of global climate change [7]. Cross-site studies have found little connection between the flux of organic carbon out of these systems and its availability to organisms, highlighting the importance of long term measurements to understand its fate [8].

Data Accessibility

All FCE LTER datasets collected are published in the Environmental Data Initiative (EDI) repository. New and updated datasets are released to the public within two years of collection with complete metadata. Open access has led to new research and synthesis using FCE LTER datasets on flux tower, seagrass productivity, and water quality. The FCE LTER has also led international, open access LTER synthesis projects [10].

Partnerships

- Everglades National Park
- South Florida Water Management District
- The Everglades Foundation

Photo credit: Rafael Travieso

Broader Impacts

Long term science for society. Socio-economic, historical, and scenario studies associated with the FCE LTER contribute to understanding how decisions about Everglades restoration have been made. This has included fostering strong, lasting agency partnerships that ensure the integration of long term science into restoration policy [9].

Fostering diversity in science. Most of the undergraduate and K-12 students engaged in field and laboratory studies at FCE LTER are from the >90% majority-minority populations of Florida International University (FIU) and Miami Dade County Public Schools. Teachers are engaged in long term science, creating experiential and data-based lessons for the K-12 Schoolyard. Undergraduates serve as mentors to high school students.

Nurturing leadership. Early career scientists gain leadership experience by co-leading FCE LTER working groups. Graduate students take on leadership roles as mentors, representatives on the executive board, and participants in Everglades Service-to-Activism workshops and congressional visits.

Science in the public sphere. Along with 12 partner institutions, FCE LTER promotes environmental literacy through an Artist in Residence program and four long term citizen science studies.

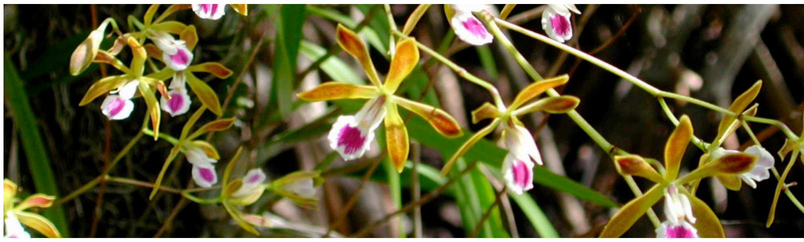


Photo credits: U.S. LTER (top); Steve Davis (bottom)

Top Products

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