FLORIDA COASTAL EVERGLADES LTER

FCE IV YEAR TWO ANNUAL REPORT

FOR NSF AWARD DEB-1832229

Reporting Period: 12/1/2019 – 11/30/2020

Submitted September 2020

Principal Investigators

Evelyn Gaiser

James Fouqurean

Kevin Grove

John Kominoski

Jennifer Rehage

This material is based upon work supported by the National Science Foundation through the Florida Coastal Everglades Long-Term Ecological Research program under Cooperative Agreements DEB-1832229, DEB-1237517, DBI-0620409, and DEB-9910514. Any opinions, findings, conclusions, or recommendations expressed in the material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

Table of Contents

Accomplishments

Major goals of the project

The goal of the Florida Coastal Everglades Long Term Ecological Research (FCE LTER) program is to conduct long-term studies to understand how climate change and resource management decisions interact with biophysical processes to modify ecosystem trajectories of coastal landscapes. Changes to hydrologic drivers at either the freshwater or marine endmember of karstic coastal ecosystems, with strong biotic feedbacks of geomorphology, hydrology, and ecosystem processes, shift the dominance of landscape patterns that determine carbon sequestration and food webs dynamics. We have observed rapid intrusion of salt water and associated limiting nutrients (phosphorus) into brackish and freshwater ecosystems driven by increased rates of sea-level rise. Experimental studies are revealing the mechanisms by which saltwater intrusion into freshwater and brackish wetlands drives rapid loss of soil elevation and stored carbon. However, we now have evidence of changes in ecological processes attributed to restoration projects implemented over the last few years. Observed increases in pulsed delivery of fresh and marine water via water management and climate change to these sensitive ecosystems provides a landscape-scale template for testing theories of how pulse dynamics may maintain ecosystems in a developing state, reducing vulnerability to the accelerating press driven by climate change (sea-level rise).

In the past year, we focused on continuing core long-term data collection and thematic research of FCE, while also reorganizing our program based on feedback from the panel that reviewed our 2018 renewal proposal that resulted in our program being placed on probation. We continued to address the central question of how changes in the balance of fresh and marine water supplies influence ecosystem structure and function in coastal karstic ecosystems, including **biogeochemistry and organic matter dynamics**, **primary producers**, and **trophic dynamics** along our freshwater to marine gradients of two major drainages, Shark River Slough (SRS) and the Taylor Slough/Panhandle (TS/Ph). We placed a particular focus on our trophic dynamics research to further integrate consumer movements and food web patterns along freshwater-marine-estuarine gradients. Integrative goals were achieved through our cross-cutting thematic research on: **climate and hydrology**, where we focused on defining hydrologic presses and pulses; **carbon stocks and fluxes**, where we completed the implementation of a full representative flux tower network to measure the net ecosystem carbon balance; **water governance**, where we continue studies of how water conflicts impact the timing, design, delivery, implementation and adaptive management of Everglades restoration; and **integrative modeling** to produce landscape-scale predictions of all key ecosystem elements of future climate and restoration scenarios. We created a new conceptual framework to achieve further integration by addressing theoretically-motivated questions that connect each of these cross-cutting themes. The overarching goals of this reporting year included: (1) addressing the key goals (summarized below) of each of the core areas in bold, above; (2) collecting core long-term data and integrating results from mechanistic experiments and spatial scaling studies; (3) modeling and synthesis efforts linking climate and disturbance legacies to future projections, (4) publishing several broad synthesis manuscripts, (5) updating FCE data to the Environmental Data Initiative (EDI) Data Portal (PASTA), (6) integrating core FCE findings with cross-site syntheses through LTER network-wide collaborations, (7) advancing education (FCE Schoolyard) and outreach activities through expanded partnerships and building on our diversity plan.

Major Activities

Climate and Hydrology: To address how long-term changes in the press-pulse regime are influencing lateral connectivity, we employed our newly developed Percentile-Range Indexed Mapping and Evaluation (PRIME) tool. To determine vertical connectivity we investigated long-term water levels and salinity fluctuations in surface and shallow ground water (peat soils) and deep groundwater (limestone bedrock) at SRS-4 and SRS-6. In addition, specific yield (similar to porosity), hydraulic conductivity, and nutrient and constituent leaching were measured from sawgrass marsh to mangroves at SRS-4. Remote sensing observations (Sentinel-1 SAR and InSAR) were used to detect annual and seasonal water level changes across the FCE.

Biogeochemistry and Organic Matter Dynamics: We published a synthesis of long-term water biogeochemical changes associated with disturbance legacies throughout the FCE. We also focused on quantifying long-term changes in dissolved and particulate organic matter and associated microbial communities along gradients of salinity and P in freshwater, brackish, and estuarine wetlands. We collected monthly water samples from all FCE sites for quantifying dissolved organic carbon (DOC) concentrations, dissolved organic matter (DOM) fluorescence characteristics, and DOM structural and isotopic composition, and breakdown rates of particulate organic carbon (POC). We finalized results from experimental salinity and P additions in freshwater and brackish peat marshes to test for drivers of peat collapse and legacies of saltwater intrusion.

Primary Production: Integration of long-term hydrological, biogeochemical, and primary production data for sawgrass and periphyton were continued to determine trajectories of ecosystem structure and function in SRS and TS/Ph marshes. We began a new study to determine the ecophysiological responses of Rhizophora mangle scrub mangroves in TS/Ph-7 to seasonal changes in salinity and hydroperiod. We continued evaluating the long-term effects of Hurricanes Wilma (2005) and Irma (2017), including on mangrove production through ground-based measurements and remote sensing observations, and on the benthic macrophyte communities in Florida Bay.

Trophic Dynamics: Assessments of FCE food web trophic dynamics took place in the dry and wet seasons of 2019 and 2020. Processing of food web stable isotope samples was conducted and is ongoing to identify changes in resource contributions to consumers over seasonal and spatial gradients in salinity and primary productivity. Consumer isotope data are being integrated with long term acoustic telemetry data and stable isotope data for Common Snook to investigate the influence of individual movement behavior on spatial subsidies across freshwater, estuarine, and marine boundaries. We continued long-term electrofishing-based consumer sampling and our acoustic telemetry-based movement tracking and tagging of game fish.

Carbon Stocks and Fluxes: We maintained and enhanced our eddy covariance flux network (Fig. 1), including tower sites in freshwater marsh (SRS-2), freshwater marl prairie (TS/Ph-1), mangrove scrub (TS/Ph-7), tall riverine mangrove forest (SRS-6), seagrass (Bob Allen) and the newest tower in the ecotone between freshwater marsh and mangrove scrub (SE-1) was established and fully operational.

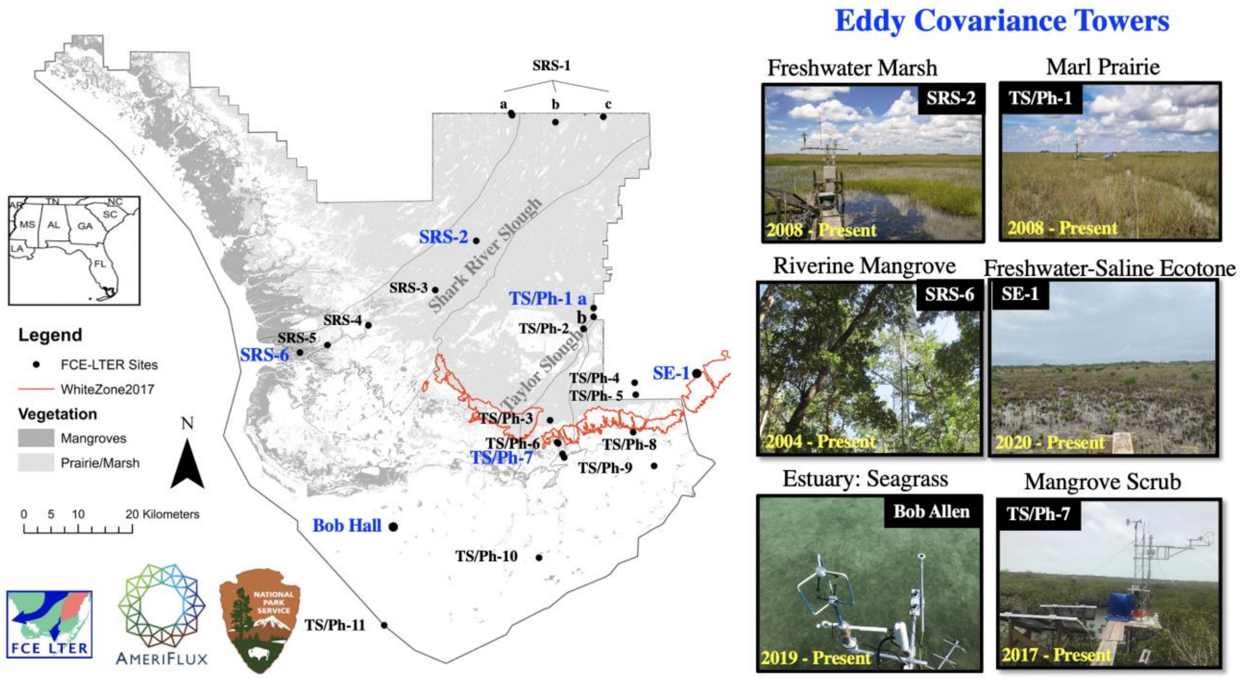


Figure 1. Florida Coastal Everglades Eddy Covariance Tower Network.

Water Governance: Our work on water governance focused on tensions between development and environmental management in Miami-Dade County, and agriculture and water management in South Dade through an additional 13 interviews and participant observations at 8 meetings. Our research on adaptive management has focused on identifying and understanding how scientists and practitioners have begun to approach the Everglades as infrastructure. We conducted interviews with FIU scientists on the technical dimensions of Everglades restoration, and Burmese python hunters involved in informal invasive species management.

Integrative Modeling: Long-term water level data (1990 - 2018) and sea levels (1965 - 2018) were combined with simulated water levels from the SFMWD 2x2 hydrologic model to understand the vulnerability of the FCE to sea-level rise and evaluate the benefits of various restoration scenarios. Four model scenarios were considered: (1) a simulation of existing conditions baseline, (2) implementation of the projects associated with the Comprehensive Everglades Restoration Plan and Central Everglades Planning Project, (3) establishment of the Everglades Agricultural Area reservoir, and (4) a simulation of the natural/pre-drainage system scenario. Measured and simulated water levels and fresh-to-marine head differences (FMHD) were used as primary indicators of vulnerability and restoration benefits.

Specific Objectives

Climate and Hydrology: Our objectives were to unravel the complex interactions between water levels and salinity within the FCE under the constant press of sea level rise and the pulses of freshwater delivered through water management operations and seasonal weather (precipitation, ET) conditions. Our specific goal was to determine the FCE's susceptibility to saltwater intrusion by estimating the FMHD along each transect as the difference in water levels at each site with sea level at Key West. In addition, we wanted to use satellite imagery to determine long-term changes in water levels at larger spatial scales.

Biogeochemistry and Organic Matter Dynamics: Our objectives were to understand biogeochemical patterns of dissolved and particulate organic matter and microbial decomposers along salinity and P gradients of SRS and TS/Ph by: (1) synthesizing long-term changes in concentrations of total N, total P, and DOC with bacterioplankton productivities in response to disturbance legacies, (2) characterizing dissolved organic matter (DOM) fluorescence optical properties, and DOM structural and isotopic composition, (3) quantifying breakdown rates of labile and recalcitrant particulate organic matter using native litter and standard substrates, (4) characterizing assemblages of water-column and benthic microbial communities responses to salinity and P, (5) identifying mechanisms of peat collapse through experimental manipulations of salinity and P to test for legacies of saltwater intrusion.

Primary Production: Our objectives were to (1) determine relationships between periphyton foundation species and total carbon accumulation (or loss) and salinity and phosphorus through analysis of results of our experimental research, (2) quantify macrophyte species composition and aboveground sawgrass biomass and net primary production, and (3) evaluate the effect of Hurricane Irma on mangrove and benthic macrophyte production, carbon cycling, and ecosystem resilience.

Trophic Dynamics: Our objectives were to: (1) continue collection and processing of food web stable isotope samples to identify changes in resource contributions to consumers over seasonal and spatial gradients in salinity and primary productivity across the freshwater-estuarine-marine habitat mosaic, (2) collect abundance and movement data on bull sharks, alligators, and game fish, (3) synthesize data collected on dolphin movement and vocalization, as it relates to trophic dynamics, and (4) continue sampling of basal resources and selected consumers for food-web analyses of freshwater food webs using stoichiometric and fatty acid data.

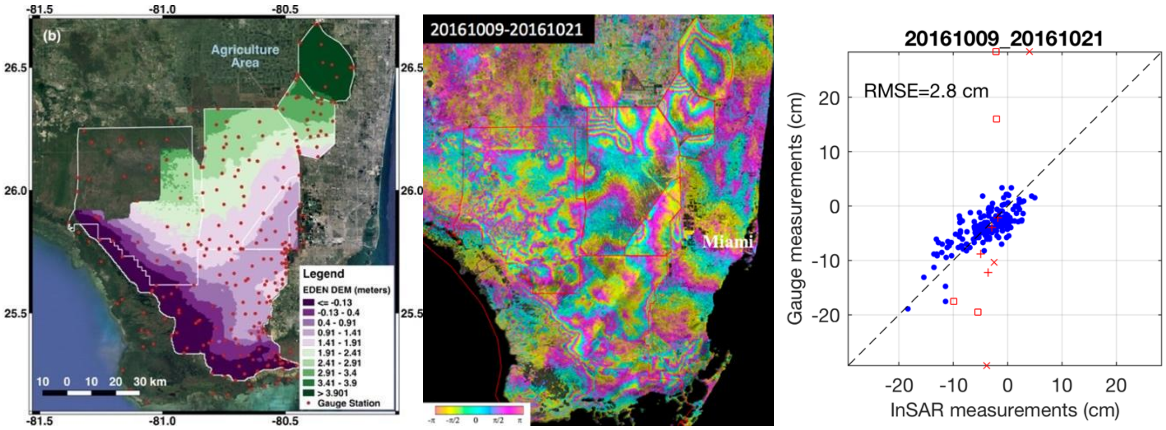
Carbon Stocks and Fluxes: Our objective was to explore within and between ecosystem variation to understand seasonal and annual patterns in CO_2 fluxes and develop methods for processing CH_4 flux data. This objective was met by collecting core long-term data, integrating results from mechanistic studies, linking climate and disturbance legacies to future projections, and integrating core findings across the LTER network-wide collaborations.

Water Governance: Our objectives focused on: (1) transcribing and coding interviews, participant observation notes, and publicly-available recordings of meetings on South Dade agriculture and resilience, (2) transcribing and analyzing interviews with FCE scientists on the technical dimensions of Everglades restoration and the rise of the new idea of the Everglades-as-infrastructure. Another goal was to complete an extensive review of the social science literature on the Everglades, with a focus on previous FCE social sciences work around the diverse and changing ideas and valuations of the Everglades and attendant human-nature relations these involve.

Integrative Modeling: Our goal was to understand how alternative restoration scenarios would influence the FMHD, and to further validate existing Everglades Landscape Model variables through an extended (2016) period of simulation, adding/refining variables including diatom and fish dynamics, and adding code/variables associated with net ecosystem exchange. We are assimilating flux tower data, thus providing the basis for improving performance of the model predictions of ecosystem carbon dynamics in ELM v3.1. This work supports project goals through the integration of experimental and modeling platforms, allowing further spatio-temporal extrapolation of long term data.

Significant Results

Climate and Hydrology: Water levels along both transects increased from 2001 to 2016 in response to increased freshwater deliveries and rainfall in the upstream reaches and sea-level rise near the coast (Dessu et al., 2020). The most significant result is that the lower ground surface elevation (at least 20 cm between sites SRS-3 and TS/Ph-3) and a lower freshwater-marine head difference in the TS/Ph transect makes it more susceptible to sea level rise and saltwater intrusion compared to SRS. We were successful in increasing the precision of water levels inferred from 4-year long Sentinel-1 SAR data with ground-based observations (Fig. 2; Liao et al., 2020).



A. B. C.

Figure 2. Sentinel-1 SAR Interferometry for water level measurement and its accuracy assessment over the entire Everglades. Subplot (a) shows our study area and the EDEN gauge distribution. Each red point stands for a gauge at its location. (b) An example interferograms generated with Sentinel-1 SAR acquisitions on Oct 9, 2016 and Oct 21, 2016, in which hydrological signal within the WCAs are prominent. (c) The accuracy of water level change derived from InSAR compared with EDEN gauge measurements. Red squares, cross and plus stand for outliers that have been excluded for comparison.

Biogeochemistry and Organic Matter Dynamics: Concentrations of DOC were linked to droughts and hurricane-induced flood events (Figs. 3A, 3E). Fire increased TN (Figs. 3B, 3F), and hurricanes increased TP concentrations in both SRS and TS/Ph (Figs 3C, 3G). Freeze and hurricane events increased bacterioplankton productivity (Figs. 3D, 3H; Kominoski et al. 2020). Particulate organic organic matter losses were higher in mangrove and seagrass than marsh or ecotone ecosystems (Fig. 4A). Burial of litter in tidal mangroves (SRS-6) reduced mass loss compared to non-tidal mangrove litter breakdown (TS/Ph-7; Fig. 4B). Surface organic matter mass loss was higher than buried in fine sediments, but buried organic matter mass loss was higher than surface in coarse sediments (Figs. 5A, 5B; Howard et al. 2020). Surface water microbial communities were distinct among freshwater marsh, mangrove and seagrass ecosystems (Fig. 6A). Experimental salinity additions (~20 ppt) and collapsed brackish peat soils had distinct microbial communities compared to ambient (Fig. 6B). Water column bacterial productivity increased with long-term increases in DOC concentrations in SRS and long-term decreases in DOC concentrations in TS/Ph (Fig. 7). Dissolved fluorescence index (FI) of TS/Ph marshes was greater than mangroves, whereas FI was similar in marsh and mangrove of SRS. Humification indices were similar between marsh and mangrove in both SRS and TS/Ph, but both were higher in SRS than TS/Ph. Biological index was higher in mangrove than marsh ecosystems of TS/Ph, and marsh and mangrove ecosystems of SRS (Fig. 8).

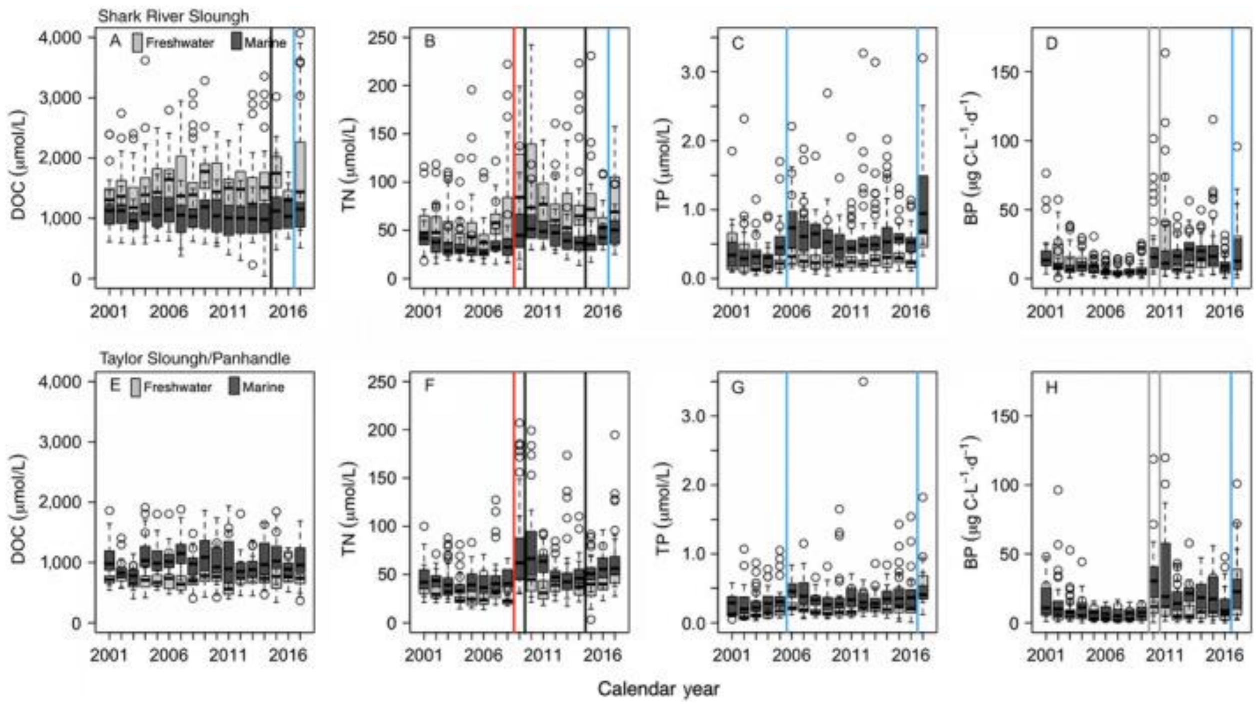


Figure 3. Box and whisker plots of median (black line), upper and lower quartiles (box edges) of annual surface water (A, E) dissolved organic carbon (DOC), (B, F) total nitrogen, (C, G) total phosphorus concentrations, and (D, H) bacterioplankton productivity among freshwater (gray) and marine wetlands (dark gray) of Shark River Slough and Taylor Slough Panhandle from 2001 to 2017. Disturbances are indicated by black (droughts, flood), red (fire), blue (hurricanes), and gray lines (freeze events). Freshwater wetlands refer to marshes, and marine wetlands refer to mangroves. Whiskers represent the maximum and minimum values; open circles represent outlier values. From Kominoski et al. (2020).

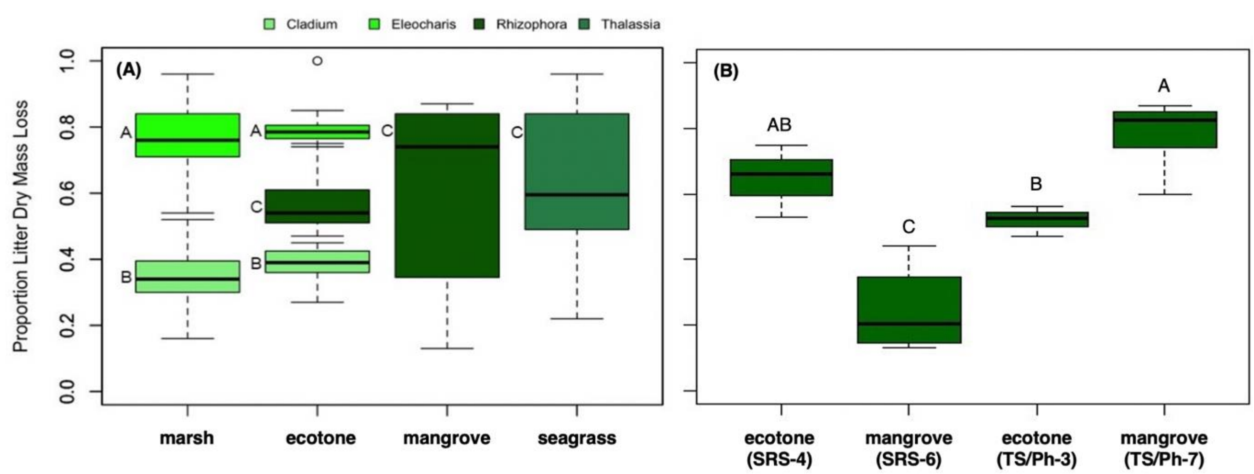


Figure 4. Dominant native litter breakdown across ecosystem types throughout the FCE.

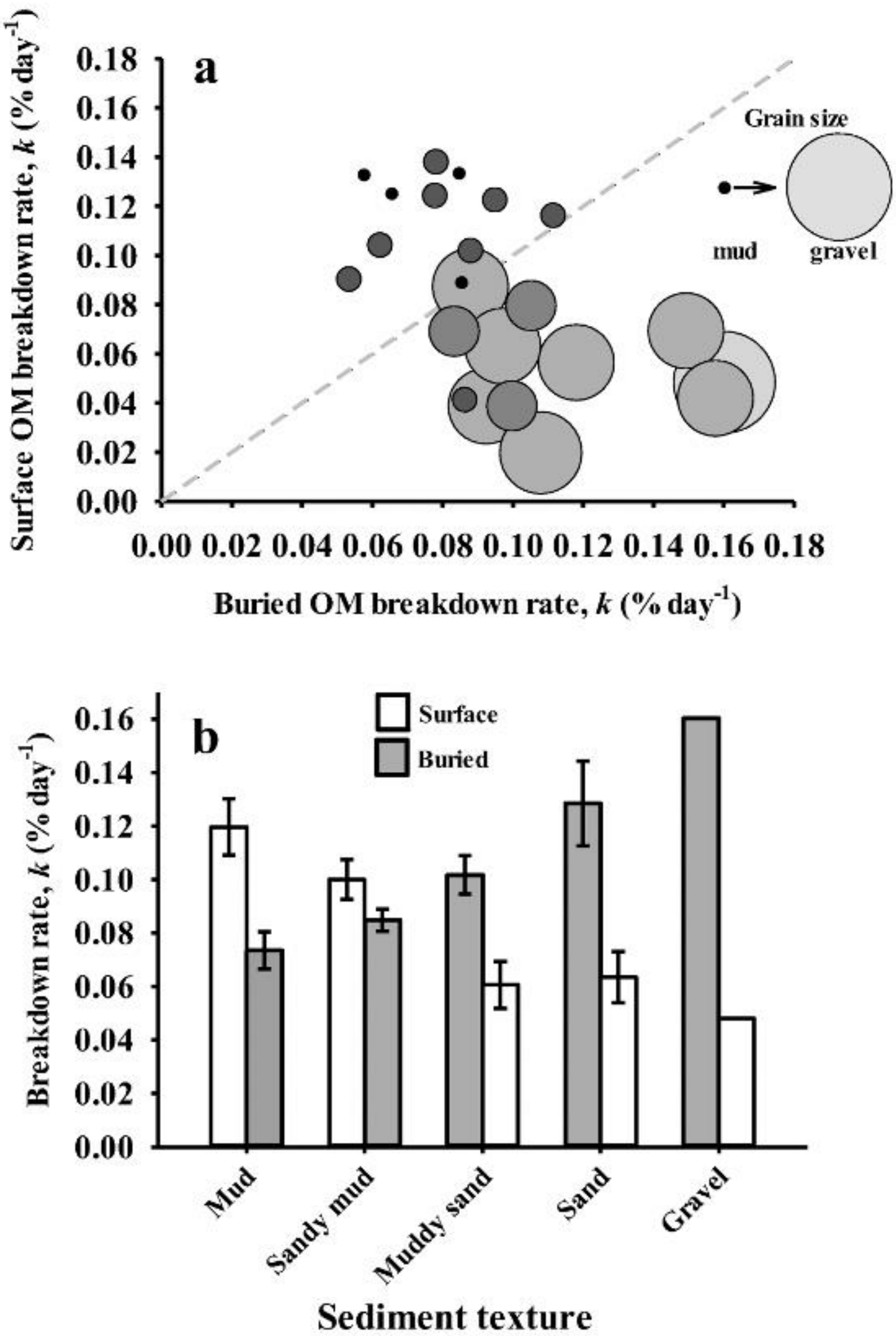


Figure 5. Breakdown of canvas organic matter standard substrates in surface and buried sediments that vary in size (fine and coarse) throughout Florida Bay.

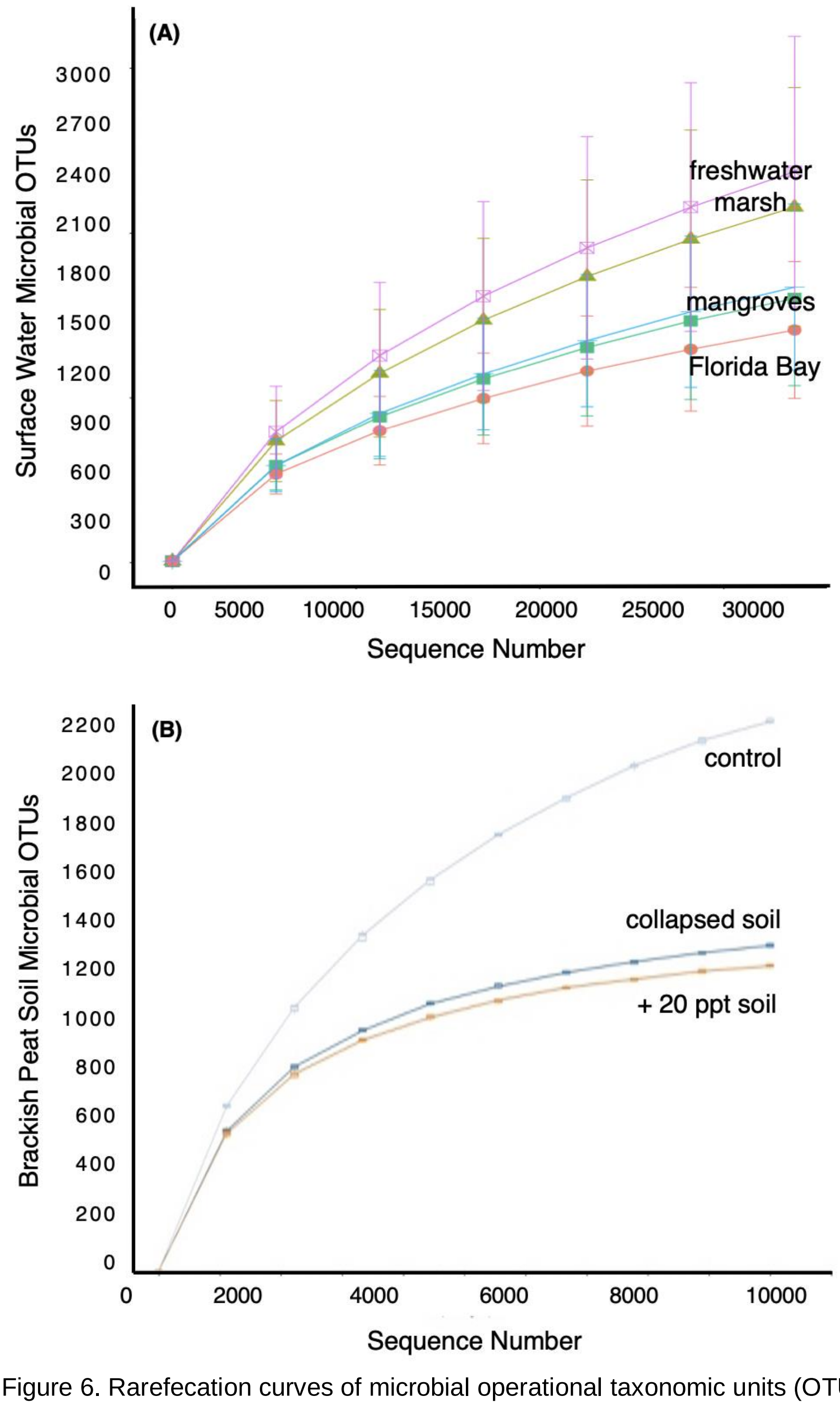


Figure 6. Rarefecation curves of microbial operational taxonomic units (OTUs) from (A) surface water and (B) brackish soil collected from the FCE.

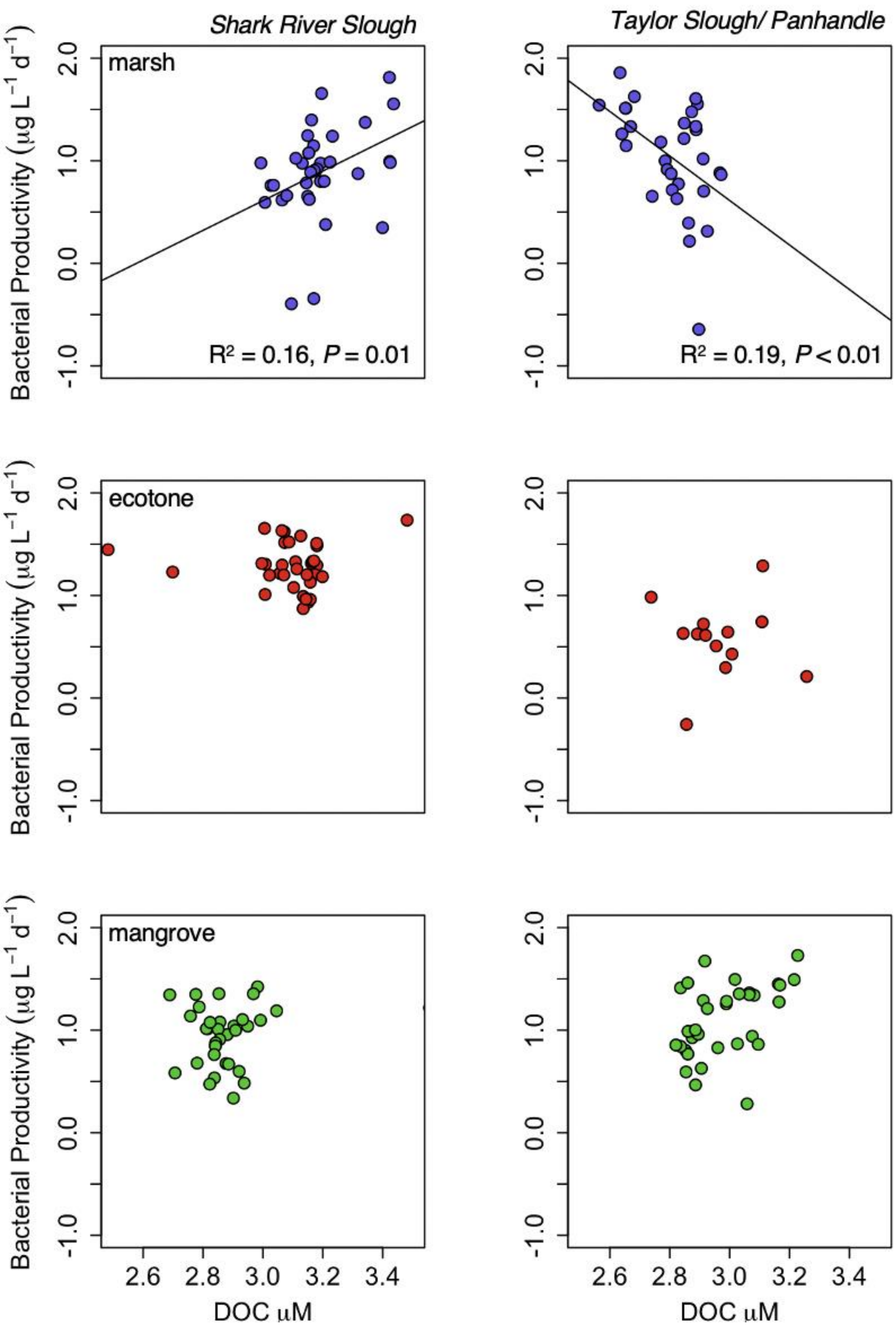


Figure 7. Relationships between water column bacterial productivity and dissolved organic carbon (DOC) concentrations across freshwater marsh, ecotone, and mangrove ecosystems of the FCE

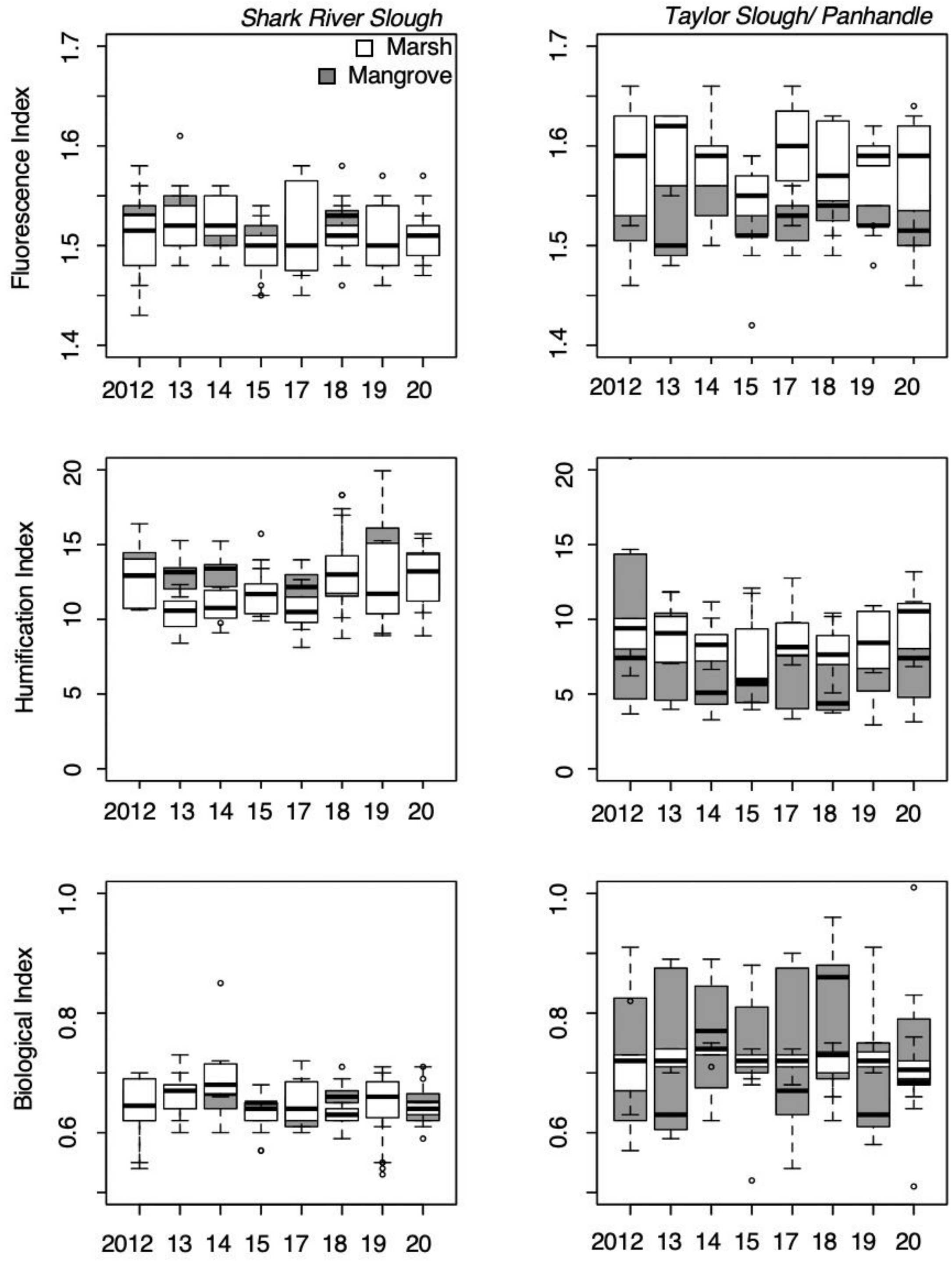


Figure 8. Temporal patterns of fluorescence DOM indices from marsh and mangrove wetlands of the FCE.

Primary Production: Periphyton mats exposed to elevated salinity (~22 kg salt m-2 yr-1) had significantly lower total carbon and dissimilar diatom assemblages relative to controls, while mats exposed to salinity and P had greater net productivity (Mazzei et al. 2020; Fig. 9). P additions only elicited compositional changes in diatom assemblages also treated with saltwater (Fig. 10). Sawgrass biomass (Fig. 11A) and densities (Fig. 11B) are steadily declining in SRS marshes. In comparison, the rates of sawgrass annual net primary production have increased at TS/Ph-1 and decreased at TS/Ph-2 and -3 over the last 11-years (Fig. 12). Sawgrass aboveground biomass at TS/Ph-6 was double that of other TS/Ph sites and its annual net primary production was negatively correlated with maximum annual salinity (Fig. 13). Eleocharis stem density was highest at TS/Ph-2 but showed no long-term trend (Fig. 14). Mangrove litterfall rates were reduced 2-4 times the 2010-2016 rate by H. Irma (Fig. 15) but increased in 2019. Increased foliar TP uptake by mangroves (Fig. 16) was explained by soil porewater SRP concentrations that were 7 times higher in 2017 than the pre-hurricane mean (Fig. 17; Castañeda-Moya et al. 2020). Scrub red mangrove C assimilation and stomatal conductance at TS/Ph-7 decreased during the wet season (Fig. 18, 19). Porewater salinity was 15-30 ppt across mangrove habitats - higher values had slightly positive effects on leaf ecophysiology (Fig. 19). Analysis of airborne G-LiHT data acquired before and after Irma revealed significant amounts of standing dead biomass (Fig. 20). Hurricane Irma’s impacts to benthic macrophyte communities were limited in spatial extent (Fig. 21).

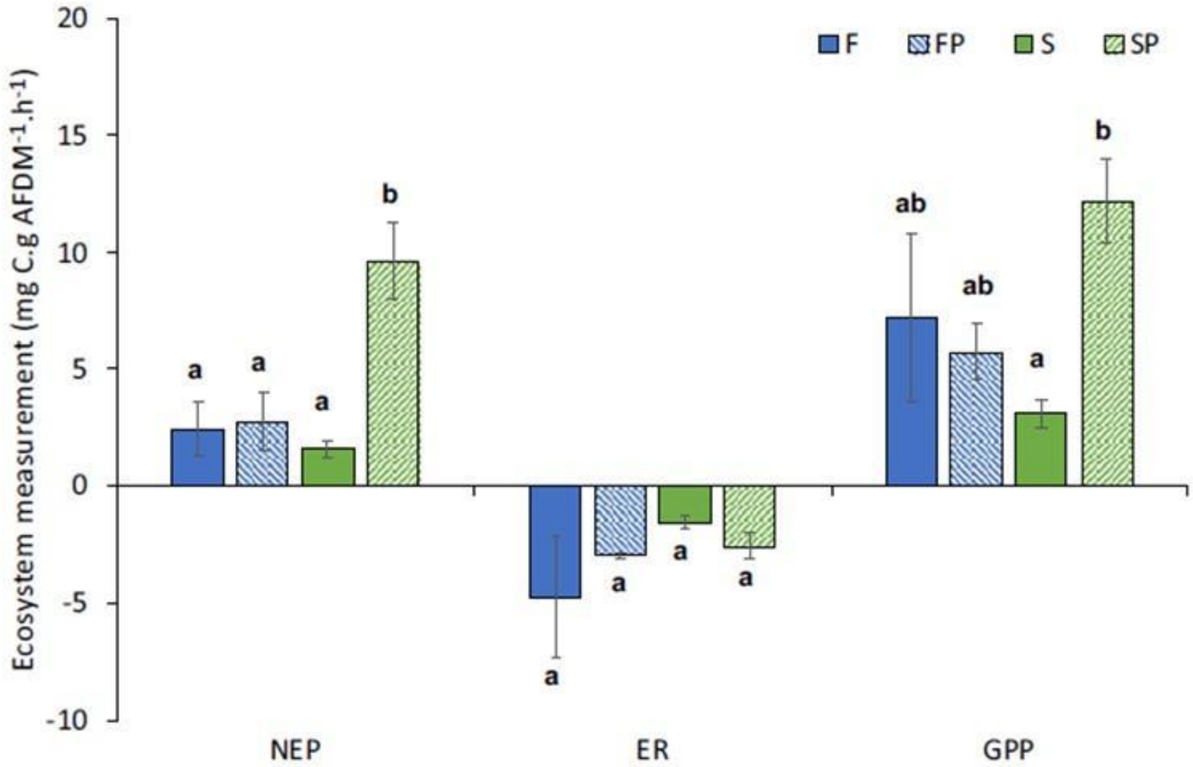


Figure 9. Periphyton net ecosystem productivity (NEP), ecosystem respiration (ER), and gross primary productivity (GPP) one-time measurements on periphyton plugs collected on February 2016. Error bars indicate standard error. Different lowercase letters indicate significant differences ($P \leq 0.05$) among treatments for each variable based on MANOVA post hoc pair-wise comparisons across treatment groups. F, freshwater control; FP, freshwater and phosphorus; S, salinity; SP, salinity and phosphorus. Periphyton net ecosystem productivity (NEP), ecosystem respiration (ER), and gross primary productivity (GPP) one-time measurements on periphyton plugs collected on February 2016. Error bars indicate standard error. Different lowercase letters indicate significant differences ($P \leq 0.05$) among treatments for each variable based on MANOVA post hoc pair-wise comparisons across treatment groups. F, freshwater control; FP, freshwater and phosphorus; S, salinity; SP, salinity and phosphorus. From Mazzei et al. (2020).

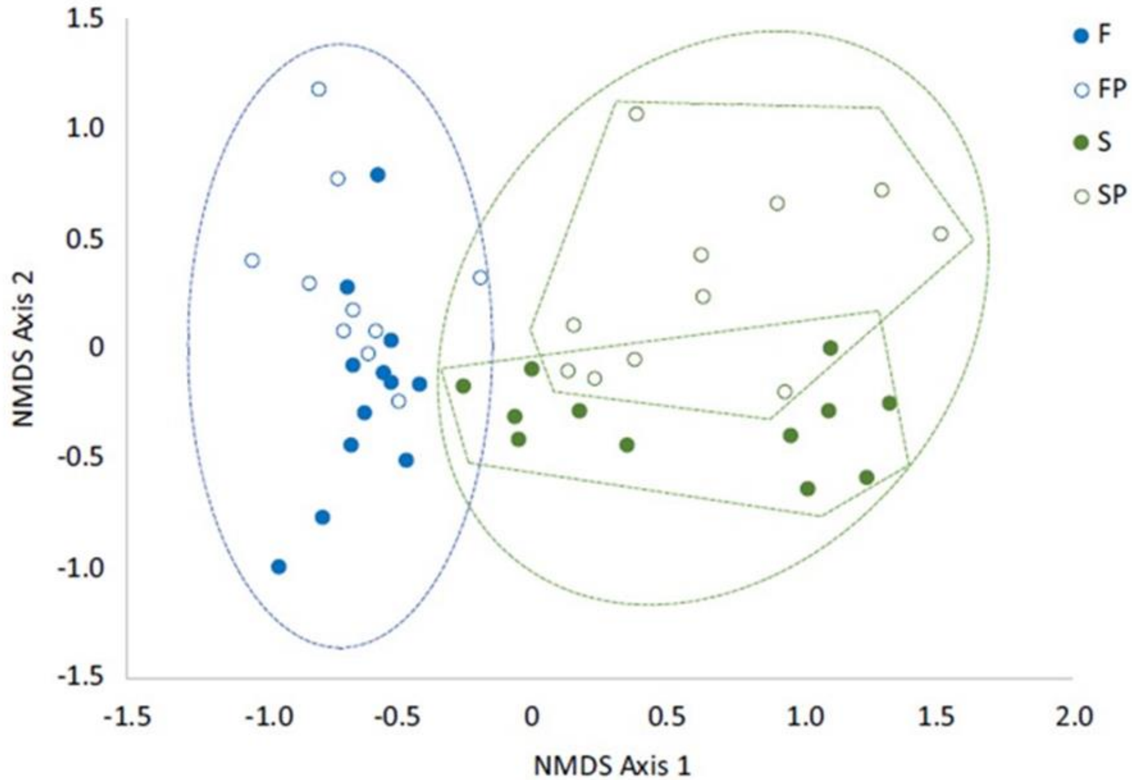


Figure 10. Nonmetric multidimensional scaling ordination of diatom species dissimilarity, determined from settlement plates, among treatments (F, freshwater; FP, freshwater and phosphorus; S, saltwater; SP, saltwater and phosphorus) across the four sampling dates. Convex hulls are drawn around significantly dissimilar groupings. From Mazzei et al. (2020).

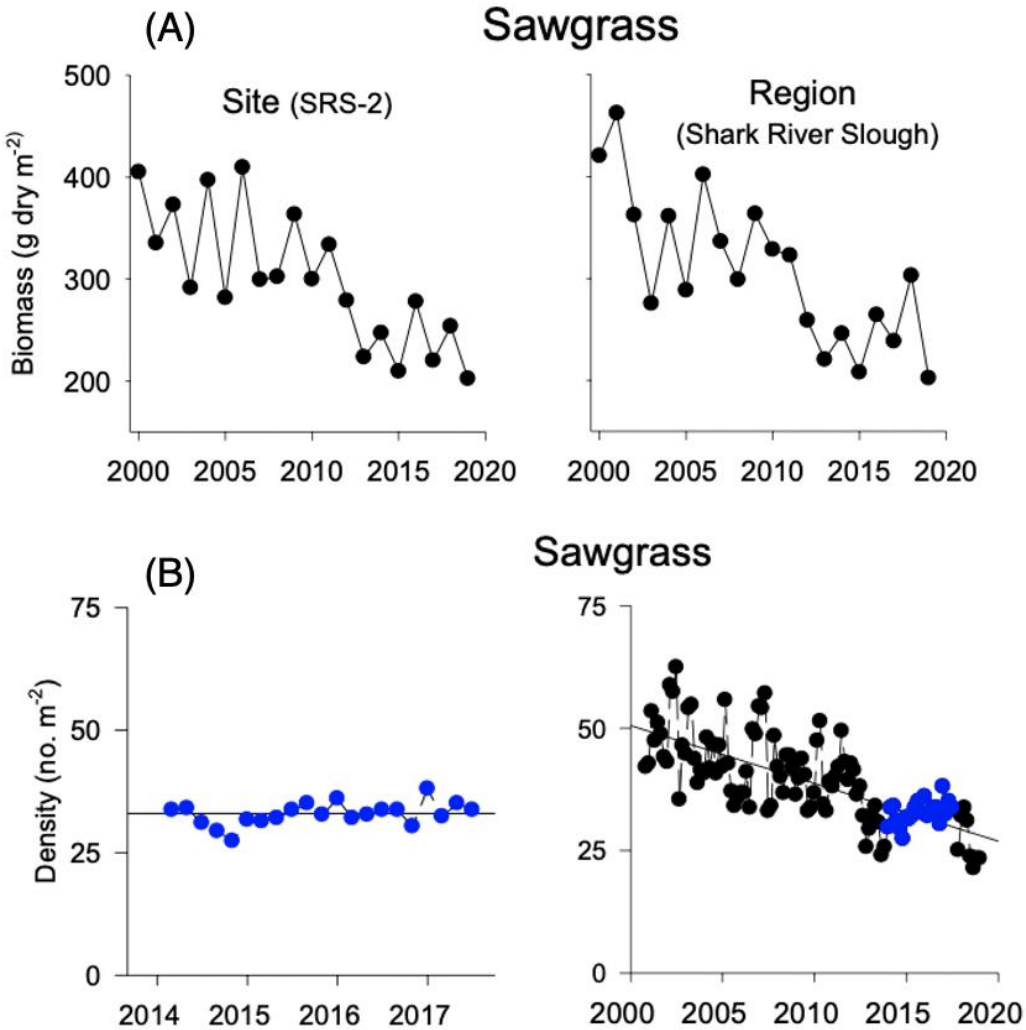
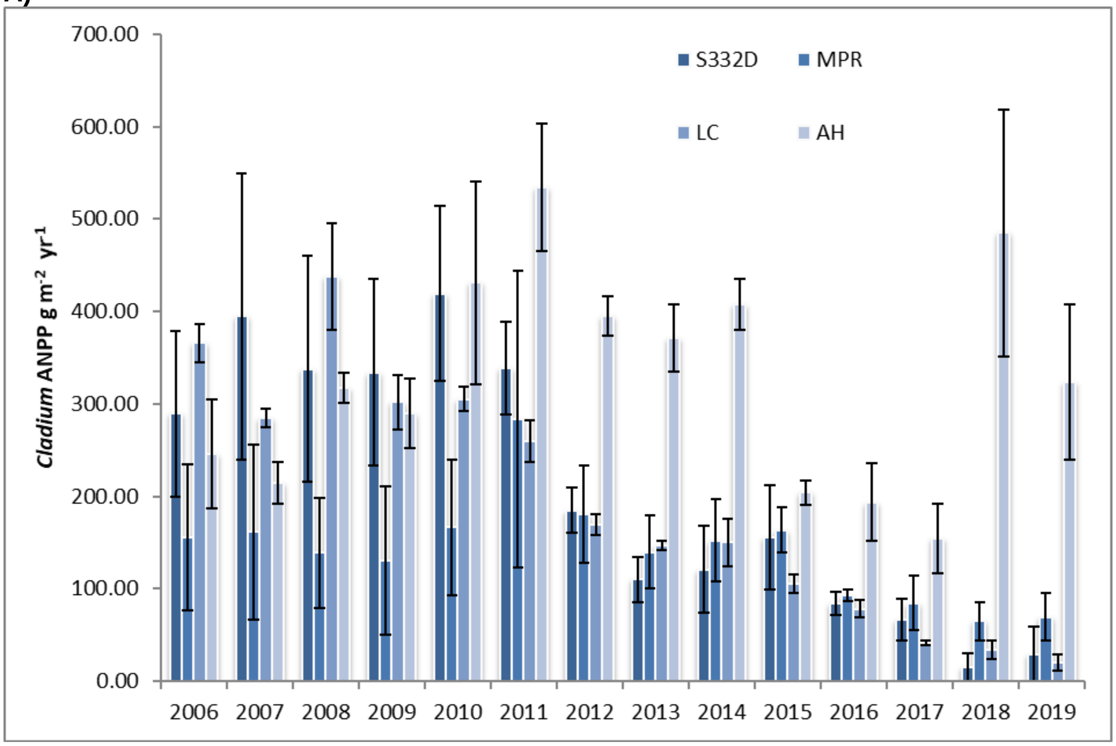


Figure 11. (A) *Cladium jamaicense* (sawgrass) aboveground biomass and (B) density Shark River Slough (SRS) sites. Figure illustrates similar pulsed declines in biomass comparing SRS-2 and all marsh sites (SRS-1, SRS-2, SRS-3). Long-term data are essential at identifying ecosystem trajectories in plant density, which may appear unchanged at short-term scales.

A)



B)

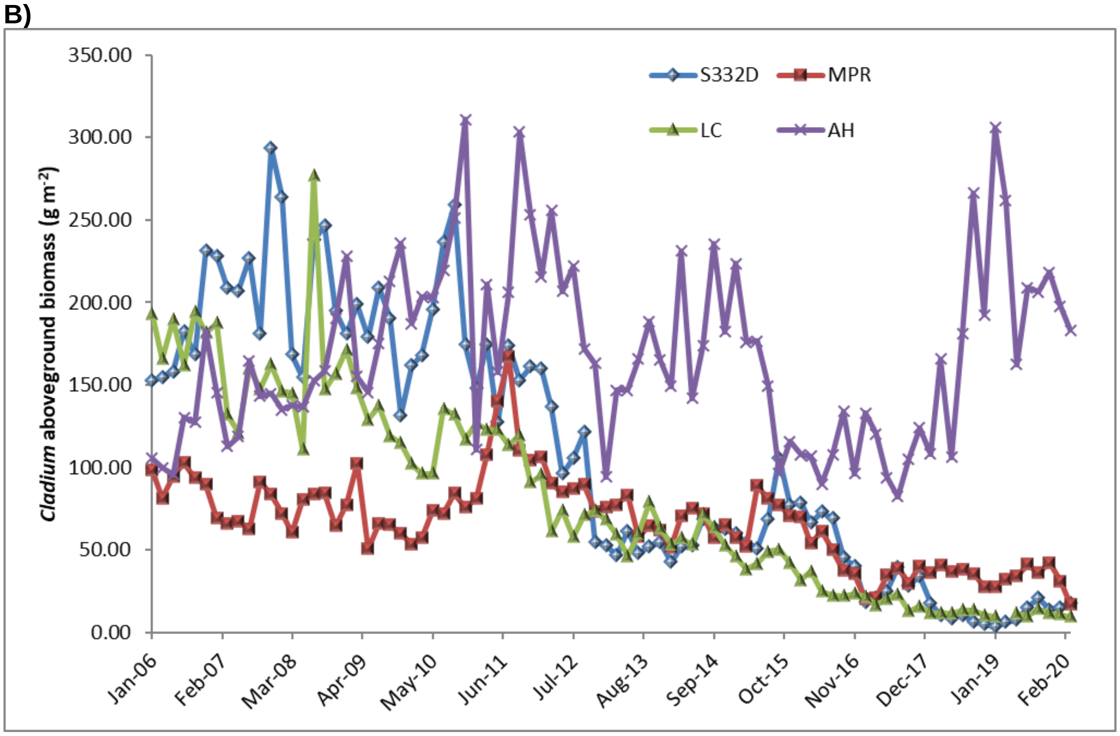


Figure 12. ANPP (A) and *Cladium* aboveground biomass (B) at Taylor Slough sites S332D, Main Park Road, Lower Central and Argyle Henry.

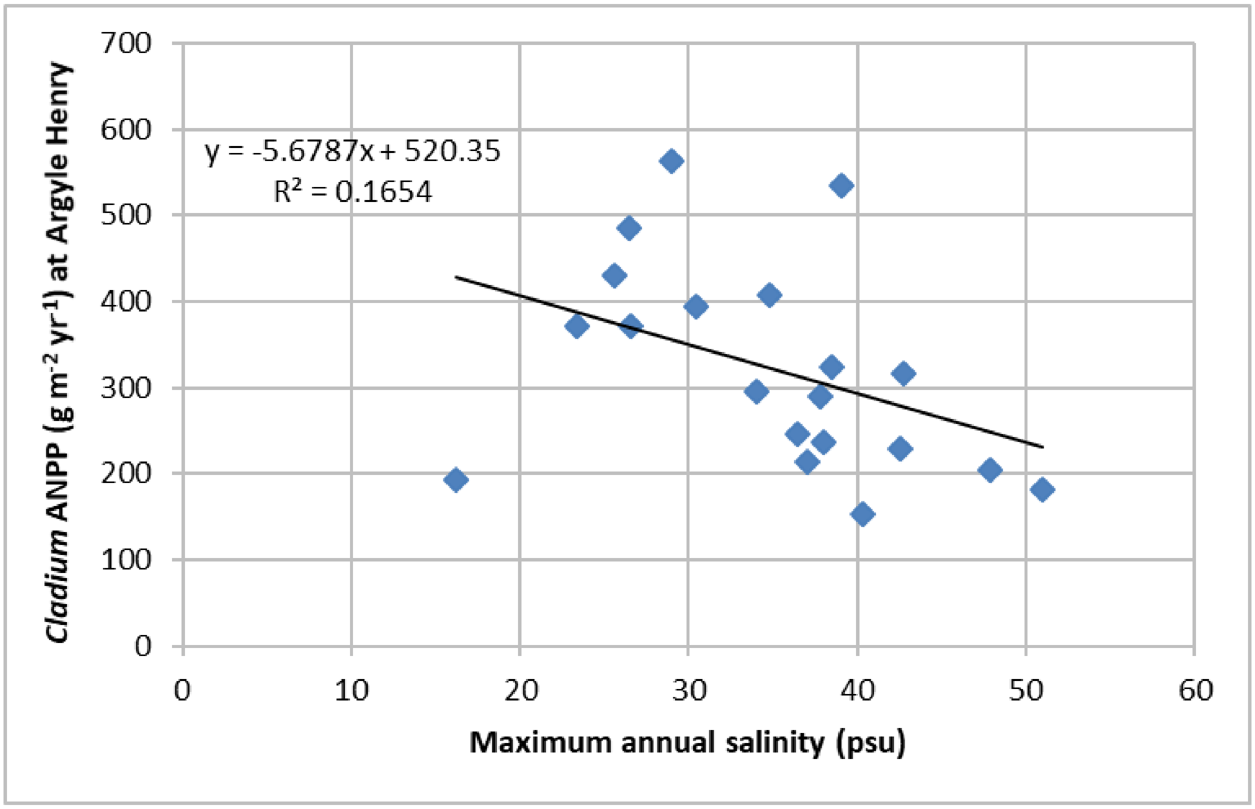


Figure 13. *Cladium* ANPP and maximum annual salinity over the 20-year period of record.

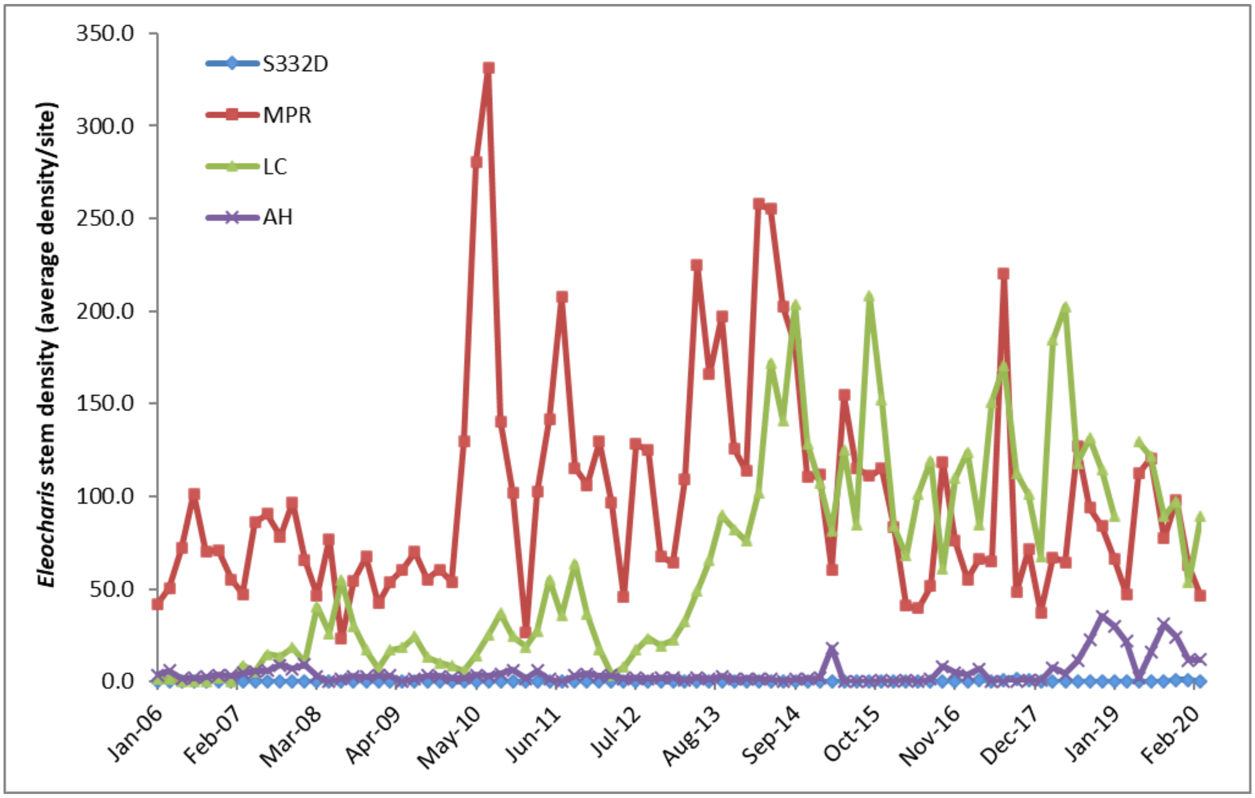


Figure 14. *Eleocharis* stem density at Taylor Slough freshwater and oligohaline marsh sites.

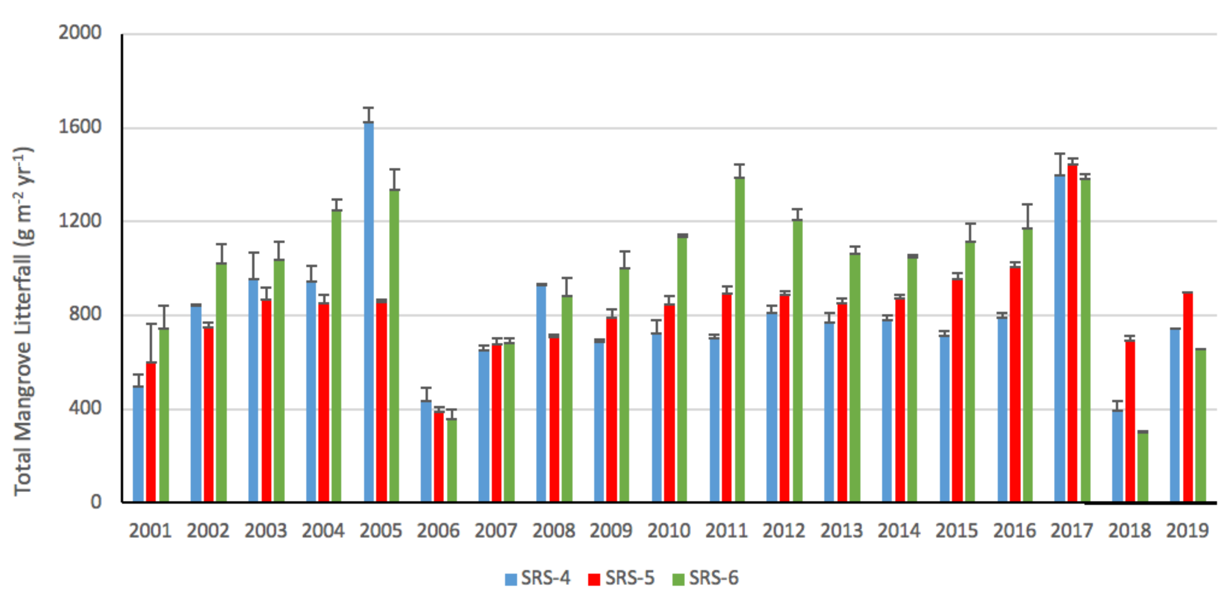


Figure 15. Long-term variation in total annual litterfall production in mangrove forests along Shark River estuary before and after the passage of Hurricanes Wilma (October 2005) and Irma (September 2017) across the FCE.

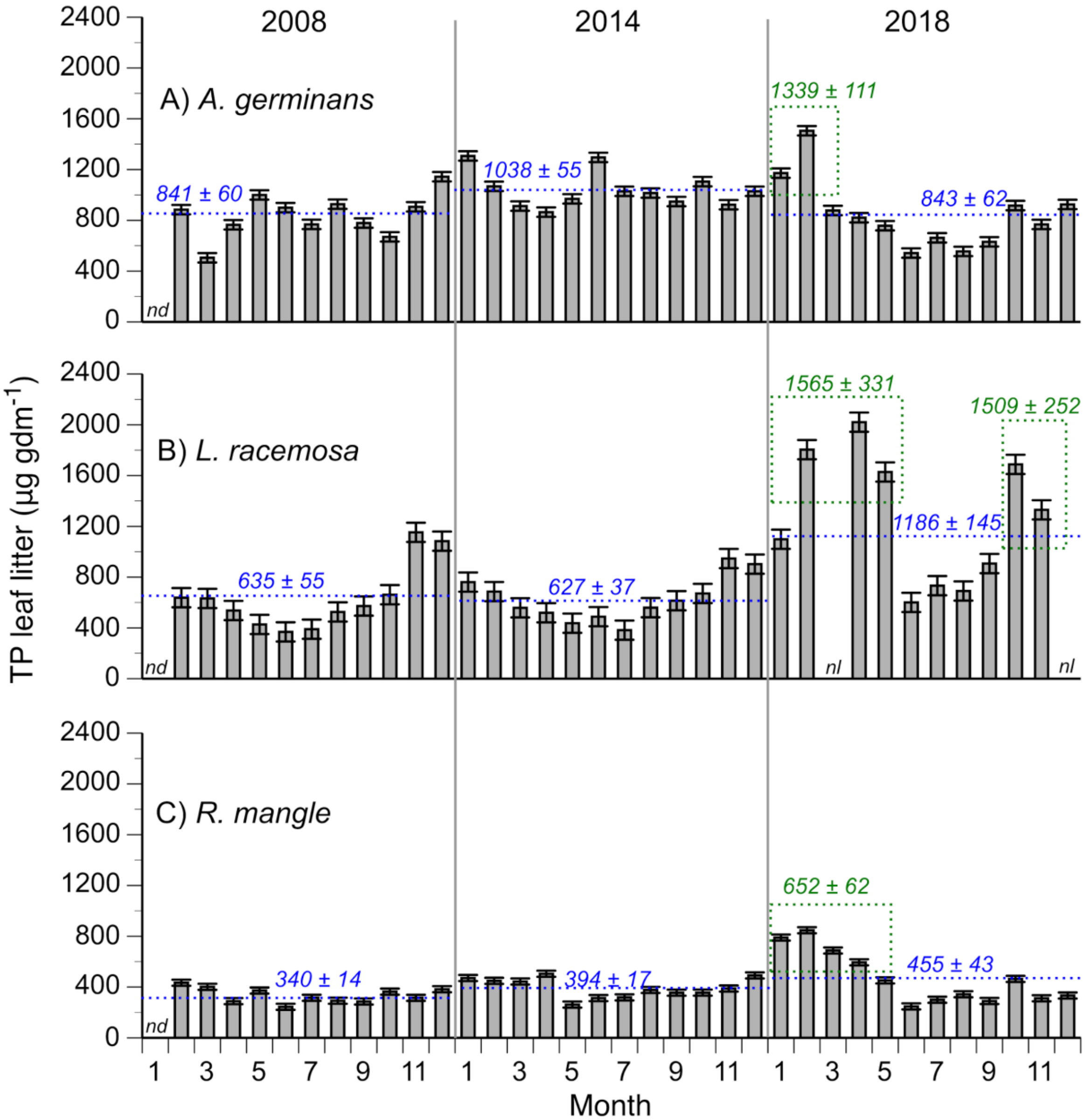


Figure 16. Monthly mean (± 1 SE) TP concentrations in leaf litter of the mangrove species (A) *A. germinans*, (B) *L. racemosa*, and (C) *R. mangle* in SRS-6 during post-Wilma (2008 and 2014) and immediately post-Irma (2018) periods. Blue dotted lines and numbers represent mean (± 1 SE) annual values. Green dotted squares and numbers indicate mean maximum TP concentrations in leaf litter during 2018; nd, no data; nl, no leaf litter data (Castañeda-Moya et al. 2020).

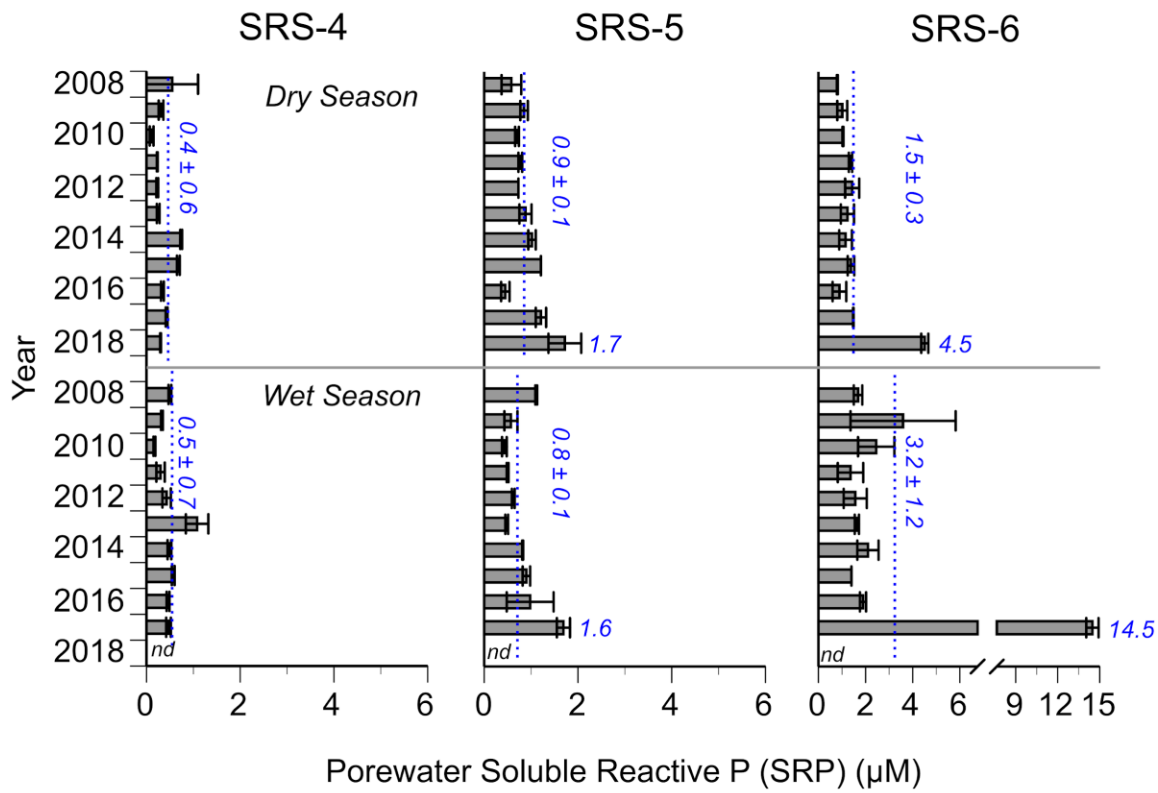


Figure 17. Spatial and seasonal variation in porewater SRP concentrations measured in mangrove sites along the Shark River estuary during post-Wilma (2008 dry season to 2017 dry season) and immediately post-Irma (2017 wet season to 2018 dry season) periods. Blue dotted lines and numbers represent mean (±1 SE) annual values; nd, no data (Castañeda-Moya et al. 2020).

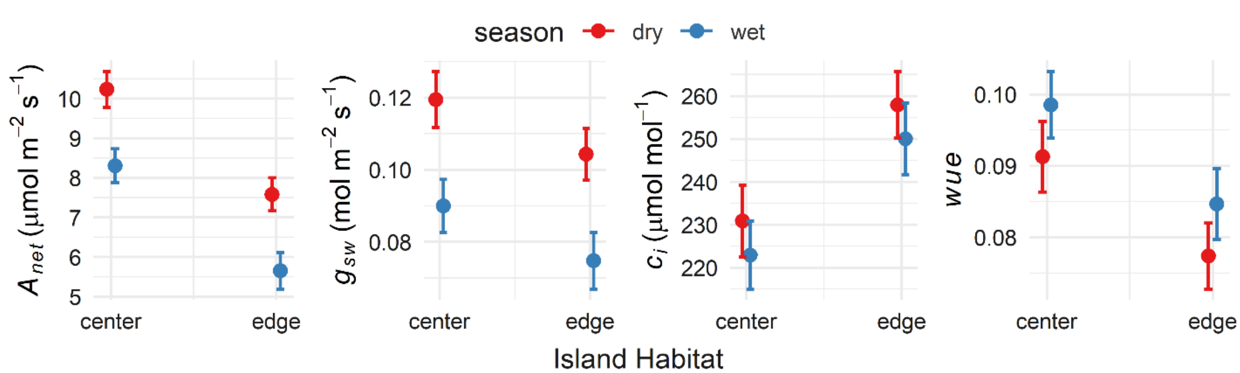


Figure 18. Predicted marginal mean (±95% confidence intervals) values of photosynthesis (A_{net}), stomatal conductance (g_{sw}), the concentration of intracellular CO_2 (C_i) and photosynthetic water use efficient (*wue*) by mangrove island habitat and season in scrub mangrove forests at TS/Ph-7. The dry season is November to April, and the wet season is May to October.

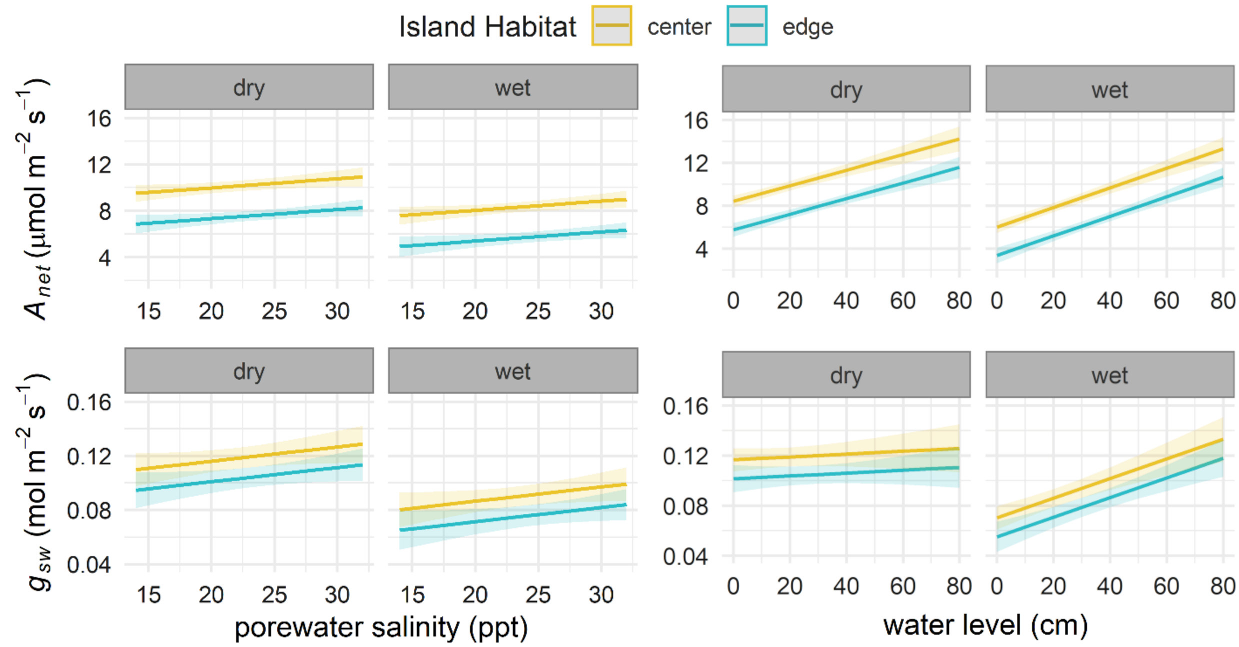


Figure 19. The effect of soil porewater salinity (left four panels) and water level (right four panels) on leaf photosynthesis (A_{net}) and stomatal conductance (g_{sw}) in scrub mangrove forests at TS/Ph-7. Lines are habitat-specific predicted mean marginal mean values (± 95% confidence intervals) from linear mixed-effects models.

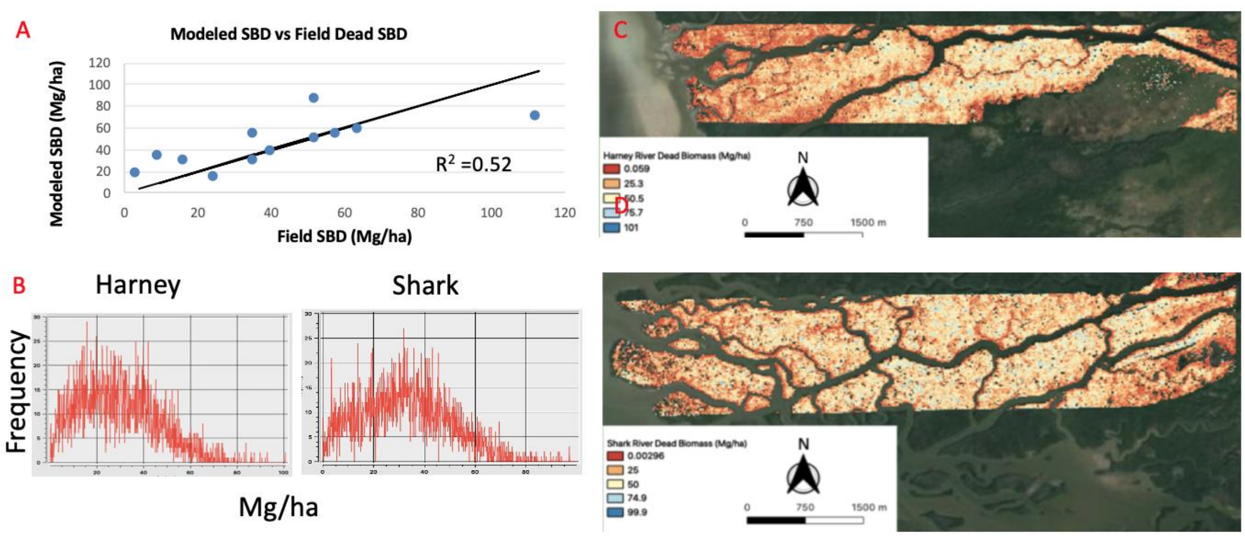


Figure 20. (A) Standing Biomass (SBD) from field observation vs Modeled SBD compute from multi-regression analysis. (B) Histogram of modeled SBD values across both sites. (C) and (D) Maps of modeled standing dead biomass along the Harney river and the Shark River.

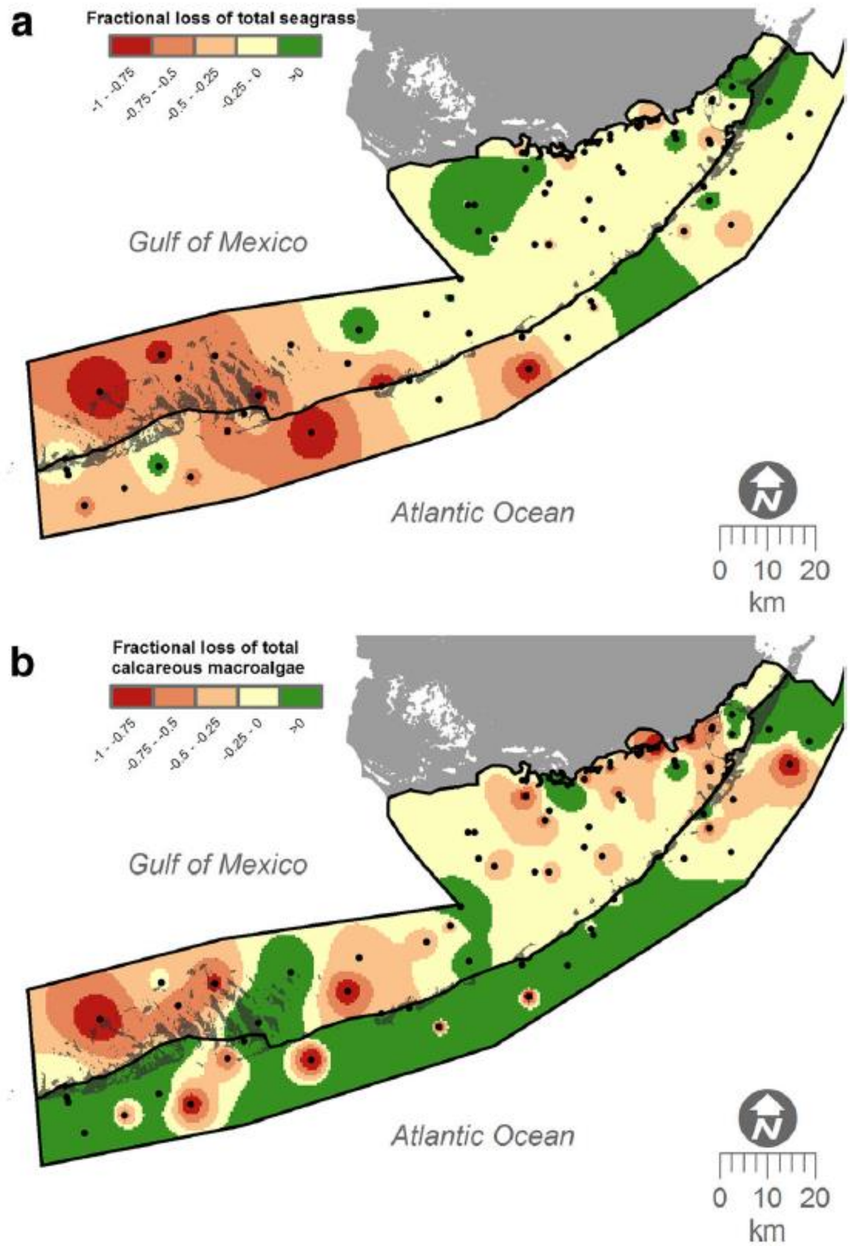


Figure 21. Spatial pattern in short-term response for total seagrass (TSG) (a) and total calcifying green macroalgae (TCAL) (b) across the Florida Keys National Marine Sanctuary (FKNMS) and Florida Bay (FB) (Wilson et al. 2020).

Trophic Dynamics: Trophodynamic research identified a strong gradient in carbon and sulfur isotope values along freshwater, estuarine and marine transects which can be exploited to trace organic matter in consumer tissues to its spatial origins with high resolution (Fig. 22) (Rezek et al. in press). These data were used to identify resource contribution to Snook and measure the extent that movement mediates cross-boundary trophic subsidies (Fig. 23). Long-term monitoring of juvenile bull sharks revealed that population structure took nearly seven years to mimic the pre-cold snap structure (Matich et al. 2020). The work found that both ontogenetic shifts and inter-individual behavioral variability led to a slower recovery than predicted based on overall shark CPUE (Matich et al. 2020). Bottlenose dolphins in the Shark River show strong seasonal and interannual variation in abundance (Fig. 24). Alligators varied in behavioral responses to Hurricane Irma ranging from no effect to a complete shift in commuting across the estuary linked to changing prey availability (Strickland et al. 2020). Native mosquitofish (*Gambusia geiseri*) were more vulnerable to intrageneric and intergeneric competition than invasive mosquitofish (*G. affinis*), explaining the comparatively widespread distribution of the invader (Rehage et al. 2020).

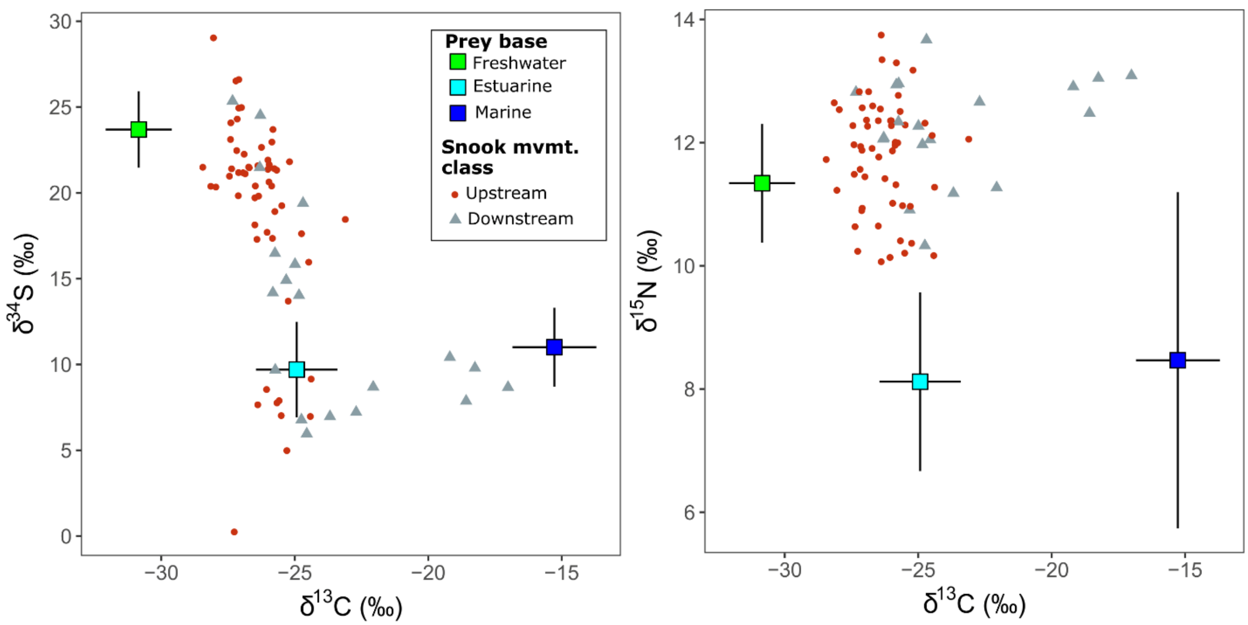


Figure 22. Carbon/sulfur and carbon/nitrogen stable isotope values of the prey base (mean ± SD) from freshwater and estuarine regions of the Shark River Estuary and Florida Bay (Marine), and individual snook tagged in the Shark River Estuary classified by their movement patterns based on acoustic telemetry data (adapted from Rezek et al. *in press, Ecosphere*).

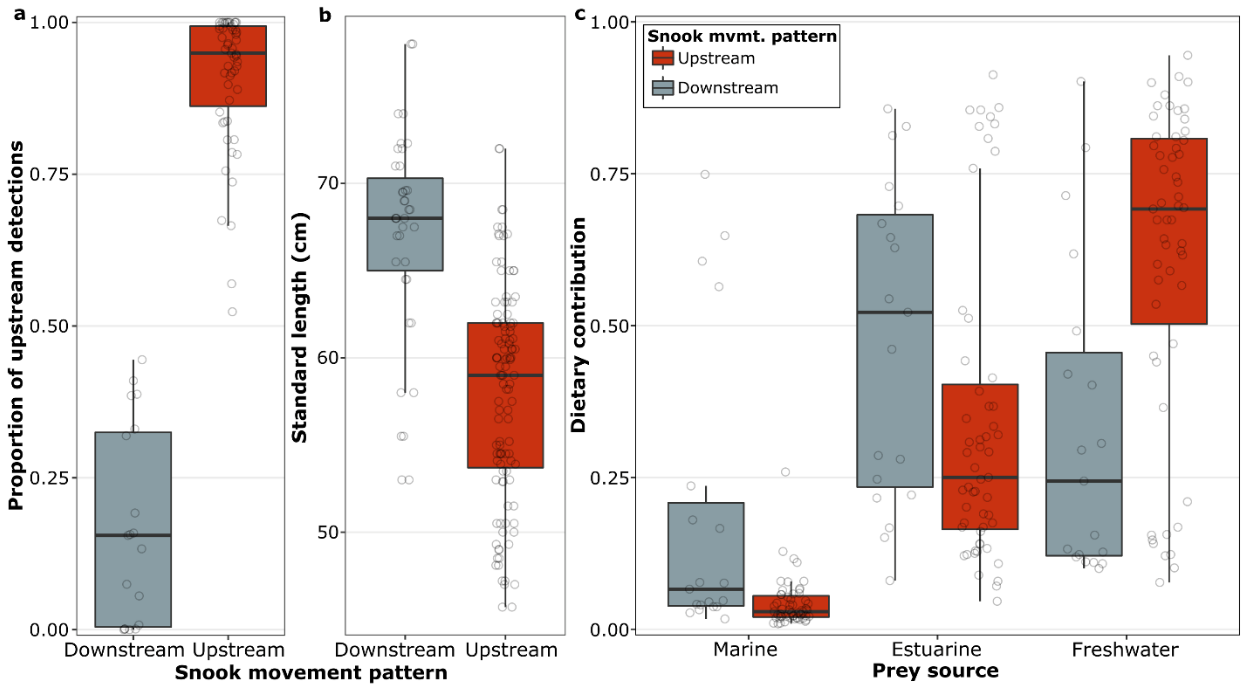


Figure 23. Boxplots showing the proportion of receiver detections in upstream freshwater regions versus downstream estuarine regions of the Shark River Estuary (a), standard length (b), and estimated prey source dietary contributions (stable isotope mixing model posterior means) (c) to individuals classified as downstream snook vs. upstream snook based on acoustic telemetry movement data (adapted from Rezek et al. *in press, Ecosphere*).

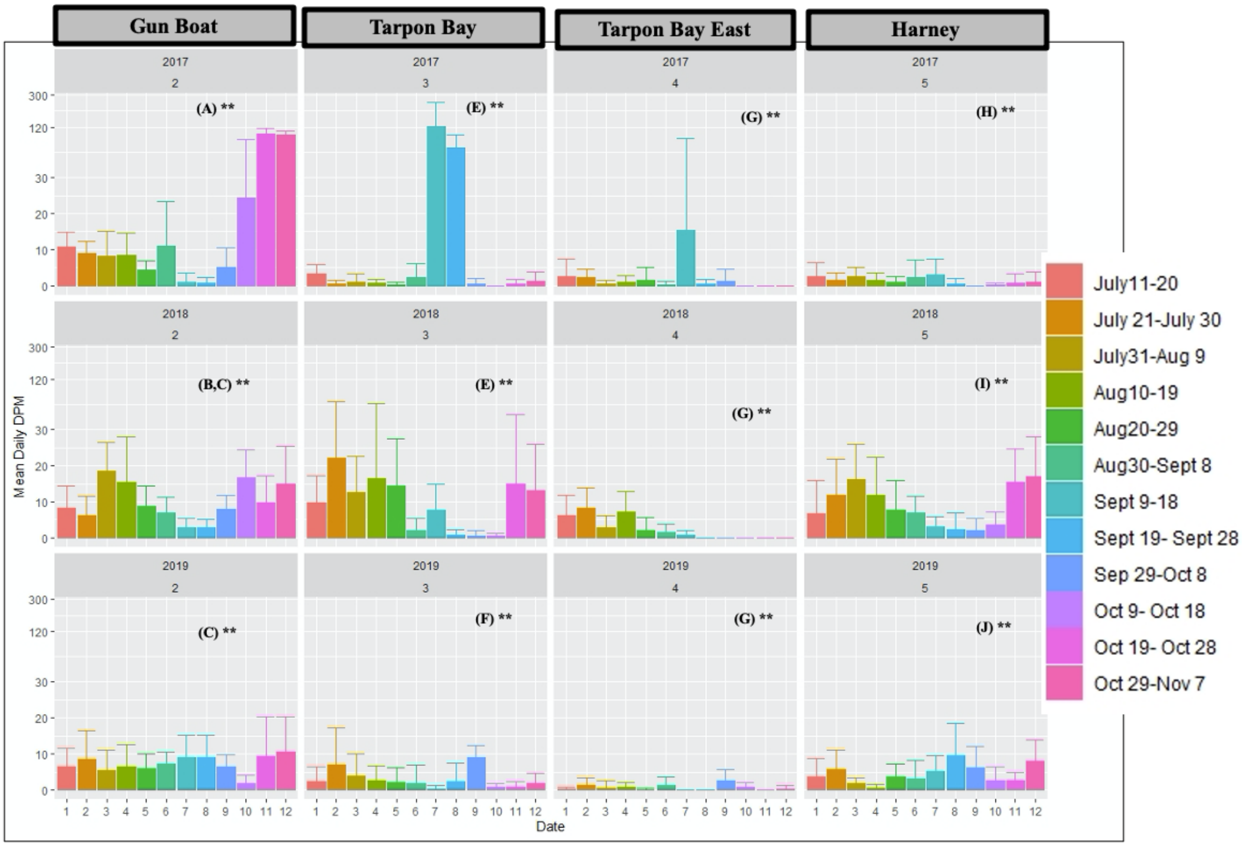


Figure 24. Mean daily detection positive minutes (DPM) and standard deviation of dolphin vocalizations for the years 2017-2019 in the Shark River Estuary, with letters indicating significant differences between years (ANOVA: $p < 0.005$).

Carbon Stocks and Fluxes: An analysis of 10 years of eddy covariance data from freshwater marl prairie showed that gross primary production decreased linearly and ecosystem respiration rates declined in a threshold manner as water level and inundation increased (Fig. 25). The ecosystem became a net CO_2 source when water level >46 cm or inundation >7 months (Fig. 26). The riverine mangrove tower site (SRS-6) was a source for CO_2 (~794 g C m-2) in 2019, while in the first half of 2020 it was a net sink for CO_2 (116 g C m-2), suggesting that the sink capacity of this site may be returning following H. Irma. CH_4 fluxes were an order of magnitude smaller than CO_2 fluxes and the greenhouse C balance (CH_4/NEE) indicated that the riverine mangrove forest offsets CH_4 emissions (Fig. 27). Everglades scrub mangroves (TS/Ph-7) exhibited strong diurnal patterns in NEE (Fig. 28) suggesting that calcium carbonate production at night is a significant sink for CO_2. The scrub mangroves were a net sink for CO_2 on the majority of days (77%) (Fig. 29) but water use efficiency of scrub mangrove forests was low (Fig. 30). In seagrass meadows, FCO_2 was 36% greater during the day than at night, causing the site to function as a net CO_2 source to the atmosphere of 0.27 µmol m-2 s-1. A quarter (23%) of the diurnal FCO_2 trend was due to the effect of changing water temperature on gas solubility. Evaporation rates were ~10 times greater than precipitation, causing a 14% increase in salinity, a potential precursor of seagrass dieoffs. We confirmed a dominant role of convective forcing on night-time enhancement and day-time suppression of gas transfer.

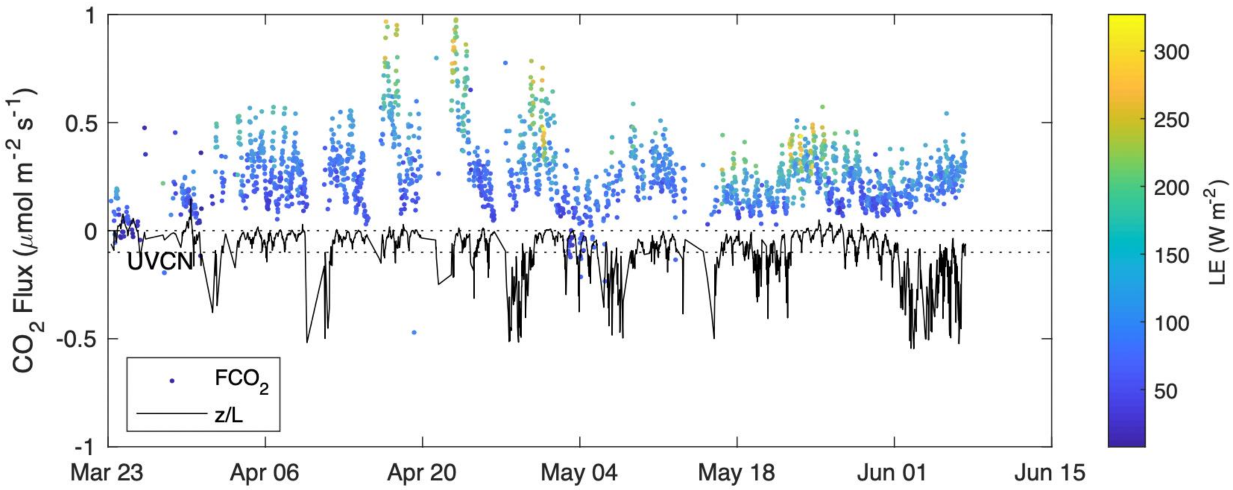


Figure 25. Time-series plot of FCO_2 and *z/L*. Values of FCO_2 are colored by LE, highlighting the positive correlation between these two fluxes. The unstable but very close to neutral zone (UVCN; $-0.1 < z/L < 0$) is shown between the dotted horizontal lines.

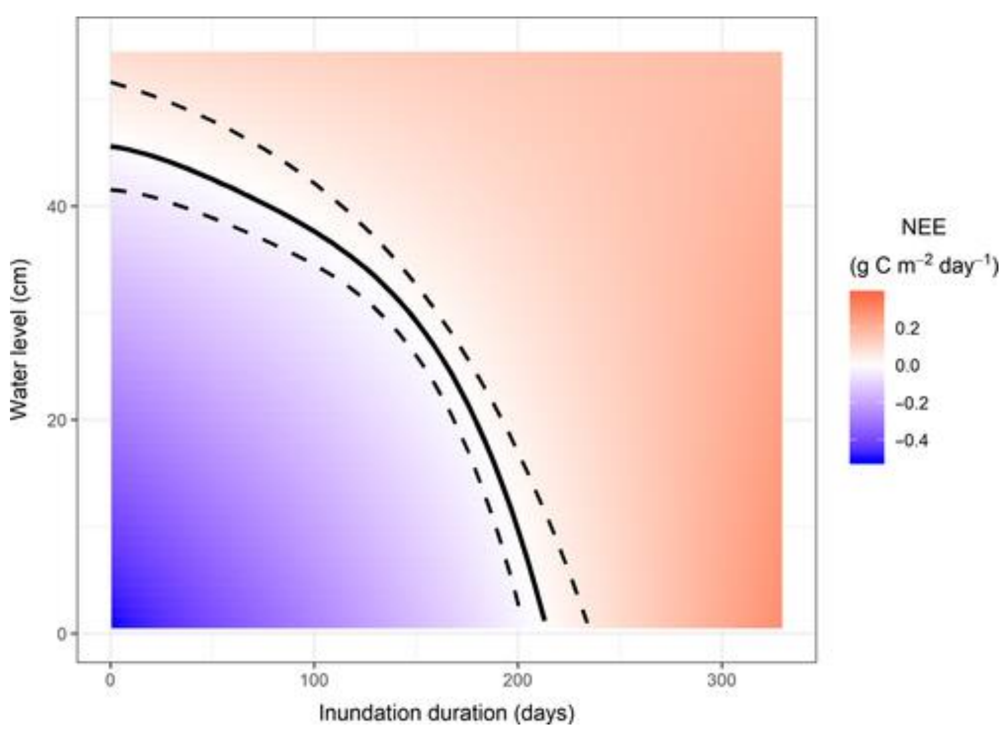


Figure 26. Net ecosystem CO_2 exchange (NEE) as a function of the interaction between WL and ID based on the least square mean predictions from the model in Table 2. The solid curve indicates the compensation points (i.e., NEE = 0 g C m−2 day−1) under the corresponding conditions. The dashed lines represent the 95% confidence interval of the compensation points.

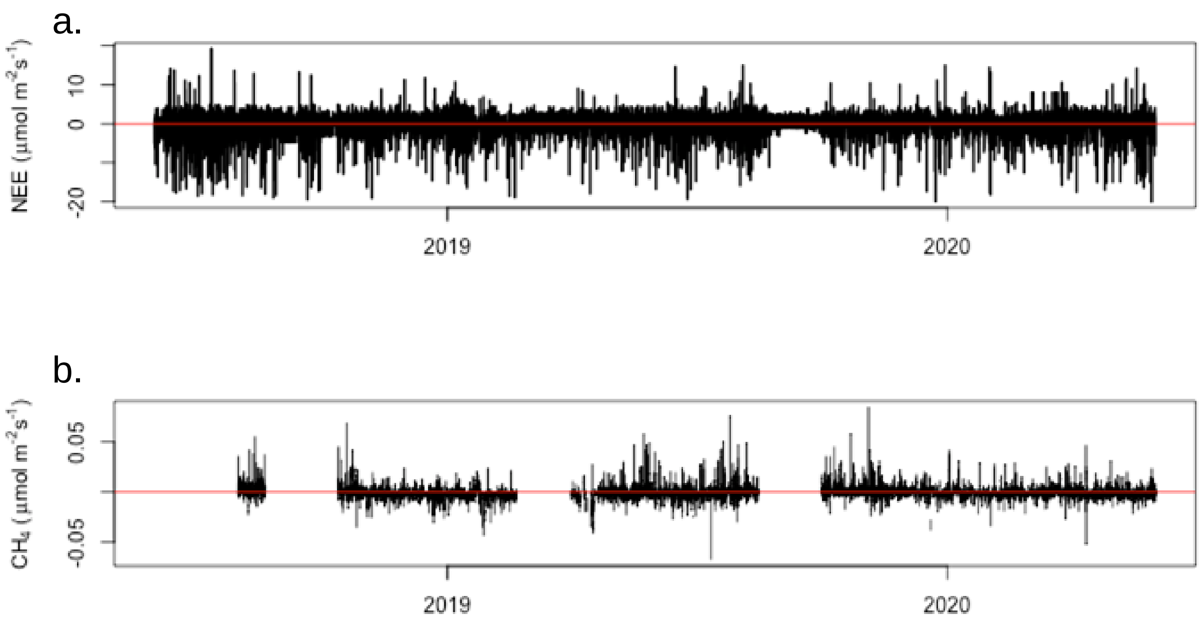


Figure 27. Half-hourly net ecosystem exchange rates (NEE) and CH_4 fluxes at the SRS-6 riverine mangrove site.

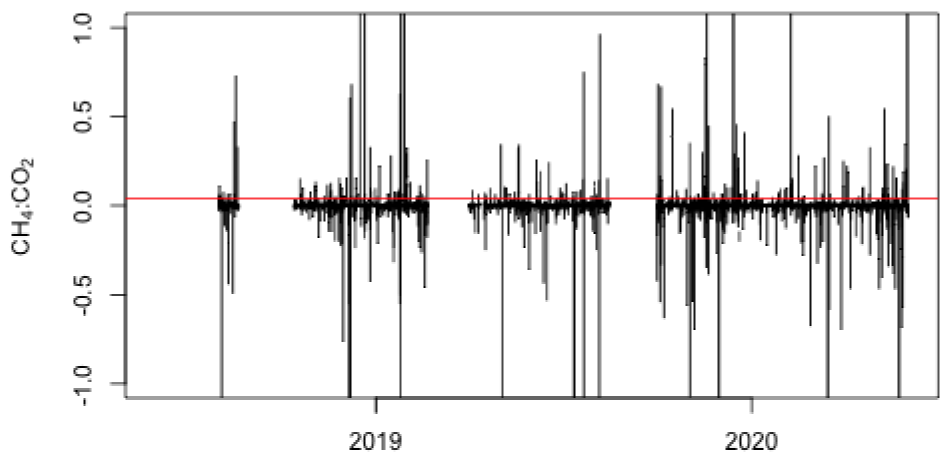


Figure 28. The greenhouse carbon balance is the ratio of net CH_4 to net CO_2. The redline indicates the compensation point (0.04) above which net CO_2 is not offsetting net CH_4 emissions at the tall riverine mangrove site (SRS-6). While this threshold is crossed sporadically, the site is a greater sink for CO_2 most of the time.

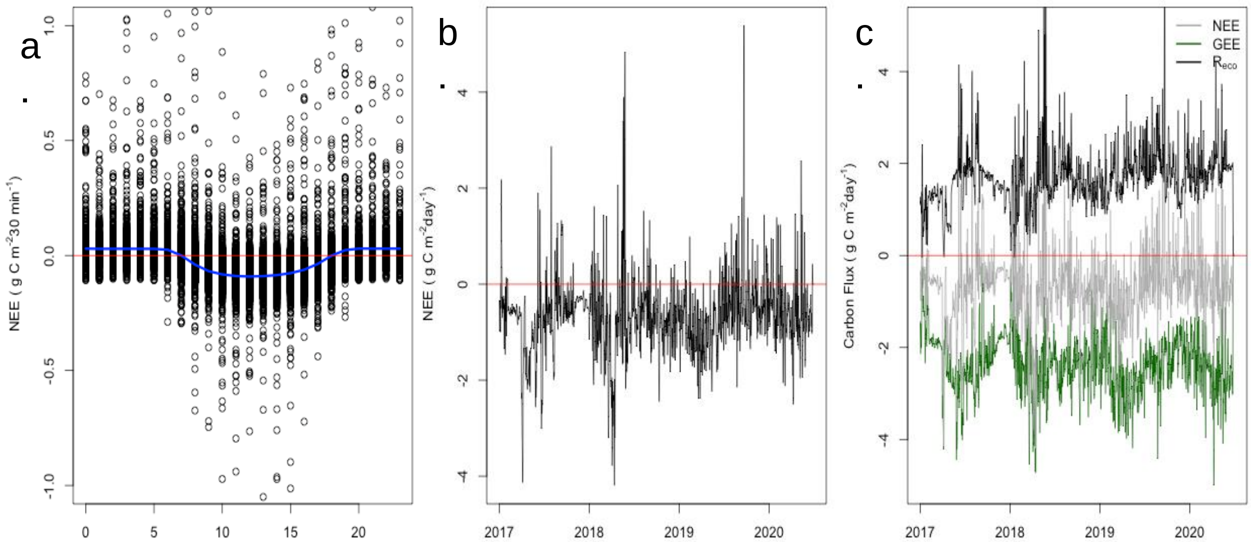


Figure 29. CO_2 dynamics at the scrub mangrove tower site. (a) Strong diurnal patterns, (b) seasonal oscillations, and dynamic fluxes of net ecosystem exchange (NEE), Ecosystem Respiration (Reco) and gross ecosystem exchange (GEE).

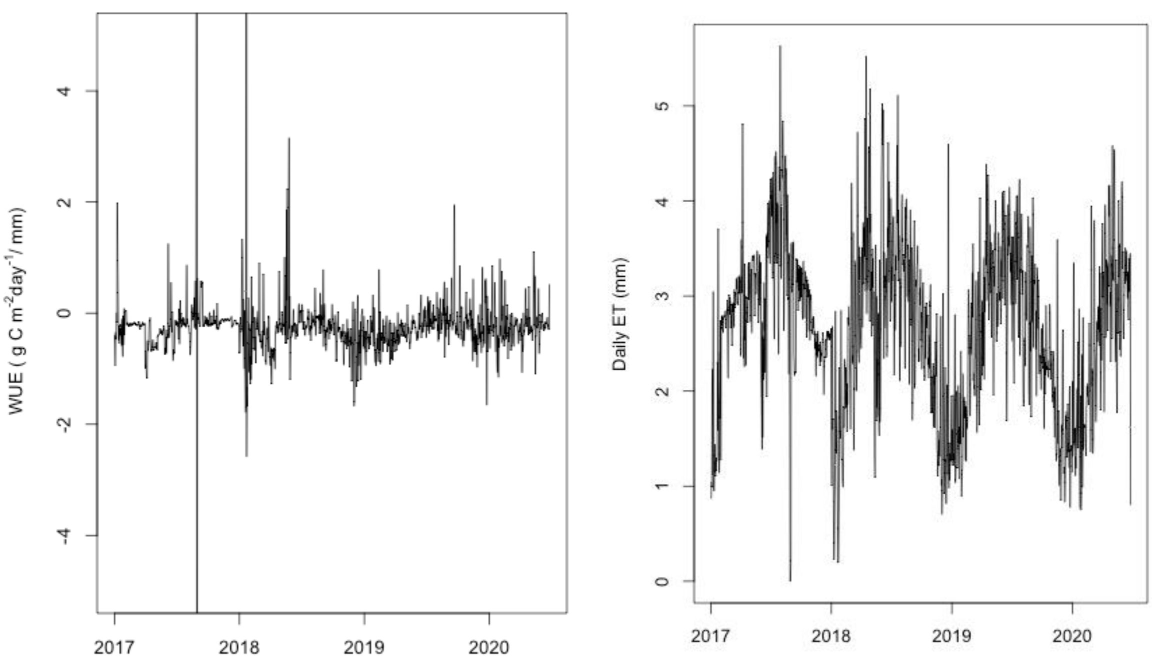


Figure 30. Daily water use efficiency (NEE/ ET) and evapotranspiration (ET) in scrub mangrove forests in southeastern Everglades.

Water Governance: Research on regional governance revealed the formative role of historic racialized development in shaping the implicit expectations many actors bring to the table when determining environmental governance goals. Development interests may set a harder boundary on the scope of possible restoration activities than prior work has recognized (Grove et al. in press). Work on water conflicts in South Dade agriculture details how water management practices both assist and complicate farmers' resilience to environmental changes, showing a divergence between expertdriven resilience initiatives and farmers' ad hoc responses to everyday experiences of environmental change. Adaptive management studies clarify a novel understanding of the Everglades as "infrastructural nature," providing a new conceptual framework to understand the specific class of nature-as-infrastructure projects geared toward using perceived natural processes to govern intrusions of other, less desirable, natural processes.

Integrative Modeling: See below

Key outcomes or Other achievements

Climate and Hydrology

- Taylor Slough is more susceptible to the effects of sea level rise compared to Shark Slough due to lower ground surface elevations.
- Satellite observations (Sentinel-1 SAR Interferometry) can be used to accurately detect seasonal and long-term changes in water levels across the Everglades.

Biogeochemistry and Organic Matter Dynamics

- Legacies of disturbance drive biogeochemical changes in freshwater and marine ecosystems.
- Increasing marine water increases variability and magnitude of organic matter mass loss. Increasing sediment grain size increases buried relative to surface organic matter mass loss.
- Microbial assemblages are similar among freshwater marshes but different among brackish marshes. Salinity dosing reduced taxonomic richness in soil microbial communities at brackish but not freshwater marsh sites.
- Bacterial productivity is positively correlated with DOC concentrations in peat-based marshes and negatively correlated with DOC concentrations in marl-based marshes.
- Marl marsh and mangrove wetlands have higher bacterial and algal-based dissolved organic matter indices and lower terrestrial/humic dissolved organic matter than peat-based wetlands.

Primary Production

- We identified the phosphorus and salinity optima and tolerances for 56 diatom taxa inhabiting periphyton mats, including 18 species that can serve as early indicators of shifts in the marsh-mangrove ecotone resulting from salinity and phosphorus changes driven by saltwater intrusion.
- Increases in water levels are decreasing plant density and biomass in longer-hydroperiod wetlands but increasing aboveground net primary productivity in shorter-hydroperiod wetlands.
- Mangrove litterfall could be used as an indicator to evaluate trajectories of canopy recovery and resilience to hurricane disturbances in areas of high recurrence of storms such as the Gulf of Mexico and the Caribbean region.
- Ecophysiological responses of R. mangle scrub forests are modulated by seasonal changes in porewater salinity and hydroperiod. Mangrove habitats

defined by elevation change (i.e., center vs. edge) also influence leaf gas exchange, with depressed rates in the edge habitats relative to their centers.

- Analysis of airborne G-LiHT data indicated large amounts of mangrove standing dead biomass after Irma's impacts in both Harney and Shark River estuaries.
- Impacts to south Florida benthic macrophyte communities from Irma were not catastrophic and were limited in spatial extent, with higher damage in areas that sustain direct impact compared to more protected areas (i.e., estuarine habitats). This suggests that benthic communities hit by heavy winds are more likely to sustain direct physical impacts, whereas estuarine areas with longer residence times are more at risk of the indirect effects of stormwater runoff and retention (Wilson et al. 2020).
- We developed a framework to study the impacts of hurricanes on ecosystems (Hogan et al. 2020).

Trophic Dynamics

- Mark recapture data collected in the Shark River Estuary was used to evaluate Largemouth Bass survival over years of varying drought intensity.
- An illustration of a hypothesized the FCE food web, developed through a collaboration of FCE scientists and a digital artist, was finalized (Fig. 31). This illustration will be used as an educational aid and disseminated in future publications.

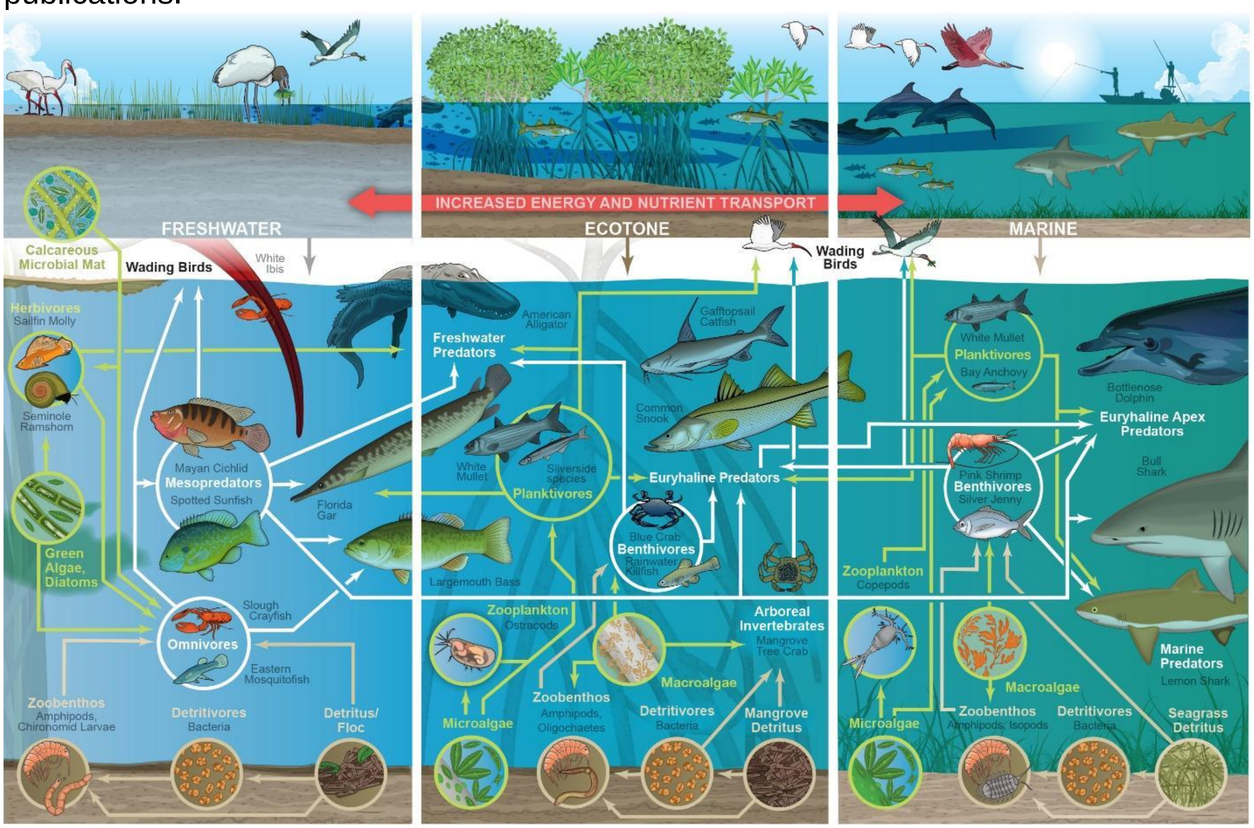


Figure 31. Illustration of important trophic interactions within and between habitats of the Florida Coastal Everglades (Bottom Panel) and the hypothesized effect of increased energy and nutrient transport between these habitats in response to increased water inflow associated with the Comprehensive Everglades Restoration Project (Top Panel).

Carbon Stocks and Fluxes

- All towers remained operational 2019-2020. A new tower at the freshwater ecotone was added.
- Climate change or water management activities that increase water levels and inundation in freshwater marshes weaken CO_2 sink strength, creating a positive feedback to climate change.
- Our findings indicate that evaporation and FCO_2 over shallow, tropical and subtropical seagrass ecosystems may be fundamentally different than in submerged vegetated environments elsewhere, in part due to the complex physical forcing of gas transfer in these coastal waters.

Water Governance

- Article in press at Geoforum on cultural values and environmental politics in South Florida
- Co-edited book on environmental politics and governance in the Anthropocene

Integrative Modeling

- Modified ELM code-data to support 64bit systems and extended climate data rescaling and processing, with promising preliminary model performance improvements towards ELM v3.2, including the incorporation of diatom assemblage-based predictions of ecotone movement.

Opportunities for training and professional development

The FCE LTER provides professional development opportunities to its members at all levels through a near peer mentoring model that includes undergraduates, graduate students, post-docs, college faculty, and K-12 teachers. Over the last year, 11 undergraduates have participated in FCE research and are distributed across five FCE labs. The Malone Disturbance Ecology Lab focused on the recruitment of underrepresented students and provided support to William Sanchez, Nisha Ali, and Jenisha Oli. Support was also provided for Zhuoran Yu who is co-advised by Starr and Staudhammer at the University of Alabama and two REUs (one active; one delayed due to COVID-19) placed in other FCE labs. The FCE Graduate Student Group consists of 69 total members distributed across our research groups where they are mentored by faculty and post-docs. Our graduate students also share in the responsibility of mentoring undergraduates and members of the K-12 community. Our post-doctoral and junior faculty members are included in site leadership roles through the Internal Executive Committee and are involved in the co-production of research with senior faculty mentors. The FCE Research Experience Programs provides professional development to K-12 teachers through Research Experience for Teacher (RET) fellowships and in collaboration with the National Tropical Botanical Gardens through the Kampong Science Enrichment Program (K-STEP). While current RET Cristina Whelan’s work has been postponed due to COVID-19, she will continue the decomposition work that she began in 2019 when it is safe to do so. Whelan’s RET will be extended for an additional year through newly secured funding. Whelan will continue collecting data for an additional year, provide near peer mentoring to new RET Ms. Beatriz Guimarãez, and serve as a facilitator for the upcoming K-STEP.

Communicating results to communities of interest

The results of our research are disseminated to communities of interest through the FCE Communications Team and the collaborators within our site membership. The Communications Team consists of the PI, Program Manager, Education & Outreach Coordinator, and Collaborator Steve Davis. The team works closely with the FIU Division of External Relations, Strategic Communications & Marketing (FIU External Relations), LTER Network Communications Office, Everglades Foundation, and NSF Communications Office to increase public awareness and generate an interest in learning about the Florida Coastal Everglades. Through these collaborations we receive guidance for communicating with external audiences through social media, press releases, newsletters, and an annual impact report. These communications allow us to maintain a consistent presence in the news media and increase our ability to engage with the members of our community that are not typically aware of our research. Scientists from both governmental agencies and NGOs are included within our membership and serve an important role in connecting with policymakers and regulators by allowing us to report our results directly to governmental agencies such as the US EPA, USGS, South Florida Water Management District, and National Park Service. As Director of Communications for the Everglades Foundation, Collaborator Davis meets regularly with lawmakers, staffers, and key constituents to provide briefings and restoration guidance and PI Gaiser informs and advises Florida's Governor of the upstream causes of harmful algal blooms as a member of his Bluegreen Algae Task Force.

Plans to accomplish goals during the next reporting period

We plan to complete the objectives of our year 2 research during the no-cost extension.

Impacts

Impact on the development of the principal disciplines

Water Governance: FCE-supported research has supported Grove and Wakefield's co-edited volume on Resilience in the Anthropocene: Governance and Politics at the End of the World, which is impacting how geographers and scholars in cognate fields understand changing forms of environmental politics and governance in the Anthropocene. This research on governance and urban development has also contributed to Grove and colleagues' forthcoming paper on design, justice and resilience in Geoforum. This promises to be a very impactful paper that will make a signal contribution to understanding the relations between cultural values, justice and equity concerns, the region's history of racialized development, and environment governance in South Florida. The analysis in this paper is also feeding directly into planned research on the relation between cultural values and forms of authority in water governance networks. Research on adaptive management is poised to make significant contributions to understandings of 'nature as infrastructure.' Wakefield is using fieldwork carried out over the previous year for an article in submission at Environment and Planning D: Society and Space that develops the concept of "Anthropocene infrastructural nature" as a means of understanding the specific class of nature-as-infrastructure projects geared toward using perceived natural processes to govern intrusions of other, less desirable, natural processes.

In addition, FCE researchers oversee projects sponsored by state and federal management agencies to understand how the ecosystem response to hydrologic changes driven by restoration and climate drivers including sea-level rise, fire, and tropical storms across the marl prairie and ridge-slough landscapes, along marl prairie-slough gradients and on tree islands, in mangrove habitats, and in the shallow seagrass meadows in Florida Bay. This work directly integrates FCE findings to inform land/water decisions. Decisions about management of endangered and non-native species is also informed by this research. For example, management-induced hydrologic changes in the last decade revealed in FCE data have caused vegetation in eastern marl prairies to shift toward wetter communities while the northeastern portion of the western prairie has become drier. These changes have shifted the habitat use for the endangered Cape Sable seaside sparrow. Changes in the abundance and distribution of this species and their habitat has strong implications for the restoration of the Everglades.

In another example, Jordan Massie and Jennifer Rehage organized and convened a workshop at the 2019 Florida Atlantic Coastal Telemetry annual meeting in Tequesta, FL (December 3, 2019). This workshop brought together researchers from across Florida and included representatives from academia (FIU, FAU, UF), NGOs (Bonefish & Tarpon Trust), and state management agencies (FWC/FWRI) to review and synthesize past acoustic telemetry research involving Common Snook and discuss outstanding research gaps and opportunities for collaborative research using movement data from different systems. This workshop has motivated current FCE analyses investigating how variation in environmental conditions influence the migration timing of Snook in the

Shark River Estuary, particularly the role of seasonal changes in the magnitude of freshwater flow. Results will provide insight into how water management, restoration, and climatic shifts may affect this recreationally/economically important fishery in the future.

Integrative Modeling and Synthesis: Advancing ecology to make it more useful and relevant requires a fundamental shift in thinking from measuring and monitoring, to using data to anticipate change, make predictions, and inform management actions. The bulk of ecological forecasts are largely scenario-based projections focused on climate change response on multidecadal time scales, yet the timescales of environmental decision-making tends to require near-term (daily to decadal) data-initialized predictions, as well as projections that evaluate decision alternatives. Rapid changes in climate and land use are creating novel ecosystem states and coastal ecosystems are especially vulnerable to abrupt transformations from SLR and human development.

We will continue to link these changes in fresh and marine water supplies to patterns in ecosystem function and study how this influences the emissions of greenhouse gases. We will achieve this through cross-site distributed studies of ecosystem carbon flux and scenario modeling. This research is particularly important for coastal regions where live plants are vital for maintaining soil structure (i.e., elevation), and decreases in vegetation health can cause wetland carbon loss. Earth System Models do not accurately predict greenhouse gas emissions under a changing climate and wetland model-data comparison studies have shown that uncertainty in model predictions of greenhouse gas emissions are due to (1) the seasonal effects of inundation, (2) the lack of representation of inundated plant processes, and (3) the need for greater representation of wetland subsurface biogeochemistry. FCE has influenced the field of coastal biogeochemistry by advancing understanding of how disturbances interact with long-term changes in dissolved and particulate chemistry. These ongoing studies will continue to directly contribute to reducing known uncertainties through observational and experimental studies of the coupled cycling of CO_2 and hydrology.

Impact on other disciplines

Grove and colleagues' forthcoming paper in Geoforum engages multi-disciplinary research (including geography, sociology, planning, design and engineering) on justice, design and resilience.

Impact on the development of human resources

Opportunities for research, teaching and mentoring in science
FCE LTER invests in human resource development through the recruitment and training of undergraduate and graduate students from diverse communities. Each year, our base funding provides support for two undergraduates as formal REUs. Each student is provided with stipend support and included as members of FIU's Coastal Ecosystems REU Site (CE-REU) where they participate in cohort-building, networking opportunities, social events, and weekly field trips. Each participant presents their results at the REU

Site Symposium, the annual FCE All Scientists Meeting, and at a national or international conference. This year, the typical operations of our program has been disrupted by the COVID-19 pandemic and has delayed one REU and postponed the second until the summer of 2021. Graduate students serve as near peer mentors to undergraduates and are engaged in all elements of the FCE program as members of our working groups and at our annual meetings. We offer and participate in LTER network-wide and FCE-specific distributed seminars designed specifically for LTER graduate students and encourage them to apply for synthesis opportunities through the LTER Network Office.

Improving access and retention of underrepresented groups in research
In 2019, the FCE Diversity and Inclusion Committee was established to improve the access and retention of members of underrepresented groups by addressing the Big Idea of NSF INCLUDES and contributing to broadening the participation of underrepresented communities in STEM fields with guidance from the NSF Strategic Plan (FY 2018-2022). The committee consists of the Lead PI, the Education and Outreach Coordinator, one graduate student, one FIU collaborator, and an off-site collaborator. The committee is currently represented to the IEC and LTER Network Executive Board by graduate student L. Iporac.

The *FCE Diversity and Inclusion Plan (FCE-DIP)* was recently developed by the committee and is being used as our guide for the advancement of students, early career scientists, and faculty from underrepresented groups by promoting the inclusion, equity, and well-being among FCE collaborators. The FCE-DIP established three measurable objectives: *(1): Enhance representation and advancement of early career scientists from underrepresented groups; (2): Enhance representation of faculty from underrepresented groups; and (3): Promote diversity, equity, inclusivity, and well-being among FCE collaborators.* Diversity issues are also addressed through the diversity of our leadership team which includes 7 women, 3 Hispanics, 1 Asian, 1 Non-Hispanic Black, and 3 LGBT members. Our senior personnel, collaborators and postdocs are 42% underrepresented and our graduate students are 38% female and 41% underrepresented ethnic groups.

The FCE program honors the identity of all participants and maintains an atmosphere that represents and embraces diverse cultures, backgrounds and life experiences that reflect the multicultural nature of South Florida and the global society. Three members of our leadership are being trained as undergraduate mentors by FIU's Multicultural Programs and Services (MPAS) Office as advocates on issues related to diversity, inclusion, and equity. PI Gaiser serves on the internal advisory board of FIU's ADVANCE program in the Office to Advance Women, Equity & Diversity to advance institutional structures, processes, and climate to recruit and promote FCE faculty from underrepresented groups.

FCE is fosters leadership through the diverse structure described above, encouraging membership in more than one working group, inclusion of multiple working groups on student advisory committees, and through the co-production of publications with agency/NGO scientists. As our Diversity and Inclusion Plan moves toward full implementation, our progress will be annually assessed by Associate Dean of Research, Dr. Rita Teutonico, through interviews, focus groups, and an anonymous survey of quantitative demographic and qualitative inclusion data.

Scholarships to support FCE Graduate Students

The *FIU ForEverglades* scholarships are funded by the Everglades Foundation and awarded annually to full-time graduate students from FIU pursuing degrees in sciences and focus on improving our knowledge on Everglades physical, chemical or biological processes, or economic impacts of environmental changes. This year, three FCE Graduate Students received $25,000 each for use towards stipends, travel, and other research-related expenses.

Providing exposure of practitioners, teachers, young people, or other members of the public to FCE science

Since our last report, the FCE Schoolyard Program has been addressing the NSF's Strategic Plan's goal to "*advance the capability of the Nation to meet current and future challenges with K-12 programs that will support the development of the next generation of researchers*" by: (1) providing mentoring to K-12 students and teachers through our LTeaER participatory science program, (2) facilitating presentation of their findings at science fairs, and (3) pursuing supplemental sources of funding to support high school teacher participants in FCE related research.

The FCE LTeaER decomposition project is a primary focus of the FCE Schoolyard Program. Modeled after the Tea Bag Index (TBI) study (Keuskamp et al. 2013) and aligned with the research objectives of the Detritus & Microbes working group, the LTeaER program engages our community in a long-term decomposition study to test hypotheses about the drivers of organic matter transformation while contributing to this global research project. Teabags are deployed at each of our research and are being studied by an REU student and a Research Experience for Teachers (RET) fellow.

In the Fall 2019, RET Cristina Whelan and four students from her Research and Experimentation course at BioTECH High School deployed teabags along the spatiotemporal pulse gradient of the Cutler Slough under mentorship of PI Kominoski and the Education and Outreach Coordinator Oehm. Located on the grounds of FCE's Deering Estate partner, this tidal creek has been reconnected to upstream wetlands as a small-scale urban representation of Everglades restoration. The initial samples were collected, analyzed, and the resulting data was presented by the students at the 2020 Southeast Regional Science and Engineering Fair of Florida in their poster *Go With The Flow: Differences In Tea Decomposition In a Restored Wetland* and were the first from their school to participate in this regional fair. While the subsequent sample collections have been postponed due to the COVID-19 pandemic, the collections will resume when it is safe to do so.

Working in collaboration with the FIUteach program, Education & Outreach Coordinator Oehm has begun to develop evaluation tools that will assess the impact of our

Research Experience programs. Initially these tools will be used to evaluate the RET program with future plans to further adapt their use for evaluating the REU and RAHSS programs.

Impact on physical resources that form infrastructure

The establishment of the eddy flux tower at the marl-marsh ecotone site has allowed us to complete our flux tower network array. The boardwalk at SRS-2 has been replaced.

Impact on institutional resources that form infrastructure

The FCE LTER program was instrumental in advising the establishment of the Institute of Environment as a State of Florida Program of Excellence.

Impact on information resources that form infrastructure

Information Management

New FCE Website

The FCE LTER information management (IM) team (Kristin Vanderbilt (IM) and Mike Rugge (Project Manager)) met a major IM milestone stated in the 2018 proposal when a new FCE website (https://fcelter.fiu.edu/**)** was launched in December 2019. The old FCE website was hand-coded and laborious to maintain. The new website takes advantage of Cascade, the content management system used by FIU, to make website updates easier. While the Project Manager did most website updates himself on the old website, migrating the website into Cascade enables other FCE staff to have permissions to sections of the website in order to update their own content. With input from PIs, staff, and students, the information on the new website has been refreshed and reorganized for ease of navigation. Cascade facilitates integration with social media and newsfeeds and offers website search functionality. The new website significantly improves on the old one by being mobile device friendly and resolving to a size appropriate to the device on which it is being viewed.

Unfortunately, Cascade does not support dynamic web pages, such as the popular custom query interfaces to data, bibliography, and personnel databases found on the old FCE website. The FCE Project Manager therefore used the Foundation Framework, a responsive front-end software framework for web design, to produce a template mimicking the Cascade FCE website. He re-wrote all the query scripts on the old website in PHP in order to replace near-obsolete Emberl scripts. He preserved the many options from the old website for filtering datasets, publications, personnel and photographs for ease of discovery, while offering the new look and feel of the Cascade website. The dynamic part of the FCE website is served via an Apache webserver that is managed by the Project Manager on a Linux virtual machine, while the Cascade part of the website is served by FIU Communications. This new, hybrid FCE website has improved the experience of web visitors seeking data or information about the FCE LTER.

New FCE Data Catalog

FCE has updated its approach to generating and querying the FCE website's Data Catalog. The new method takes advantage of RESTful web services provided by EDI's PASTA+ data repository software. Previously, the FCE IM had submitted EML documents to the EDI Data Repository and then captured a subset of that metadata in a local Oracle database to drive the FCE Data Catalog. Maintaining two copies of the metadata, one in the EDI repository and the other local, was inefficient. With the new system, the IM submits EML to the EDI Data Repository as before, but then the EDI Repository becomes the source of metadata to populate the FCE Data Catalog. Further, PASTA+'s Solr repository can be queried from the FCE website to discover FCE datasets based on metadata stored in keywords, author, and title EML fields. This new approach for generating and querying the FCE Data Catalog expedites updates of FCE datasets.

The new FCE Data Catalog improves over the old catalog because EDI's web services allow the retrieval and display of the DOI associated with each dataset citation on the new FCE website. Having complete dataset citations on the FCE website will make it easier for FCE scientists to cite the datasets they use. As more FCE scientists include dataset citations in the papers they author, the better FCE LTER will be able to track data usage in the future.

FCE Databases

The FCE Information Management System (FCE IMS) contains 177 datasets which are available on the FCE LTER's website **(**https://fcelter.fiu.edu/data/index.html**)** and in the EDI Data Repository. Three datasets were added and 44 long-term datasets were updated between 12/01/2019 and 08/31/2020. All datasets are publicly accessible except when an embargo has been granted while a graduate student publishes on a dataset or where a dataset was not collected using FCE LTER funds. A table of titles and DOIs for FCE LTER datasets deposited in the EDI Data Repository is included as a supporting file in the Products section of this report.

Data Processing

FCE LTER has traditionally relied on the XLSX2EML perl program, written by the Program Manager, to translate metadata from an Excel template to EML. This program works extremely well for datasets that have only a single data entity. It is not designed, however, to generate EML for data packages with multiple entities. More and more, FCE scientists are wanting to archive datasets with code or multiple data tables, so the FCE information manager has adopted EDI's EMLAssemblyline R package for this purpose.

Data Use

Use of FCE LTER data is steady. A manual search of Google Scholar for DOI's from the EDI Data Repository detected 5 papers published between 12/1/2019 and August 30, 2020 that contain 13 citations of FCE LTER datasets. Downloads of FCE datasets suggest that the data are being used more frequently than they are cited. The logs from the FCE website recorded 231 non-robot dataset downloads between 12/1/2019 and

8/17/2020, while the EDI Repository recorded 26,182 non-robot downloads of FCE datasets during the same period. Roughly 1000 of these downloads do not have an identifiable user agent, however, so could reflect robot activity. Seven datasets had about 3000 downloads apiece. For just one of the seven, data package knb-lter-fce.1074.7, there have been 1052 requests between August 26 and September 9, 2020, but 977 are checksum requests from DataONE (Servilla, pers. comm.). A better estimate of downloads from PASTA is thus about 4000 when unidentifiable user agents and repetitious DataONE requests are filtered out. This still indicates considerable interest in FCE data.

Supporting local and LTER Network science

The FCE information management team supports site and network level science by making high quality FCE data and metadata accessible through the FCE LTER website, the EDI Data Repository, and Network-level cross-site databases. Updates to long-term FCE datasets are regularly published in both locations in compliance with the FCE Data Management Policy and LTER Data Access Policy. The FCE IM made final updates to the LTER Network's cross-site climate database (ClimDB) in June 2020 because that database will soon be archived in the EDI Repository. Future FCE climate data will go into CUAHSI's archive, along with the climate data from other LTER sites, per the new approach to standardizing LTER climate data approved by LTER's Executive Committee.

The FCE information management team lends its expertise to FCE researchers and graduate students by offering presentations about information management topics and assistance with metadata development, data submissions, individual project database design, GIS and research graphics.

IT Infrastructure

The FCE information management system's web server, Oracle 12c database and SFTP server are loaded on three virtual servers housed on FIU's Division of Information Technology's equipment. Per the FCE Disaster Recovery Plan, the FCE LTER Oracle database and websites are backed up offsite at the Northwest Florida Regional Data Center (NWRDC) located on the campus of Florida State University in Tallahassee, Florida.

Other contributions

The FCE IM is a co-PI on the EDI award and works quarter-time for EDI doing education and outreach. She serves as the liaison between the LTER Information Management Committee and EDI. She is currently the Associate Editor for Data Science for the journal Ecological Informatics. She serves as the US representative on the International LTER's Information Management Committee and has co-authored a chapter about the US ILTER experience (Waide and Vanderbilt, in press). She collaborates with other LTER information managers on presentations at national meetings (Kui et al. 2020).

Impact on technology transfer

FCE ensures that science and management are fully integrated through coproduction of science through academic and agency collaborations. Everglades restoration directly relies on FCE for science to inform restoration best practices. For instance, FCE data is being reported in the 2020 System-Wide Ecological Indicators for Everglades Restoration report of the South Florida Ecosystem Restoration Task Force that conveys the progress of ecosystem restoration directly to the U.S. Congress. We contribute to the National Academies of Science biennial report by the Committee on Independent Scientific Review of Everglades Restoration Progress.

Impact on society beyond science and technology

We have produced many press releases and public news articles that link the science of FCE to the community of South Florida.

Products

Publications

Books

Chandler, D., K. Grove and S. Wakefield. 2020. Resilience in the Anthropocene: Governance and Politics at the End of the World. Routledge.

Book Chapters

Grove, K., and A. Barnett. 2020. Destituting resilience: contextualizing and contesting science for the Anthropocene, in Chandler, D., K. Grove and S. Wakefield (eds.) Resilience in the Anthropocene: Governance and Politics at the End of the World. Routledge.

Waide, R., and K. Vanderbilt. In Press. Understanding the Fundamental Principles of Ecosystems through a Global Network of Long-Term Ecological Research Sites, in Waide, R. and S.E. Kingsland (eds.) The Challenges of Long Term Ecological Research: A Historical Analysis. Springer.

Wakefield, S., K. Grove, and D. Chandler. 2020. Introduction: the power of life, in Chandler, D., K. Grove and S. Wakefield (eds.) Resilience in the Anthropocene: Governance and Politics at the End of the World. Routledge.

Journal Articles

Published

Breithaupt, J.L., J.M. Smoak, T.S. Bianchi, D. Vaughn, C.J. Sanders, K. Radabaugh, M.J. Osland, L.C. Feher, J. Lynch, D.R. Cahoon, G. Anderson, K.R.T. Whelan, B.E. Rosenheim, R.P. Moyer, and L.G. Chambers. 2020. Increasing rates of carbon burial in southwest Florida coastal wetlands. JGR Biogeosciences DOI: 10.1029/2019JG005349.

Castañeda-Moya, E., V.H. Rivera-Monroy, R.M. Chambers, X. Zhao, L. Lamb-Wotton, A. Gorsky, E.E. Gaiser, T. Troxler, J. Kominoski, and M. Hiatt. 2020. Hurricanes fertilize mangrove forests in the Gulf of Mexico (Florida Everglades, USA). Proceedings of the National Academy of Sciences 117: 4831-4841. DOI: 10.1073/pnas.1908597117

Cattelino, J. 2019. From green to green: The environmentalization of agriculture. Journal for the Anthropology of North America 22: 135–138. DOI: 10.1002/nad.12105

Cattelino, J., G. Drew, and R.A. Morgan. 2019. Water flourishing in the Anthropocene . Cultural Studies Review 25: 135-152. DOI: 10.5130/csr.v25i2.6887

Dessu, S.B., R.M. Price, J. KoDessu, S.B., R.M. Price, J. Kominoski, S.E. Davis, A. Wymore, W.H. McDowell, and E.E. Gaiser. 2020. Percentile-Range Indexed Mapping and Evaluation (PRIME): A new tool for long-term data discovery and application. Environmental Modelling & Software 124: 104580. DOI: 10.1016/j.envsoft.2019.104580

Engebretson, J.M., K.C. Nelson, L.A. Ogden, K. Larson, J.M. Grove, S.J. Hall, D.H. Locke, D.E. Pataki, R. Roy Chowdhury, T.L.E. Trammell, and P.M. Groffman. 2020. How the nonhuman world influences homeowner yard management in the American residential macrosystem. Human Ecology DOI: 10.1007/s10745-020-00164-2.

Feagin, R.A., I. Forbrich, T.P. Huff, J.G. Barr, J. Ruiz-Plancarte, J.D. Fuentes, R.G. Najjar, R. Vargas, A.L. Vazquez-Lule, L. Windham-Myers, K. Kroeger, E.J. Ward, G.W. Moore, M.Y. Leclerc, K.W. Krauss, C.L. Stagg, M. Alber, S.H. Knox, K.V.R. Schafer, T.S. Bianchi, J.A. Hutchings, H. Nahrawi, A. Noormets, B. Mitra, A. Jaimes, A.L. Hinson, B. Bergamaschi, and J.S. King. 2020. Tidal wetland Gross Primary Production across the continental United States, 2000-2019. Global Biogeochemical Cycles DOI: 10.1029/2019GB006349.

Flood, P.J., A. Duran, M. Barton, A.E. Mercado-Molina, and J.C. Trexler. 2020. Invasion impacts on functions and services of aquatic ecosystems. Hydrobiologia DOI: 10.1007/s10750-020-04211-3.

Gaiser, E.E., D.M. Bell, M.C.N. Castorani, D.L. Childers, P.M. Groffman, R.C. Jackson, J. Kominoski, D.P.C. Peters, S.T.A. Pickett, J. Ripplinger, and J.C. Zinnert. 2020. Long term ecological research and evolving frameworks of disturbance ecology. BioScience 70: 141-156. DOI: 10.1093/biosci/biz162

Gatto, J., and J.C. Trexler. 2020. Speed and directedness predict colonization sequence post-disturbance. Oecologia 193: 713-727. DOI: 10.1007/s00442-020-04689-7

Ghajarnia, N. et al. 2020. Data for wetlandscapes and their changes around the world. Earth System Science Data 12: 1083-1100. DOI: 10.5194/essd-12-1083-2020

Goldberg, L., D. Lagomasino, N. Thomas, and T.E. Fatoyinbo. 2020. Global declines in human-driven mangrove loss. Global Change Biology DOI: 10.1111/gcb.15275.

He, D., S.N. Ladd, C.J. Saunders, R.N. Mead, and R. Jaffe. 2020. Distribution of n-alkanes and their δ^2H and δ^{13}C values in typical plants along a terrestrial-coastal-oceanic gradient. Geochimica et Cosmochimica Acta 281: 31-52. DOI: 10.1016/j.gca.2020.05.003

He, D., V.H. Rivera-Monroy, R. Jaffe, and X. Zhao. 2020. Mangrove leaf species-specific isotopic signatures along a salinity and phosphorus soil fertility gradients in a subtropical estuary. Estuarine, Coastal and Shelf Science DOI: 10.1016/j.ecss.2020.106768.

Hogan, J.A. et al. 2020. A research framework to investigate ecosystem responses to tropical cyclones. BioScience 70: 477-489. DOI: 10.1093/biosci/biaa034

Howard, J., C. Lopes, S. Wilson, V. McGee-Absten, C. Carrion, and J.W. Fourqurean. 2020. Decomposition rates of surficial and buried organic matter and the lability of soil carbon stocks across a large tropical seagrass landscape. Estuaries and Coasts DOI: 10.1007/s12237-020-00817-x.

Jones, M.W., A.I. Coppola, C. Santin, T. Dittmar, R. Jaffe, S.H. Doerr, and T.A. Quine. 2020. Fires prime terrestrial organic carbon for riverine export to the global oceans. Nature Communications 11: 2791. DOI: 10.1038/s41467-020-16576-z

Kominoski, J., E.E. Gaiser, E. Castañeda-Moya, S.E. Davis, S.B. Dessu, P. Julian, D.Y. Lee, L. Marazzi, V.H. Rivera-Monroy, A. Sola, U. Stingl, S. Stumpf, D.D. Surratt, R. Travieso, and T. Troxler. 2020. Disturbance legacies increase and synchronize nutrient concentrations and bacterial productivity in coastal ecosystems. Ecology DOI: 10.1002/ecy.2988.

Liao, H., S. Wdowinski, and S. Li. 2020. Regional-scale hydrological monitoring of wetlands with Sentinel-1 InSAR observations: Case study of the South Florida Everglades. Remote Sensing of Environment 251: 112051. DOI: 10.1016/j.rse.2020.112051

Matich, P., B.A. Strickland, and M.R. Heithaus. 2020. Long-term monitoring provides insight into estuarine top predator (*Carcharhinus leucas*) resilience following an extreme weather event. Marine Ecology Progress Series 639: 169-183. DOI: 10.3354/meps13269

Mazzei, V., B.J. Wilson, S. Servais, S.P. Charles, J. Kominoski, and E.E. Gaiser. 2020. Periphyton as an indicator of saltwater intrusion into freshwater wetlands: insights from experimental manipulations. Ecological Applications DOI: 10.1002/eap.2067.

Richards, J.H., and P.C. Olivas. 2019. A common-mesocosm experiment recreates sawgrass (*Cladium jamaicense*) phenotypes from Everglades marl prairies and peat marshes. American Journal of Botany 107: 1-10. DOI: 10.1002/ajb2.1411

Sarker, S., J. Kominoski, E.E. Gaiser, L. Scinto, and D.T. Rudnick. 2020. Quantifying effects of increased hydroperiod on wetland nutrient concentrations during early phases of freshwater restoration of the Florida Everglades. Restoration Ecology DOI: 10.1111/rec.13231.

Servais, S., J. Kominoski, C. Coronado-Molina, L. Bauman, S.E. Davis, E.E. Gaiser, S.P. Kelly, C.J. Madden, V. Mazzei, D.T. Rudnick, F. Santamaria, F.H. Sklar, J.

Stachelek, T. Troxler, and B.J. Wilson. 2020. Effects of saltwater pulses on soil microbial enzymes and organic matter breakdown in freshwater and brackish coastal wetlands. Estuaries and Coasts DOI: 10.1007/s12237-020-00708-1.

Strickland, B.A., K.R. Gastrich, F.J. Mazzotti, J. Massie, V.A. Paz, N. Viadero, J.S. Rehage, and M.R. Heithaus. 2020. Variation in movement behavior of alligators after a major hurricane. Animal Biotelemetry 8: 7. DOI: 10.1186/s40317-020-00193-0

Van Dam, B., C. Lopes, P. Polsenaere, R.M. Price, A. Rutgersson, and J.W. Fourqurean. 2020. Water temperature control on CO_2 flux and evaporation over a subtropical seagrass meadow revealed by atmospheric eddy covariance. Limnology and Oceanography DOI: 10.1002/lno.11620.

Van Dam, B., C. Lopes, C. Osburn, and J.W. Fourqurean. 2019. Net heterotrophy and carbonate dissolution in two subtropical seagrass meadows. Biogeosciences 16: 4411-4428. DOI: 10.5194/bg-16-4411-2019

Yoder, L., R. Roy Chowdhury, and C. Hauck. 2020. Watershed restoration in the Florida Everglades: Agricultural water management and long-term trends in nutrient outcomes in the Everglades Agricultural Area. Agriculture, Ecosystems & Environment 302: 107070. DOI: 10.1016/j.agee.2020.107070

Zhao, X., V.H. Rivera-Monroy, H. Wang, Z. Xue, C. Tsai, C.S, Wilson, E. Castañeda-Moya, and R.R. Twilley. 2020. Modeling soil porewater salinity in mangrove forests (Everglades, Florida, USA) impacted by hydrological restoration and a warming climate. Ecological Modelling 436: 109292. DOI: 10.1016/j.ecolmodel.2020.109292

In Press

Brown, C.E., M.G. Bhat, and J.S. Rehage. In press. Valuing ecosystem services under climate risk: a case of recreation in the Florida Everglades. Journal of Water Resources Planning & Management.

Rastetter, E.B., M.D. Ohman, K.J. Elliott, J.S. Rehage, V.H. Rivera-Monroy, R.E. Boucek, E. Castañeda-Moya, T.M. Danielson, L. Gough, P. Groffman, C.R. Jackson, C.F. Miniat, and G.R. Shaver. In press. Future trajectories for ecosystems in the U.S. Long-term Term Ecological Research Network: The importance of time lags. Ecosphere.

Accepted

Grove, K., Barnett, A. and Cox, S. 2020. Designing Justice? Race and the Limits of Recognition in Greater Miami Resilience Planning. Accepted. Geoforum.

Rehage, J.S., L. Lopez, E.M. Maurer, and A. Sih. Accepted. A closer look at invasiveness and relatedness: life histories, temperature and establishment success of four congeners. Ecosphere.

Rezek, R.J., J.A. Massie, J.A. Nelson, R.O. Santos, N.M. Viadero, R.E. Boucek, and J.S. Rehage. Accepted. Individual consumer movement mediates food web coupling across a coastal ecosystem. Ecosphere.

Zeller, M.A., B.R. Van Dam, C. Lopes, and J.S. Kominoski. Accepted. Carbonate-associated organic matter is a putative FDOM source in a subtropical seagrass meadow. Frontiers in Marine Science. DOI: 10.3389/fmars.2020.580284

In Review

Kominoski, J.S., J. Pachón, J. Brock, and C. McVoy. In review. Understanding drivers of aquatic ecosystem metabolism in Everglades ridge and slough wetlands. Ecosphere.

Lee, D.Y., J.S. Kominoski, H. Briceño, S. Thomas, J.N. Boyer, and C.J. Madden. In review. Increased seagrass biomass buffers planktonic responses to marine storms and sea-level rise in shallow oligotrophic estuaries. Ecosystems.

Malone, S.L., J. Zhao, J.S. Kominoski, G. Starr, C.L. Staudhammer, P. C. Olivas, J.C. Cummings, and S.F. Oberbauer. In review. Integrating aquatic metabolism and net ecosystem CO_2 balance in calcareous short- and long-hydroperiod subtropical freshwater wetlands. Ecosystems.

Meeder, J.F., R.W. Parkinson, M.S. Ross, J.S. Kominoski, and S. Castañeda. In review. Global implications of increased coastal organic carbon storage associated with mangrove expansion in response to accelerating rate of sea-level rise, Biscayne Bay, Florida, U.S.A. Estuaries and Coasts.

Nocentini, A., J.S. Kominoski, and J.P. Sah. In review. Comparing biogeochemical legacies of fire in shorter- and longer-hydroperiod wetlands with different soil types. Ecosphere.

Pennings, S.C., R. Glazner, Z. Hughes, J.S. Kominoski, and A.R. Armitage. In review. Effects of mangrove cover on coastal erosion during a hurricane in Texas, USA. Ecology

Servais, S. J.S. Kominoski, M. Fernandez, and K. Morales. In review. Experimental saltwater and phosphorus additions lead to microbial biogeochemical changes in wetland soil mesocosms. Ecosphere.

Zhao, J., S.L. Malone, C.L. Staudhammer, G. Starr, H. Hartmann, and S.F. Oberbauer. In review. Wetland plants respond nonlinearly to inundation over a sustained period. New Phytologist.

Related

Rehage J.S., L.K. Lopez, and A. Sih. 2020. A comparison of the establishment success, response to competition, and community impact of invasive and non-invasive Gambusia species. Biological Invasions 22: 509–522.

Conference Papers and Presentations

Castañeda-Moya, E., V.H. Rivera-Monroy, R.M. Chambers, X. Zhao, L. Lamb-Wotton, A. Nocentini, E.E. Gaiser, T. Troxler, J. Kominoski and M. Hiatt. 2020. Hurricanes fertilize mangrove forests in the Gulf of Mexico (Florida Everglades, USA). Hurricon conference, East Carolina University. Greenville, North Carolina, February 27, 2020.

Chavez, S., S. Wdowinski, D. Lagomasino, T.E. Fatoyinbo, B. Cook, E. Castañeda-Moya, R.P. Moyer, K. Radabaugh and J.M. Smoak. 2019. Observing changes in the mangrove forests of the south Florida Everglades following Hurricane Irma using remote sensing measurements. American Geophysical Union Fall Meeting, San Francisco, California, December 9, 2019.

Flood, P.J. and J.C. Trexler. 2020. Dietary niche between seasons and among habitats in an aquatic food web. Ecological Society of America Annual Meeting 2020, Virtual, August 3, 2020 - August 6, 2020.

Gaiser, E.E., D.M. Bell, M.C.N. Castorani, D.L. Childers, P.M. Groffman, C.R. Jackson, J. Kominoski, D.P.C. Peters, S.T.A. Pickett, J. Ripplinger and J.C. Zinnert. 2020. Long term ecological research and evolving frameworks of disturbance ecology. Ecological Society of America Annual Meeting 2020, Virtual, August 3, 2020 - August 6, 2020.

Gaiser, E.E. 2020. Invited Plenary: Long-term trends in Everglades National Park. Everglades Coalition, Captiva, Florida, January 9, 2020 - January 11, 2020.

Hogan, J.A., E. Castañeda, L. Lamb-Wotton, T. Troxler and C. Baraloto. 2020. Habitat-modulated effects of water level and salinity drive variation in photosynthetic assimilation of a scrub mangrove forest. Ecological Society of America Annual Meeting 2020, Virtual, August 3, 2020 - August 6, 2020.

Kominoski, J., A.R. Armitage, S.C. Pennings and C.A. Weaver. 2020. Differences in organic matter processing rates in marsh-mangrove wetlands are homogenized following a major hurricane. Ecological Society of America Annual Meeting 2020, Virtual, August 3, 2020 - August 6, 2020.

Kui, L., K. Vanderbilt and J.H. Porter. 2020. Streamline QA/QC for Observational Data. Ecological Society of America Annual Meeting 2020, Virtual, August 3, 2020 - August 6, 2020.

Lamb-Wotton, L., T. Troxler, M. Wilson, D. Gann, S.L. Malone, P.C. Olivas, D.T. Rudnick and F.H. Sklar. 2020. Using fine-scale variation in ecosystem properties to detect peat collapse in the Florida Coastal Everglades. Ecological Society of America Annual Meeting 2020, Virtual, August 3, 2020 - August 6, 2020.

Liao, H., R. Garcia and S. Wdowinski. 2019. High spatial resolution 2D wetland surface water flow modeling in the Everglades, Florida, constrained by Interferometric SAR observations. American Geophysical Union Fall Meeting, San Francisco, California, December 11, 2019.

Malone, S.L., S. Oberbauer, P.C. Olivas, J. Schedlbauer, J. Zhao, G. Starr, C.L. Staudhammer and S.P. Charles. 2020. Carbon uptake efficiency across Everglades wetland ecosystems. Ecological Society of America Annual Meeting 2020, Virtual, August 3, 2020 - August 6, 2020.

Malone, S.L., S. Oberbauer, J. Zhao, P.C. Olivas, C.L. Staudhammer and G. Starr. 2019. Extreme events and C dynamics across the Florida Everglades. American Geophysical Union Fall Meeting, San Francisco, California, December 12, 2019.

Massie, J., R.O. Santos, R. Rezek, N. Viadero, R. Boucek and J.S. Rehage. 2019. Keeping up with the currents: Movement patterns of Common Snook in the Shark River, Everglades National Park. Snook Migration Workshop, Florida Atlantic Coastal Telemetry Winter Meeting, Tequesta, Florida, December 3, 2019.

Nocentini, A., J. Kominoski, J.P. Sah and M.S. Ross. 2020. Comparing biogeochemical legacies of fire and hydrology in short- and long-hydroperiod wetlands. Ecological Society of America Annual Meeting 2020, Virtual, August 3, 2020 - August 6, 2020.

Paz, V.A., M.R. Heithaus and J.J. Kiszka. 2020. Investigating the habitat use of coastal bottlenose dolphins (*Tursiops truncatus*) in response to a major hurricane. Ecological Society of America Annual Meeting 2020, Virtual, August 3, 2020 - August 6, 2020.

Paz, V.A., J.J. Kiszka and M.R. Heithaus. 2020. Investigating the habitat use of coastal bottlenose dolphins (*Tursiops truncatus*) in response to a major Hurricane. Biosymposium, Florida International University, Miami, Florida, February 8, 2020.

Paz, V.A., J.J. Kiszka and M.R. Heithaus. 2019. Investigating the habitat use of coastal bottlenose dolphins (*Tursiops truncatus*) in response to a major Hurricane. World Marine Mammal Conference, Barcelona, Spain, December 9, 2019 - December 12, 2019.

Smith, M.A., J. Kominoski, R.M. Price, E.E. Gaiser and T. Troxler. 2020. Evaluating spatiotemporal variation in water source contributions to coastal urban canal networks using an endmember mixing model. Ecological Society of America Annual Meeting 2020, Virtual, August 3, 2020 - August 6, 2020.

Smith, M.A. and J. Kominoski. 2019. The Urban Flood Pulse Concept: defining spatiotemporal periodicity and synchrony of flood pulse dynamics in urban ecosystems. American Geophysical Union Annual Meeting, San Francisco, California, December 9, 2019 - December 13, 2019.

Smoak, J.M., J.L. Breithaupt, R.P. Moyer, K. Radabaugh, T.S. Bianchi, D. Vaughn, B.E. Rosenheim, C. Schafer, L.G. Chambers, S. Harttung and J. Kominoski. 2019. Sea-level rise and storms alter soil carbon dynamics of southwest Florida mangrove forests. American Geophysical Union Fall Meeting, San Francisco, California, December 13, 2019.

Starr, G., C.L. Staudhammer, M.W. Binford, P. Stoy and H. Loescher. 2020. Land-Atmosphere interactions in the Southeastern United States: Challenges and opportunities for research. Department of Energy ARM/ARS Faculty and PI Meeting, Virtual Meeting, June 22, 2020 - June 26, 2020.

Strickland, B.A., P.J. Flood, M.R. Heithaus and J.C. Trexler. 2020. Trophic structure of ponds engineered by American alligators in an oligotrophic wetland. Ecological Society of America Annual Meeting 2020, Virtual, August 3, 2020 - August 6, 2020.

Strickland, N.D. and J.C. Trexler. 2020. Using spatially balanced sample design to estimate fish biomass from meter scale to the landscape scale. Ecological Society of America Annual Meeting 2020, Virtual, August 3, 2020 - August 6, 2020.

Wdowinski, S., T. Oliver-Cabrera and S. Fiaschi. 2020. Land subsidence contribution to coastal flooding hazard in southeast Florida. Proceedings of the International Association of Hydrological Sciences, 382: 207–211, April 22, 2020.

Wdowinski, S.. 2019. Coherent spatio-temporal variations in the rate of sea level rise along the US Atlantic and Gulf coasts. American Geophysical Union Annual Meeting, San Francisco, California, December 9, 2019 - December 13, 2019.

Vanderbilt, K., C. Gries and M. O'Brien. 2020. Annotating metadata to improve data discovery and reuse. Ecological Society of America Annual Meeting 2020, Virtual, August 3, 2020 - August 6, 2020.

Yu, Z., C.L. Staudhammer, S.L. Malone, S. Oberbauer and G. Starr. 2020. Drivers of methane emissions in freshwater marshes of the Florida Everglades. Ecological Society of America Annual Meeting 2020, Virtual, August 3, 2020 - August 6, 2020.

Zhang, B. and S. Wdowinski. 2019. Space-based monitoring of wetland surface water levels using Sentinel-1 SAR backscattering observations. American Geophysical Union Fall Meeting, San Francisco, California, December 11, 2019.

Dissertations and Theses

Master's Theses

Brown, Theresa Kelly. 2020. Taking apart the time machine: Investigating space-for-time substitution modeling in the Florida Everglades. Master's thesis, Florida International University.

Ph.D. Dissertations

Abiy, Anteneh. 2020. Modeling drought, drought teleconnection, and its effect on groundwater level dynamics in the Biscayne Aquifer. Ph.D. dissertation, Florida International University.

Gatto, John. 2019. Incorporating early life history and recruitment in the analysis of population dynamics of marsh fish. Ph.D. dissertation, Florida International University.

James, W. Ryan. 2020. A seascape approach to understanding coastal food web dynamics and species distributions. Ph.D. dissertation, University of Louisiana at Lafayette.

Strickland, Bradley. 2020. Beyond predation: How do consumers impact bottom-up processes in ecosystems? Ph.D. dissertation, Florida International University.

Websites

Florida Coastal Everglades LTER Program Website
https://fcelter.fiu.edu/
The Florida Coastal Everglades LTER Program Website provides information about FCE research, data, publications, personnel, education & outreach activities, and the FCE Student Organization.

Coastal Angler Science Team (CAST) Website
http://cast.fiu.edu/
The Coastal Angler Science Team (CAST) Website, created by FCE graduate student Jessica Lee, provides information about how researchers and anglers are working together to collect data on important recreational fish species in Rookery Branch and Tarpon Bay in the Everglades and invites anglers to participate in this project.

Predator Tracker
http://tracking.fiu.edu/
The Predator Tracker website has information about the Predator Tracker application and a link to download the application. Predator Tracker is a stand alone application based on a kiosk at the Museum of Discovery and Science in Ft. Lauderdale. The application allows one to learn how researchers at Florida International University track

and study big predators in the Shark River Estuary in Everglades National Park and explore their predator tracking data.

Wading Through Research
http://floridacoastaleverglades.blogspot.com/
A blog created by FCE graduate students which focuses on the experiences of graduate students conducting research in the Everglades.

Other products

Databases
The FCE Information Management System contains 177 datasets which are publicly available on FCE LTER's website (https://fce-lter.fiu.edu/data/core/) and in the EDI Data Repository (https://portal.edirepository.org). Datasets include climate, consumer, primary production, water quality, soils, and microbial data as well as other types of data. A table of FCE LTER datasets in the EDI Data Repository with dataset titles and DOIs is included in the Appendix.

Participants & Other Collaborating Organizations

Participants

Name	Most Senior Project Role
Evelyn Gaiser	PD/PI
James Fourqurean	Co PD/PI
Kevin Grove	Co PD/PI
John Kominoski	Co PD/PI
Jennifer Rehage	Co PD/PI
Robert Burgman	Faculty
Edward Castaneda	Faculty
Michael Heithaus	Faculty
Sparkle Malone	Faculty
Willm Martens-Habbena	Faculty
James Nelson	Faculty
Steven Oberbauer	Faculty
Nick Oehm	Faculty
Chris Osburn	Faculty

Name	Most Senior Project Role
Rene Price	Faculty
Jay Sah	Faculty
Gregory Starr	Faculty
Christina Staudhammer	Faculty
Ulrich Stingl	Faculty
Joel Trexler	Faculty
Tiffany Troxler	Faculty
Shimon Wdowinski	Faculty
Kaelin Cawley	Staff Scientist (doctoral level)
Shimelis Dessu	Staff Scientist (doctoral level)
Carl Fitz	Staff Scientist (doctoral level)
Bryce Van Dam	Staff Scientist (doctoral level)
Dong Yoon Lee	Staff Scientist (doctoral level)
Kristin Vanderbilt	Staff Scientist (doctoral level)
Sean Charles	Postdoctoral
Alex Mercado Molina	Postdoctoral
Ryan Rezek	Postdoctoral
Alan Roebuck	Postdoctoral
Rolando Santos	Postdoctoral
Stephanie Wakefield	Postdoctoral
Mary Zeller	Postdoctoral
Christina Whelan	K-12 Teacher
Emily Castellanos	Other Professional
Kirk Gastrich	Other Professional
Gabriel Kamener	Other Professional
Michael Rugge	Other Professional
Sandro Stumpf	Other Professional
Franco Tobias	Other Professional
Rafael Travieso	Other Professional
Sara Wilson	Other Professional
Emily Ashberry	Technician

Name	Most Senior Project Role
Rafael Diaz-Hung	Technician
Shakira Trabelsi	Technician
Kenny Anderson	Graduate Student
Melissa Bernardo	Graduate Student
Nicholas Castillo	Graduate Student
Selena Chavez	Graduate Student
Cody Eggenberger	Graduate Student
Meredith Emery	Graduate Student
Peter Flood	Graduate Student
Laura Garcia	Graduate Student
Ryan James	Graduate Student
Paige Kleindl	Graduate Student
Luke Lamb-Wotton	Graduate Student
Joshua Linenfelser	Graduate Student
Christian Lopes	Graduate Student
Jordan Massie	Graduate Student
Valeria Paz	Graduate Student
Carlos Pulido	Graduate Student
Jonathan Rodemann	Graduate Student
Thomas Shannon	Graduate Student
Matt Smith	Graduate Student
Kaitlin Stansbury	Graduate Student
Bradley Strickland	Graduate Student
Nicole Strickland	Graduate Student
Natasha Viadero	Graduate Student
Boya Zhang	Graduate Student
Samantha Horminga	Undergraduate Student
Rachel Schinbeckler	Undergraduate Student
Andreina Contreras	Research Experience for Undergraduates (REU) Participant
Andy Distrubell	Research Experience for Undergraduates (REU) Participant

Partner Organizations

Clark University
Worcester, MA

College of William & Mary
Williamsburg, Virginia

The Deering Estate
Miami, Florida

Eckerd College
St. Petersburg, Florida

EcoLandMod, Inc.
Fort Pierce, Florida

Encounters in Excellence, Inc.
Miami, Florida

Everglades Foundation
Palmetto Bay, Florida

Everglades National Park
Homestead, Florida

Florida Gulf Coast University
Fort Myers, Florida

Florida State University
Tallahassee, Florida

Georgia Tech
Atlanta, Georgia

Louisiana State University
Baton Rouge, Louisiana

Miami-Dade County Public Schools
Miami-Dade County, Florida

NASA Goddard Space Flight Center
Greenbelt, Maryland

National Audubon Society - Tavernier Science Center
Tavernier, Florida

National Park Service - South Florida/Caribbean Network Inventory and Monitoring Program
Palmetto Bay, Florida

National Tropical Botanical Gardens
Coconut Grove, Florida

The Pennsylvania State University
University Park, Pennsylvania

South Florida Water Management District
West Palm Beach, Florida

UNAVCO
Boulder, Colorado

University of Alabama
Tuscaloosa, Alabama

University of California, Los Angeles
Los Angeles, California

University of Central Florida
Orlando, Florida

University of Florida
Gainesville, Florida

University of Hawaii at Manoa
Honolulu, Hawaii

University of Louisiana at Lafayette
Lafayette, Louisiana

University of South Carolina
Columbia, South Carolina

University of South Florida
Tampa, Florida

University of South Florida St. Petersburg
St. Petersburg, Florida

University of Wisconsin
Madison, Wisconsin

U.S. Geological Survey
Reston, Virginia

Appendix: FCE LTER Datasets

Anderson, W. 2013. Pond Cypress C-111 Basin, Everglades (FCE), South Florida Dendroisotope Data from 1970 to 2000 ver 2. Environmental Data Initiative. https://doi.org/10.6073/pasta/9e929b1d4c7ab02e3afd12652391f3a3.

Anderson, W. 2015. DIC and DOC 13C tracer data from Shark River Slough and Harney River (FCE), Everglades, South Florida in November 2011 ver 3. Environmental Data Initiative. https://doi.org/10.6073/pasta/dd9da92e48b2506cc0c2a352a5cbea8f.

Barr, J., J. Fuentes, and J. Zieman. 2013. Flux measurements from the SRS-6 Tower, Shark River Slough, Everglades National Park, South Florida (FCE) from January 2004 to August 2005 ver 2. Environmental Data Initiative. https://doi.org/10.6073/pasta/aec87311dc582fde9adf4a11a198e0aa.

Barr, J., J. Fuentes, and J. Zieman. 2013. Light limited carboxylation rates of Red mangrove leaves at Key Largo, Watson River Chickee, Taylor Slough, and Little Rabbit Key, South Florida (FCE) from July 2001 to August 2001 ver 2. Environmental Data Initiative. https://doi.org/10.6073/pasta/d6bea805dbfa2dca53bfd60735de1af8.

Barr, J., J. Fuentes, and J. Zieman. 2013. Mangrove leaf physiological response to local climate at Key Largo, Watson River Chickee, Taylor Slough, and Little Rabbit Key, South Florida (FCE) from July 2001 to August 2001 ver 2. Environmental Data Initiative. https://doi.org/10.6073/pasta/7390d5ffed6b06f0b881a8942a53e880.

Barr, J., J. Fuentes, and J. Zieman. 2013. Meteorological measurements at Key Largo Ranger Station, South Florida (FCE) for July 2001 to August 2001 ver 2. Environmental Data Initiative. https://doi.org/10.6073/pasta/d0950d21f1ba78c9e91ae08d867174be.

Barr, J., J. Fuentes, and J. Zieman. 2013. Radiation measurements at Key Largo Ranger Station, South Florida (FCE) for July 2001 ver 2. Environmental Data Initiative. https://doi.org/10.6073/pasta/7682f3f1180f6048716b39531328a0b4.

Barr, J., J. Fuentes, and J. Zieman. 2013. Rubisco limited photosynthesis rates of Red mangrove leaves at Key Largo, Watson River Chickee, Taylor Slough, and Little Rabbit Key, South Florida (FCE) from July 2001 to August 2001 ver 2. Environmental Data Initiative. https://doi.org/10.6073/pasta/6a3a958ec35ea159a935be9ceb214fe8.

Barr, J., J. Fuentes, V. Engel, and J. Zieman. 2020. Flux measurements from the SRS-6 Tower, Shark River Slough, Everglades National Park (FCE LTER), South Florida from October 2006 to 2014 ver 6. Environmental Data Initiative. https://doi.org/10.6073/pasta/846912ffee551f31a886a24efb3064bb.

Boyer, J. and S. Dailey. 2013. Overnight Shark River Surveys from Shark River Slough, Everglades National Park (FCE), South Florida from October 2001 to March 2002 ver 3. Environmental Data Initiative. https://doi.org/10.6073/pasta/8b6e429fb37dbeaeaa22f962af725a42.

Briceno, H. 2020. Microbial Sampling from Shark River Slough and Taylor Slough, Everglades National Park, South Florida (FCE LTER) from January 2001 to Present ver 8. Environmental Data Initiative. https://doi.org/10.6073/pasta/73e3a958c9d7b1eeaf55fa41b4815b6d.

Briceno, H. 2020. Surface Water Quality Monitoring Data collected in South Florida Coastal Waters (FCE LTER) from June 1989 to Present ver 9. Environmental Data Initiative. https://doi.org/10.6073/pasta/84f68e11230e6c6fce1c38eb07e5280f.

Cardona-Olarte, P., V. Rivera-Monroy, and R. Twilley. 2013. Greenhouse experiment (FCE) in April and August 2001: Responses of neotropical mangrove saplings to the combined effect of hydroperiod and salinity/Biomass ver 2. Environmental Data Initiative. https://doi.org/10.6073/pasta/b4200968cd7c84d47fd59a3d271e11b8.

Cardona-Olarte, P., V. Rivera-Monroy, and R. Twilley. 2013. Greenhouse mixed culture experiment from August 2002 to April 2003 (FCE): Evaluate the effect of salinity and hydroperiod on interspecific mangrove seedlings growth rate (mixed culture) / Morphometric variables ver 2. Environmental Data Initiative. https://doi.org/10.6073/pasta/c559309bdc4b90e325b1e8772e1de60a.

Castaneda, E. and V. Rivera-Monroy. 2020. Abiotic monitoring of physical characteristics in porewaters and surface waters of mangrove forests from the Shark River Slough and Taylor Slough, Everglades National Park (FCE LTER), South Florida from December 2000 to Present ver 8. Environmental Data Initiative. https://doi.org/10.6073/pasta/1506f26afff3056d8b2a7738e2f6253e.

Castaneda, E. and V. Rivera-Monroy. 2020. Sediment and nutrient deposition and plant-soil phosphorus interactions associated with Hurricane Irma (2017) in mangroves of the Florida Coastal Everglades (FCE LTER), Florida ver 3. Environmental Data Initiative. https://doi.org/10.6073/pasta/2eb6663175051c21427304e75d0840fb.

Castaneda, E., V. Rivera-Monroy, and R. Twilley. 2013. Mangrove Soil Chemistry Shark River Slough and Taylor Slough, Everglades National Park (FCE), from December 2000 to May 23, 2002 ver 4. Environmental Data Initiative. https://doi.org/10.6073/pasta/542c044a50f7081beb454d1314fddff2.

Castaneda, E., V. Rivera-Monroy, and R. Twilley. 2020. Mangrove Litterfall from the Shark River Slough and Taylor Slough, Everglades National Park (FCE), South Florida from January 2001 to Present ver 7. Environmental Data Initiative. https://doi.org/10.6073/pasta/eb094c43ecd8c2c99bbeda0605f67fd3.

Castaneda, E., V. Rivera-Monroy, and R. Twilley. 2020. Monitoring of nutrient and sulfide concentrations in porewaters of mangrove forests from the Shark River Slough and Taylor Slough, Everglades National Park (FCE LTER), South Florida from December 2000 to Present ver 9. Environmental Data Initiative. https://doi.org/10.6073/pasta/b7cc9644dbe22e6f3e869a6e8b2277bc.

Center for Operational Oceanographic Products and Services (CO-OPS). 2019. NOAA Monthly Mean Sea Level Summary Data for the Key West, Florida, Water Level Station (FCE) (NOAA/NOS Co-OPS ID 8724580) from 01-Jan-1913 to Present ver 10. Environmental Data Initiative. https://doi.org/10.6073/pasta/566f715b925fdf8d9d96c17d7f7c992f.

Chambers, R., T. Russell, and A. Gorsky. 2019. Physical and Chemical Characteristics of Soil Sediments from the Shark River Slough and Taylor Slough, Everglades National Park (FCE LTER) from August 2004 to Present ver 9. Environmental Data Initiative. https://doi.org/10.6073/pasta/48bbbc5e009be9663bd9cfdac0cbcb53.

Chambers, R., T. Russell, R. Hatch, D. Katsaros, and A. Gorsky. 2019. Percentage of Carbon and Nitrogen of Soil Sediments from the Shark River Slough, Taylor Slough and Florida Bay within Everglades National Park (FCE) from August 2008 to Present ver 5. Environmental Data Initiative. https://doi.org/10.6073/pasta/7d38b9b5d9c235c3b81468fae06dd654.

Childers, D. and R. Price. 2020. Water Levels from the Shark River Slough, Everglades National Park (FCE), South Florida from October 2000 to Present ver 12. Environmental Data Initiative. https://doi.org/10.6073/pasta/f974ce5d26b36cc7dec2f8ac6456c903.

Collado-Vides, L. 2019. Macroalgae Production in Florida Bay (FCE), South Florida from May 2007 to Present ver 8. Environmental Data Initiative. https://doi.org/10.6073/pasta/e49e256a8b8d4842b68894721107ab16.

Coronado, C. and F. Sklar. 2017. Sediment Elevation Change (Feldspar Marker Horizon Method) from Northeastern Florida Bay (FCE) from 1996 to Present ver 1. Environmental Data Initiative. https://doi.org/10.6073/pasta/1755e84862607d90e33bcefe6ce997e2.

Coronado, C. and F. Sklar. 2017. Sediment Elevation Change (SET Method) from Northeastern Florida Bay (FCE) from 1996 to Present ver 4. Environmental Data Initiative. https://doi.org/10.6073/pasta/0edc80f91191e66eea6b4b0ebd407a0d.

Fourqurean, J. 2019. Florida Bay Braun Blanquet, Everglades National Park (FCE), South Florida from October 2000 to Present ver 8. Environmental Data Initiative. https://doi.org/10.6073/pasta/80bdd9313e1b82967389cef66cc087eb.

Fourqurean, J. 2019. Florida Bay Nutrient Data, Everglades National Park (FCE), South Florida from August 2008 to Present ver 6. Environmental Data Initiative. https://doi.org/10.6073/pasta/536f61d4f0383101fc618ea51ae83d6b.

Fourqurean, J. 2019. Florida Bay Physical Data, Everglades National Park (FCE), South Florida from September 2000 to Present ver 7. Environmental Data Initiative. https://doi.org/10.6073/pasta/37e73f234bc9756ada9192b3ee6ebd86.

Fourqurean, J. 2019. Florida Bay Productivity Data, Everglades National Park (FCE), South Florida from September 2000 to Present ver 6. Environmental Data Initiative. https://doi.org/10.6073/pasta/ff606f863b711d4d9ce5d279f2fa3b56.

Fourqurean, J. 2019. Florida Bay Seagrass Canopy Temperature Data, Everglades National Park (FCE), South Florida from September 2000 to Present ver 7. Environmental Data Initiative. https://doi.org/10.6073/pasta/45c042a44df4060b1766631dd2070851.

Fourqurean, J. 2020. Florida Bay Stable Isotope Data Everglades National Park (FCE LTER), South Florida from January 2005 to Present ver 7. Environmental Data Initiative. https://doi.org/10.6073/pasta/8313969490ed0d91f8769b2853621fff.

Fourqurean, J. and J. Howard. 2020. Cross Bank Benthic Aboveground Biomass, Everglades National Park (FCE LTER), South Florida from 1983 to 2014 ver 2. Environmental Data Initiative. https://doi.org/10.6073/pasta/4ad1a469ff103d2e8f0c3971f703ec16.

Fourqurean, J. and J. Howard. 2020. Cross Bank Sediment Characteristics, Everglades National Park (FCE LTER), South Florida from 2014 ver 2. Environmental Data Initiative. https://doi.org/10.6073/pasta/3a9bb697bbb8295bffdf6031ff1ae644.

Frankovich, T. 2013. Florida Bay Physical Data, Everglades National Park (FCE), South Florida from January 2001 to February 2002 ver 2. Environmental Data Initiative. https://doi.org/10.6073/pasta/f0e13c236606c1ed6efe5618e3eee8c0.

Frankovich, T. 2013. Florida Bay, South Florida (FCE) Seagrass Epiphyte Light Transmission from December 2000 to February 2002 ver 2. Environmental Data Initiative. https://doi.org/10.6073/pasta/393fd3bbbd5a520e5cf372483113f2ce.

Frankovich, T. 2013. Gastropod Biomass and Densities found at Rabbit Key Basin, Florida Bay (FCE) from March 2000 to April 2001 ver 2. Environmental Data Initiative. https://doi.org/10.6073/pasta/e9498a3ecfd1d497c6b4c266901c9d4b.

Frankovich, T. 2013. Mean Seagrass Epiphyte Accumulation for Florida Bay, South Florida (FCE) from December 2000 to September 2001 ver 2. Environmental Data Initiative. https://doi.org/10.6073/pasta/0d88f0cd8f29d6f227e19050bde91896.

Frankovich, T. 2013. Seagrass Epiphyte Accumulation for Florida Bay, South Florida (FCE) from December 2000 to September 2001 ver 2. Environmental Data Initiative. https://doi.org/10.6073/pasta/2bf2a1f1d9c7904b12b137ba58956203.

Frankovich, T. 2013. Seagrass Epiphyte Accumulation: Epiphyte Loads on Thalassia testudinum in Rabbit Key Basin, Florida Bay (FCE) from March 2000 to April 2001 ver 2. Environmental Data Initiative. https://doi.org/10.6073/pasta/5aadc198730a74b48ae27b6c1e11f3a8.

Frankovich, T. 2013. Thalassia leaf morphology and productivity measurements from arbitrary plots located in a Thalassia seagrass meadow in Rabbit Key Basin, Florida Bay (FCE) from March 2000 to April 2001 ver 2. Environmental Data Initiative. https://doi.org/10.6073/pasta/bf798892c1105cb3a157f7132165c732.

Gaiser, E. 2013. Diatom Species Abundance Data from LTER Caribbean Karstic Region (CKR) study (FCE) in Yucatan, Belize and Jamaica during 2006, 2007, 2008 ver 2. Environmental Data Initiative. https://doi.org/10.6073/pasta/84241f5358c01c8dacd832b42d3fc736.

Gaiser, E. 2013. Environmental data from FCE LTER Caribbean Karstic Region (CKR) study in Yucatan, Belize and Jamaica during Years 2006, 2007 and 2008 ver 4. Environmental Data Initiative. https://doi.org/10.6073/pasta/5a01d59e5f7d73bd1f7baee2c71af765.

Gaiser, E. 2013. Periphyton data from LTER Caribbean Karstic Region (CKR) study in Yucatan, Belize and Jamaica (FCE) during 2006, 2007, 2008 ver 3. Environmental Data Initiative. https://doi.org/10.6073/pasta/f3a6a99aa7dacb1d338cf2d6d1698482.

Gaiser, E. 2017. Periphyton and Associated Environmental Data From the Comprehensive Everglades Restoration Plan (CERP) Study from February 2005 to November 2014 (FCE) ver 4. Environmental Data Initiative. https://doi.org/10.6073/pasta/7ed04d64d07a7dd7a4694615df8211a6.

Gaiser, E. 2017. Relative Abundance Diatom Data from Periphyton Samples Collected for the Comprehensive Everglades Restoration Plan (CERP) Study (FCE) from February 2005 to November 2014 ver 3. Environmental Data Initiative. https://doi.org/10.6073/pasta/cb0f7e88d28075a6ff1f59d008bb732c.

Gaiser, E. 2017. Relative Abundance of Soft Algae From theComprehensive Everglades Restoration Plan (CERP) Study (FCE) from February 2005 to November 2014 ver 1. Environmental Data Initiative. https://doi.org/10.6073/pasta/6e16b97781030e670fd94221ac812f5d.

Gaiser, E. 2020. Macrophyte count data collected from Northeast Shark Slough, Everglades National Park (FCE LTER) from September 2006 to September 2008 ver 4. Environmental Data Initiative. https://doi.org/10.6073/pasta/df0df1868e303a71e58ec7b29fcf8b29.

Gaiser, E. 2020. Periphyton Accumulation Rates from Shark River Slough, Taylor Slough and Florida Bay, Everglades National Park (FCE LTER) from January 2001 to Present ver 11. Environmental Data Initiative. https://doi.org/10.6073/pasta/b5b4d8388cd2a415eeac9fc50a6743d8.

Gaiser, E. 2020. Periphyton Biomass Accumulation from the Shark River and Taylor Sloughs, Everglades National Park (FCE), from January 2003 to Present ver 9. Environmental Data Initiative. https://doi.org/10.6073/pasta/edd4ed44a9b3428eb516b87e54e836cd.

Gaiser, E. 2020. Periphyton data collected from Northeast Shark Slough, Everglades National Park (FCE LTER) from September 2006 to September 2008 ver 4. Environmental Data Initiative. https://doi.org/10.6073/pasta/e7898d1958661abfec2910d778cb2991.

Gaiser, E. 2020. Periphyton Productivity from the Shark River Slough and Taylor Slough, Everglades National Park (FCE LTER), from October 2001 to Present ver 10. Environmental Data Initiative. https://doi.org/10.6073/pasta/7f39fae51cdbf902b73020bddeb8a3a0.

Gaiser, E. and D. Childers. 2019. Sawgrass Above and Below Ground Total Nitrogen and Total Carbon from the Shark River Slough, Everglades National Park (FCE), from September 2002 to Present ver 10. Environmental Data Initiative. https://doi.org/10.6073/pasta/f183f7ef316e0ede14bf0b8d80c36a41.

Gaiser, E. and D. Childers. 2019. Sawgrass Above and Below Ground Total Phosphorus from the Shark River Slough, Everglades National Park (FCE), from September 2002 to Present ver 10. Environmental Data Initiative. https://doi.org/10.6073/pasta/26ae26f77da4f6ef86c0f5f781ce1b51.

Gaiser, E. and D. Childers. 2020. Sawgrass above ground biomass from the Shark River Slough, Everglades National Park (FCE LTER), South Florida from November 2000 to Present ver 7. Environmental Data Initiative. https://doi.org/10.6073/pasta/f3b3549cf2ac5a7469dc894957f7dd01.

Gaiser, E. and D. Childers. 2020. Water Quality Data (Extensive) from the Shark River Slough, Everglades National Park (FCE LTER), from October 2000 to Present ver 13. Environmental Data Initiative. https://doi.org/10.6073/pasta/a37050c370e9477f2eea4228db08adca.

Gaiser, E. and D. Childers. 2020. Water Quality Data (Grab Samples) from the Shark River Slough, Everglades National Park (FCE LTER), from May 2001 to Present ver 13. Environmental Data Initiative. https://doi.org/10.6073/pasta/0faa7d98aab58e5cb4ca5e85cf4ee5c8.

Gaiser, E. and D. Childers. 2020. Water Quality Data (Porewater) from the Shark River Slough, Everglades National Park (FCE LTER), from January 2001 to Present ver 12. Environmental Data Initiative. https://doi.org/10.6073/pasta/9f645c84557dfbc1eb25c7f9aa81d385.

Gaiser, E. and J. Trexler. 2014. Fish and consumer data collected from Northeast Shark Slough, Everglades National Park (FCE) from September 2006 to September 2008 ver 3. Environmental Data Initiative. https://doi.org/10.6073/pasta/4eda63d153f0859a70c4398c3762be9e.

Gaiser, E. and L. Scinto. 2020. Biogeochemical data collected from Northeast Shark Slough, Everglades National Park (FCE LTER) from September 2006 to September 2008 ver 8. Environmental Data Initiative. https://doi.org/10.6073/pasta/b07ae4ab29f525b7a9924382904e581b.

Harrison, E. and J. Trexler. 2020. Cichlasoma urophthalmus cytochrome b sequences collected from the Florida Everglades (FCE) and Central America from January 2012 to May 2014 ver 3. Environmental Data Initiative. https://doi.org/10.6073/pasta/4a07f10ec6a08e78279a506423f22305.

Harrison, E. and J. Trexler. 2020. Cichlasoma urophthalmus microsatellite fragment size collected from the Florida Everglades (FCE) and Central America from June 2010 to March 2013 ver 5. Environmental Data Initiative. https://doi.org/10.6073/pasta/19cf88ce1278d8aec2bf776de13f4ff4.

Heithaus, M. and C. Bessey. 2019. Fish trap catch, set, and environmental data from Shark Bay Marine Park, Western Australia from May 2010 to July 2012 ver 3. Environmental Data Initiative. https://doi.org/10.6073/pasta/b7742d3e0a93696342708d98590b9db1.

Heithaus, M. and C. Bessey. 2019. Stationary camera observations, set, and environmental data from Shark Bay Marine Park, Western Australia from July 2011 to June 2012 ver 3. Environmental Data Initiative. https://doi.org/10.6073/pasta/299262fa63c46ead98210cb5ea0bcac2.

Heithaus, M. and J. Thomson. 2019. Capture data for sharks caught in standardized drumline fishing in Shark Bay, Western Australia, with accompanying abiotic data, from February 2008 to July 2014. ver 3. Environmental Data Initiative. https://doi.org/10.6073/pasta/b4c39439f21d56d0c87b00c59073cf89.

Heithaus, M. and J. Thomson. 2019. Capture data for sharks caught in standardized drumline fishing in Shark Bay, Western Australia, with accompanying abiotic data, from January 2012 to April 2014. ver 3. Environmental Data Initiative. https://doi.org/10.6073/pasta/225c82aa5925cee430a8c7a6a44e8d85.

Heithaus, M. and J. Thomson. 2019. Marine turtles captured during haphazard at-sea surveys in Shark Bay, Australia from February 2008 to December 2013 ver 4. Environmental Data Initiative. https://doi.org/10.6073/pasta/7696e20214fbf84f25d664ff7dc8050c.

Heithaus, M. and P. Matich. 2014. Bull shark catches, water temperatures, salinities, and dissolved oxygen levels in the Shark River Slough, Everglades National Park (FCE), from May 2005 to May 2009 ver 3. Environmental Data Initiative. https://doi.org/10.6073/pasta/04a8792fed9ceed4237bd3273a97e8f8.

Heithaus, M. and P. Matich. 2019. Large shark catches (Drumline), water temperatures, salinities, dissolved oxygen levels, and stable isotope values in the Shark River Slough, Everglades National Park (FCE LTER) from May 2009 to May 2011 ver 6. Environmental Data Initiative. https://doi.org/10.6073/pasta/f8b5c0585e41ab48f07faf79c380043c.

Heithaus, M. and P. Matich. 2020. Shark catches (longline), water temperatures, salinities, and dissolved oxygen levels, and stable isotope values in the Shark River Slough, Everglades National Park (FCE LTER) from May 2005 to Present ver 8. Environmental Data Initiative. https://doi.org/10.6073/pasta/0109a56d2d7d672be4d34cdc50bd63d0.

Heithaus, M. and R. Nowicki. 2015. Fish community data obtained from Antillean-Z fish trap deployment in the Eastern Gulf of Shark Bay, Australia from June 2013 to August 2013 ver 3. Environmental Data Initiative. https://doi.org/10.6073/pasta/3eed6e46081423861d71e6d6a6ee3194.

Heithaus, M. and R. Nowicki. 2019. Count data of air-breathing fauna from visual transect surveys including water temperature, time, sea and weather conditions in Shark Bay Marine Park, Western Australia from February 2008 to July 2014 ver 5. Environmental Data Initiative. https://doi.org/10.6073/pasta/e91ff5368ab0dfc412678170f8a0d1a6.

Heithaus, M. and R. Nowicki. 2019. Percent cover, species richness, and canopy height data of seagrass communities in Shark Bay, Western Australia, with accompanying abiotic data, from October 2012 to July 2013 ver 4. Environmental Data Initiative. https://doi.org/10.6073/pasta/29ed91e46b4a898129f8b03c3500abbd.

Heithaus, M., P. Matich, and A. Rosenblatt. 2019. Large consumer isotope values, Shark River Slough, Everglades National Park (FCE LTER), May 2005 to Present ver 10. Environmental Data Initiative. https://doi.org/10.6073/pasta/0fb149ced55edb32c282deb234caab56.

Heithaus, M., P. Matich, and A. Rosenblatt. 2019. Temperatures,salinities, and dissolved oxygen levels in the Shark River Slough, Everglades National Park (FCE LTER) , from May 2005 to May 2014 ver 7. Environmental Data Initiative. https://doi.org/10.6073/pasta/79e8ef59e5b93b2ff59321e0a93118ae.

Howard, J.L. and J.W. Fourqurean. 2020. Organic and inorganic data for soil cores from Brazil and Florida Bay seagrasses to support Howard et al 2018, CO_2 released by carbonate sediment production in some coastal areas may offset the benefits of seagrass “Blue Carbon” storage, Limnology and Oceanography, DOI: 10.1002/lno.10621 ver 2. Environmental Data Initiative. https://doi.org/10.6073/pasta/45cfe2505580cedf88a82f8911bdd741.

Jaffe, R. 2013. Characterization of dissloved organic nitrogen in an oligotrophic subtropical coastal ecosystem (Taylor Slough and Shark River Slough) for December 2001 in Everglades National Park (FCE), South Florida, USA ver 2. Environmental Data Initiative. https://doi.org/10.6073/pasta/cc9f23891b8bb977eaf5d7eb6f76005f.

Jaffe, R. 2013. Chemical characteristics of dissolved organic matter in an oligotrophic subtropical wetland/estuary ecosystem, Everglades National Park (FCE), South Florida from December 2001 to January 2002 ver 2. Environmental Data Initiative. https://doi.org/10.6073/pasta/76696c297746734756f827ec748eb20f.

Jaffe, R. 2013. Examination of protein-like fluorophores in chromophoric dissolved organic matter (CDOM) in a wetland and coastal environment for the wet and dry seasons of the years 2002 and 2003 (FCE) ver 2. Environmental Data Initiative. https://doi.org/10.6073/pasta/6d2e26bc8c8cd2322981d22a095ab968.

Jaffe, R. 2013. Monthly monitoring fluorescence data for Florida Bay, Ten Thousand Islands, and Whitewater Bay, in southwest coast of Everglades National Park (FCE) for February 2001 to December 2002 ver 3. Environmental Data Initiative. https://doi.org/10.6073/pasta/1bb7981116c89e6f414964b0a113b294.

Jaffe, R. 2013. Physical and microbial processing of dissolved organic nitrogen (DON) (Salinity Experiment) along an oligotrophic marsh/mangrove/estuary ecotone (Taylor Slough and Florida Bay) for August 2003 in Everglades National Park (FCE), South Florida, USA ver 2. Environmental Data Initiative. https://doi.org/10.6073/pasta/07272b339cff887abca38b8676789a56.

Jaffe, R. 2013. Physical and microbial processing of dissolved organic nitrogen (DON) (Photodegradation Experiment) along an oligotrophic marsh/mangrove/estuary ecotone (Taylor Slough and Florida Bay) for August 2003 in Everglades National Park (FCE), South Florida, USA ver 2. Environmental Data Initiative. https://doi.org/10.6073/pasta/da883a9edecd3c2a2be661531b16a780.

Jaffe, R. 2013. Quantitative and qualitative aspects of dissolved organic carbon leached from plant biomass in Taylor Slough, Shark River and Florida Bay (FCE) for samples collected in July 2004 ver 2. Environmental Data Initiative. https://doi.org/10.6073/pasta/22916d1d52d8a756020b8c7537b1bd87.

Jaffe, R. 2018. Monthly monitoring fluorescence data for Shark River Slough and Taylor Slough, Everglades National Park (FCE) for October 2004 to February 2014 ver 7. Environmental Data Initiative. https://doi.org/10.6073/pasta/3938d3bb664d57584afc749c6a768f31.

Jaffe, R. 2020. Monthly monitoring of Fluorescence, UV, Humic and non-Humic Carbon, Carbohydrates, and DOC for Shark River Slough, Taylor Slough, and Florida Bay, Everglades National Park (FCE LTER) for January 2002 to August 2004 ver 4. Environmental Data Initiative. https://doi.org/10.6073/pasta/b244a3eb610cdfb419088f2ebab00d34.

Jaffe, R. and O. Pisani. 2015. Biomarker assessment of spatial and temporal changes in the composition of flocculent material (floc) in the subtropical wetland of the Florida Coastal Everglades (FCE) from May 2007 to December 2009 ver 2. Environmental Data Initiative. https://doi.org/10.6073/pasta/e84cc609ffbc63bb45bd484810e6746b.

Kominoski, J. and E. Gaiser. 2019. Mangrove soil phosphorus addition experiment from June 2013 to August 2013 at the mangrove peat soil mesocosms (FCE), Key Largo, Florida - Nutrients in Porewater, Soil and Roots ver 4. Environmental Data Initiative. https://doi.org/10.6073/pasta/e355a9f1d3c1e5ad4e5764a9c24b02c3.

Kominoski, J. and E. Gaiser. 2019. Mangrove soil phosphorus addition experiment from July 2013 to August 2013 at the mangrove peat soil mesocosms (FCE), Key Largo, Florida - Nutrients in Surface Water and Aboveground Biomass ver 4. Environmental Data Initiative. https://doi.org/10.6073/pasta/96f4fc41e721f657219429c64b01f0e4.

Lee, D., B.J. Wilson, S. Servais, V. Mazzei, and J. Kominoski. 2019. The Salinity and phosphorus mesocosm experiment in freshwater sawgrass wetlands: Determining the trajectory and capacity of freshwater wetland ecosystems to recover carbon losses from saltwater intrusion (FCE LTER), Florida, USA from 2015 to 2018 ver 2. Environmental Data Initiative. https://doi.org/10.6073/pasta/a269722318964f74cb5cabf87f0d3fb3.

Lorenz, J. 2015. Standard Lengths and Mean Weights for Prey-base Fishes from Taylor River and Joe Bay Sites, Everglades National Park (FCE), South Florida from January 2000 to April 2004 ver 3. Environmental Data Initiative. https://doi.org/10.6073/pasta/73c32ad91eddd1843338e4081754d41e.

Lorenz, J. 2019. Physical Hydrologic Data for the National Audubon Society's 16 Research Sites in coastal mangrove transition zone of southern Florida (FCE) from November 2000 to Present ver 7. Environmental Data Initiative. https://doi.org/10.6073/pasta/3fa6e42c9e27156616baaebb3172b15f.

Mazzei, V. and E. Gaiser. 2018. Periphyton, hydrological and environmental data in a coastal freshwater wetland (FCE), Florida Everglades National Park, USA (2014-2015) ver 2. Environmental Data Initiative. https://doi.org/10.6073/pasta/4e6dc2b1aab5c02c224a27c2eaff2e82.

McIvor, C. 2013. Global Climate Change Impacts on the Vegetation and Fauna of Mangrove Forested Ecosystems in Florida (FCE): Nekton Portion from March 2000 to April 2004 ver 2. Environmental Data Initiative. https://doi.org/10.6073/pasta/7b0e0c1a9a93965c79fd66bd4bbae46d.

McIvor, C. 2015. Global Climate Change Impacts on the Vegetation and Fauna of Mangrove Forested Ecosystems in Florida (FCE): Nekton Mass from March 2000 to April 2004 ver 3. Environmental Data Initiative. https://doi.org/10.6073/pasta/beb355c2f21efc3653f888709cf49637.

Mead, R. 2013. Bulk Parameters for Soils/Sediments from the Shark River Slough and Taylor Slough, Everglades National Park (FCE), from October 2000 to January 2001 ver 2. Environmental Data Initiative. https://doi.org/10.6073/pasta/435f4c70788b8199849b43c5445d3367.

National Climatic Data Center (NCDC) NOAA. 2013. NOAA Daily Surface Meteorologic Data at NCDC Tavernier Station (ID-088841)(FCE), South Florida from June 1936 to May 2009 ver 3. Environmental Data Initiative. https://doi.org/10.6073/pasta/dd507279ead6dab518823bdcafec8071.

National Climatic Data Center (NCDC) NOAA. 2020. NOAA Daily Surface Meteorologic Data at NCDC Everglades Station (ID-082850)(FCE LTER), South Florida from February 1924 to 2017 ver 17. Environmental Data Initiative. https://doi.org/10.6073/pasta/705982cd2283522fd897664bbd65aef2.

National Climatic Data Center (NCDC) NOAA. 2020. NOAA Daily Surface Meteorologic Data at NCDC Flamingo Ranger Station (ID-083020) (FCE), South Florida from January 1951 to Present ver 15. Environmental Data Initiative. https://doi.org/10.6073/pasta/7fed0a47b285b6be06030fa4108e56aa.

National Climatic Data Center (NCDC) NOAA. 2020. NOAA Daily Surface Meteorologic Data at NCDC Miami International Airport Station (ID-085663)(FCE LTER), South Florida from January 1948 to Present ver 19. Environmental Data Initiative. https://doi.org/10.6073/pasta/e73196a56cbee37148761f83c94aacf2.

National Climatic Data Center (NCDC) NOAA. 2020. NOAA Daily Surface Meteorologic Data at NCDC Royal Palm Ranger Station (ID-087760)(FCE LTER), South Florida from May 1949 to Present ver 14. Environmental Data Initiative. https://doi.org/10.6073/pasta/19d4d4031f389ea62faa65c0f0f7342f.

Onsted, J. 2014. FCE Redlands 1994 Land Use, Miami-Dade County, South Florida ver 2. Environmental Data Initiative. https://doi.org/10.6073/pasta/e7856aad78610c7c365cf620f47a5ef5.

Onsted, J. 2014. FCE Redlands 1998 Land Use, Miami-Dade County, South Florida ver 4. Environmental Data Initiative. https://doi.org/10.6073/pasta/ab8e1dea7bc3301919512575093460fc.

Onsted, J. 2014. FCE Redlands 1998 Roads, Miami-Dade County, South Florida ver 4. Environmental Data Initiative. https://doi.org/10.6073/pasta/f5831e56dffab52a99bbe8a1a2563b1d.

Onsted, J. 2014. FCE Redlands 2001 Land Use, Miami-Dade County, South Florida ver 4. Environmental Data Initiative. https://doi.org/10.6073/pasta/b1c64a9c7c616829ace724de8d41785b.

Onsted, J. 2014. FCE Redlands 2001 Zoning, Miami-Dade County, South Florida ver 3. Environmental Data Initiative. https://doi.org/10.6073/pasta/e6e6563f64ae6d6aa4cb07b294f1ec95.

Onsted, J. 2014. FCE Redlands 2006 Land Use, Miami-Dade County, South Florida ver 4. Environmental Data Initiative. https://doi.org/10.6073/pasta/b7e35d8321a2db2138748b869993dacd.

Onsted, J. 2014. FCE Redlands 2006 Roads, Miami-Dade County, South Florida ver 3. Environmental Data Initiative. https://doi.org/10.6073/pasta/c1e2b4bdf4d5a1ad441e69b7417cdfab.

Onsted, J. 2014. FCE Redlands 2008 Slope Mosaic, Miami-Dade County, South Florida ver 3. Environmental Data Initiative. https://doi.org/10.6073/pasta/f0c0fcaaca44b472112745262c372628.

Onsted, J. 2014. FCE Redlands Flood Zones, Miami-Dade County, South Florida ver 3. Environmental Data Initiative. https://doi.org/10.6073/pasta/54138174a44f11a0000279a7e480b632.

Onsted, J. 2015. FCE Redlands 1994 Land Use, Miami-Dade County, South Florida ver 3. Environmental Data Initiative. https://doi.org/10.6073/pasta/1d696e0668ed238469adeaed24dd7bc1.

Price, R. 2013. Groundwater and surface water phosphorus concentrations, Everglades National Park (FCE), South Florida for June, July, August and November 2003 ver 2. Environmental Data Initiative. https://doi.org/10.6073/pasta/2b42a17496155b8a7ce2191ae90e193b.

Price, R. 2019. Water flow velocity data, Shark River Slough (SRS) near Chekika tree island, Everglades National Park (FCE LTER) from January 2006 to Present ver 8. Environmental Data Initiative. https://doi.org/10.6073/pasta/a26144d352063ef4969868177d62a79f.

Price, R. 2019. Water flow velocity data, Shark River Slough (SRS) near Gumbo Limbo Island, Everglades National Park (FCE) from October 2003 to Present ver 9. Environmental Data Initiative. https://doi.org/10.6073/pasta/bdc327b2f493cfd4f51e3820fcbe4a0c.

Price, R. 2020. Monthly water balance data for southern Taylor Slough Watershed (FCE LTER) from January 2001 to December 2011 ver 3. Environmental Data Initiative. https://doi.org/10.6073/pasta/756edd5f40dbf69ca478d8c48f6ee6ba.

Price, R. 2020. Non-continous meteorological data from Butternut Key Weather Tower, Florida Bay, Everglades National Park (FCE LTER), April 2001 through August 2013 ver 7. Environmental Data Initiative. https://doi.org/10.6073/pasta/d5a224eed0f1bec5b69ce963493d9af1.

Price, R. 2020. Non-continuous TS/Ph7b Weather Tower Data, Everglades National Park (FCE LTER), South Florida from May 2008 to 2017 ver 5. Environmental Data Initiative. https://doi.org/10.6073/pasta/06938136601cdd81eb37837b7ea4b5fb.

Price, R. 2020. Rainfall Stable Isotopes collected at Florida International University-MMC (FCE LTER), Miami Florida, from October 2007 to Present ver 7. Environmental Data Initiative. https://doi.org/10.6073/pasta/cb1409728ddb1d071a405f9afc0d9309.

Price, R. 2020. Water flow velocity data, Shark River Slough (SRS) near Black Hammock island, Everglades National Park (FCE LTER), South Florida from October 2003 to August 2005 ver 4. Environmental Data Initiative. https://doi.org/10.6073/pasta/f2dea22c72b4ba72fed419f15cbabb60.

Price, R. 2020. Water flow velocity data, Shark River Slough (SRS) near Frog City, south of US 41, Everglades National Park (FCE LTER) from October 2006 to July 2009 ver 3. Environmental Data Initiative. https://doi.org/10.6073/pasta/18c744af8da6cbfb986ff2a2fb20eded.

Price, R. 2020. Water flow velocity data, Shark River Slough (SRS) near Satinleaf Island, Everglades National Park (FCE LTER) from July 2003 to December 2005 ver 3. Environmental Data Initiative. https://doi.org/10.6073/pasta/fbb12ce7f9595d2b9c6ec6011b9236e1.

Price, R. and D. Childers. 2020. Precipitation from the Shark River Slough, Everglades National Park (FCE LTER), South Florida from November 2000 to Present ver 13. Environmental Data Initiative. https://doi.org/10.6073/pasta/fda88d1c6d754c328191236f93f5d6a3.

Rains, M. 2016. Subsurface Water Temperatures taken in Shark River Slough and Taylor Slough, Everglades National Park, South Florida (FCE) from May 2010 to Present ver 6. Environmental Data Initiative. https://doi.org/10.6073/pasta/56a7c2c88e4e20dc8c2b0100c3de9a1d.

Regier, P. and R. JaffÃ©. 2016. Fluxes of dissolved organic carbon from the Shark River Slough, Everglades National Park (FCE), South Florida from May 2001 to September 2014 ver 1. Environmental Data Initiative. https://doi.org/10.6073/pasta/02cf0405c4f560746a5e5275ef6e225b.

Rehage, J. 2013. Minnowtrap Data from Rookery Branch and the North, Watson, and Roberts Rivers National Park (FCE) from November 2004 to April 2008 ver 2. Environmental Data Initiative. https://doi.org/10.6073/pasta/91d7c7dd18e2580c7b1523c562db8021.

Rehage, J. 2015. Common snook (Centropomus undecimalis) movements within the Shark River estuary (FCE), Everglades National Park, South Florida from February 2012 to Present ver 2. Environmental Data Initiative. https://doi.org/10.6073/pasta/58414574e57fd558d71cfab0952c0dc1.

Rehage, J. 2015. Trophic transfer of Everglades marsh consumer biomass to Everglades Estuaries (FCE), Everglades National Park, South Florida from December 2010 to Present ver 2. Environmental Data Initiative. https://doi.org/10.6073/pasta/bb567fd4066fa2866419a1a200a89c92.

Rehage, J. 2019. Seasonal Electrofishing Data from Rookery Branch and Tarpon Bay, Everglades National Park (FCE) from November 2004 to Present ver 8. Environmental Data Initiative. https://doi.org/10.6073/pasta/58459b0ae2531cbd516536a35735f83e.

Rivera-Monroy, V. and E. Castaneda. 2020. Water Levels from the Shark River Slough and Taylor Slough, Everglades National Park (FCE), South Florida from May 2001 to Present ver 9. Environmental Data Initiative. https://doi.org/10.6073/pasta/3ce265436817ee2ad539c2b037515e1d.

Rizzie, C., S. Sarker, J. Kominoski, E. Gaiser, and L. Scinto. 2020. Biogeochemical data collected from Northeast Shark River Slough, Everglades National Park, Florida from September 2006 to present ver 4. Environmental Data Initiative. https://doi.org/10.6073/pasta/d7c6e94ab80ed2ca18f29935877f91e4.

Rizzie, C.B., A. Nocentini, F. Tobias, J.S. Kominoski, and E. Gaiser. 2020. Vegetation data collected from Northeast Shark River Slough, Everglades National Park, Florida, from September 2006 to present ver 1. Environmental Data Initiative. https://doi.org/10.6073/pasta/510de0ee18750619c160efd857211700.

Rosenblatt, A. 2013. Water Temperature measured at Shark River, Everglades National Park (FCE) from October 2007 to August 2008 ver 2. Environmental Data Initiative. https://doi.org/10.6073/pasta/274fb25dec72d09d8226f147cdfbecb1.

Rosenblatt, A. 2013. Water Temperature measured at Shark River, Everglades National Park (FCE) from July 2007 to June 2011 ver 2. Environmental Data Initiative. https://doi.org/10.6073/pasta/a50dd41d188c25bc122deee65c2c73a9.

Rosenblatt, A. 2020. Water Temperature, Salinity and other physical measurements taken at Shark River, Everglades National Park (FCE LTER) from February 2010 to March 2014 ver 5. Environmental Data Initiative. https://doi.org/10.6073/pasta/d5f7c45539c24870c37a4e05689ba9f2.

Sarker, S. 2018. Water, Soil, Floc, Plant Total Phosphorus, Total Carbon, and Bulk Density data (FCE) from Everglades Protection Area (EPA) from 2004 to 2016 ver 2. Environmental Data Initiative. https://doi.org/10.6073/pasta/f66a58d857b76740e03c3c48da16cc73.

Saunders, C. 2013. Isotopic Variation of Soil Macrofossils from Shark River Slough, Everglades National Park (FCE) in December 2004 ver 2. Environmental Data Initiative. https://doi.org/10.6073/pasta/2bcdb06ad4018aac1783c25701fa086b.

Saunders, C. 2013. Macrofossil Characteristics of Soil from Shark River Slough, Everglades National Park (FCE) from July 2003 to February 2006 ver 2. Environmental Data Initiative. https://doi.org/10.6073/pasta/e8f697869b4be3ac9c0cecff377d94d8.

Saunders, C. 2013. Physical Characteristics and Stratigraphy of Deep Soil Sediments from Shark River Slough, Everglades National Park (FCE) from 2005 and 2006 ver 2. Environmental Data Initiative. https://doi.org/10.6073/pasta/43f9e2156680db7372e8ad4db497eb0d.

Saunders, C. 2013. Radiometric Characteristics of Soil Sediments from Shark River Slough, Everglades National Park (FCE) from 2005 and 2006 ver 2. Environmental Data Initiative. https://doi.org/10.6073/pasta/c0cb8ff0f150e429674ecf0db15bedc5.

Smith, N. 2013. Evaporation Estimates for Long Key C-MAN Weather Station, Florida Bay (FCE) from July 1998 to May 2004 ver 3. Environmental Data Initiative. https://doi.org/10.6073/pasta/c40d320f5d15fdd36a65ef7a2ef93f17.

Trexler, J. 2013. Consumer Stocks: Fish Biomass from Everglades National Park (FCE), South Florida from February 2000 to April 2005 ver 3. Environmental Data Initiative. https://doi.org/10.6073/pasta/b0e2ae3fb140447717b8dd9fdc3f4ac5.

Trexler, J. 2013. Consumer Stocks: Fish Biomass from Everglades National Park (FCE), South Florida from February 1996 to March 2000 ver 2. Environmental Data Initiative. https://doi.org/10.6073/pasta/4c6f16f6825cc77204ef76f21e86b75a.

Trexler, J. 2016. Consumer Stocks: Fish, Vegetation, and other Non-physical Data from Everglades National Park (FCE), South Florida from February 2000 to April 2005 ver 4. Environmental Data Initiative. https://doi.org/10.6073/pasta/354b4b6ac638551cc947a9e83e17805d.

Trexler, J. 2016. Consumer Stocks: Physical Data from Everglades National Park (FCE), South Florida from February 1996 to April 2008 ver 3. Environmental Data Initiative. https://doi.org/10.6073/pasta/bc7e38fe4b8f5f976f1adb9e6395a8f8.

Trexler, J. 2016. Consumer Stocks: Wet weights from Everglades National Park (FCE), South Florida from March 2003 to April 2008 ver 4. Environmental Data Initiative. https://doi.org/10.6073/pasta/7ff817fdf10aac0ad84a64acd6ca1c95.

Trexler, J. and J. Sanchez. 2018. Periphyton Nutritonal Data across the freshwater Everglades (FCE): June 2016-Feb 2017 ver 2. Environmental Data Initiative. https://doi.org/10.6073/pasta/70cdfca241ed9dffefdb7b3608d20ef1.

Troxler, T. 2019. Water Quality Data (Extensive) from the Taylor Slough, Everglades National Park (FCE LTER), from April 1996 to Present ver 11. Environmental Data Initiative. https://doi.org/10.6073/pasta/5e32731a74634d39ad19b3b6334307e2.

Troxler, T. 2019. Water Quality Data (Extensive) from the Taylor Slough, Everglades National Park (FCE), South Florida from July 1999 to Present ver 10. Environmental Data Initiative. https://doi.org/10.6073/pasta/c485d6cd55dfaed28ea8d9985816a63d.

Troxler, T. 2019. Water Quality Data (Grab Samples) from the Taylor Slough, Everglades National Park (FCE LTER), South Florida from September 1999 to Present ver 9. Environmental Data Initiative. https://doi.org/10.6073/pasta/a27bee7be093db941365ab224c339b09.

Troxler, T. and D. Childers. 2015. Periphyton Net Primary Productivity and Respiration Rates from the Taylor Slough, just outside Everglades National Park (FCE), South Florida from December 1998 to December 2004 ver 4. Environmental Data Initiative. https://doi.org/10.6073/pasta/6cd7783c4871eaf3527ab177deacd035.

Troxler, T. and D. Childers. 2015. Periphyton Net Primary Productivity and Respiration Rates from the Taylor Slough, just outside Everglades National Park, South Florida (FCE) from December 1998 to August 2002 ver 4. Environmental Data Initiative. https://doi.org/10.6073/pasta/6b1a16e33753fdd17053c94d3e69c044.

Troxler, T. and D. Childers. 2015. Precipitation from the Taylor Slough, just outside Everglades National Park (FCE), South Florida from August 2000 to December 2006 ver 3. Environmental Data Initiative. https://doi.org/10.6073/pasta/6581a4898452afd4bc1f6665b44aeb4f.

Troxler, T. and D. Childers. 2015. Sawgrass above ground biomass from the Taylor Slough, just outside Everglades National Park (FCE), South Florida from October 1997 to December 2006 ver 3. Environmental Data Initiative. https://doi.org/10.6073/pasta/e6640b978d38e54d88f2231ebc7db92d.

Troxler, T. and D. Childers. 2015. Soil Characteristic and Nutrient Data from the Taylor Slough, within Everglades National Park (FCE), from March 2002 to April 2004 ver 3. Environmental Data Initiative. https://doi.org/10.6073/pasta/6040a745baed01378e215c8070d0126d.

Troxler, T. and D. Childers. 2015. Soil Characteristics and Nutrient Data from the Shark River Slough, within Everglades National Park (FCE), from March 2003 to March 2004 ver 3. Environmental Data Initiative. https://doi.org/10.6073/pasta/b159b26b251d40494258f3d4430f4dfc.

Troxler, T. and D. Childers. 2015. Soil Physical Data from the Shark River Slough, Everglades National Park (FCE), from November 2000 to January 2007 ver 3. Environmental Data Initiative. https://doi.org/10.6073/pasta/903576c777c0b7dc6bf87cd86f9fbc05.

Troxler, T. and D. Childers. 2015. Soil Physical Data from the Taylor Slough, just outside Everglades National Park (FCE), from October 1998 to October 2006 ver 3. Environmental Data Initiative. https://doi.org/10.6073/pasta/81e0fc75f420c948340b17715a4d78a5.

Troxler, T. and D. Childers. 2015. Soil Physical Data from the Taylor Slough, within Everglades National Park (FCE), from September 1999 to November 2006 ver 3. Environmental Data Initiative. https://doi.org/10.6073/pasta/ac54452865f50d6ca972a4c196522e4f.

Troxler, T. and D. Childers. 2015. Water Levels from the Taylor Slough, just outside the Everglades National Park (FCE), South Florida from October 1997 to December 2006 ver 3. Environmental Data Initiative. https://doi.org/10.6073/pasta/2bb421d19f71704ed7476ca128bacb72.

Troxler, T. and D. Childers. 2015. Water Quality Data (Grab Samples) from the Taylor Slough, just outside Everglades National Park (FCE), for August 1998 to November 2006 ver 3. Environmental Data Initiative. https://doi.org/10.6073/pasta/cd96927a753e84af3d9d2a07b02fa322.

Troxler, T. and D. Childers. 2015. Water Quality Data (Porewater) from the Taylor Slough, just outside Everglades National Park (FCE), from August 1998 to October 2006 ver 3. Environmental Data Initiative. https://doi.org/10.6073/pasta/1c4f9019e3dc4306b17a067f455430ad.

Troxler, T. and D. Childers. 2015. Water Quality Data (Porewater) from the Taylor Slough, Everglades National Park (FCE), South Florida from September 1999 to December 2006 ver 3. Environmental Data Initiative. https://doi.org/10.6073/pasta/d4e923e473d693cce2a896d82348e112.

Troxler, T. and D. Childers. 2019. Sawgrass Above and Below Ground Total Phosphorus from the Taylor Slough, Everglades National Park (FCE LTER), South Florida for March 2002 to Present ver 10. Environmental Data Initiative. https://doi.org/10.6073/pasta/50874ba7600fb71e1449cab6683e528c.

Troxler, T. and D. Childers. 2019. Sawgrass Above and Below Ground Total Nitrogen and Total Carbon from the Taylor Slough, Everglades National Park (FCE LTER), South Florida for March 2002 to Present ver 8. Environmental Data Initiative. https://doi.org/10.6073/pasta/1236a3a431500ef619f5ad277ebbd650.

Troxler, T. and D. Childers. 2019. Water Quality Data (Extensive) from the Taylor Slough, just outside Everglades National Park (FCE), from August 1998 to December 2006 ver 4. Environmental Data Initiative. https://doi.org/10.6073/pasta/986977091d9ff18aac52ea1c4886e64b.

Troxler, T. and D. Childers. 2019. Water Quality Data (Grab Samples) from the Taylor Slough, Everglades National Park (FCE), from May 2001 to Present ver 9. Environmental Data Initiative. https://doi.org/10.6073/pasta/d36baf5e9fa98559ced5901f4f6c38c5.

Troxler, T. and D. Childers. 2020. Precipitation from the Taylor Slough, Everglades National Park (FCE LTER), South Florida from July 2000 to Present ver 8. Environmental Data Initiative. https://doi.org/10.6073/pasta/7bd9a996223de17e9dc1eb48eb9a4a61.

Troxler, T. and D. Childers. 2020. Sawgrass above ground biomass from the Taylor Slough, Everglades National Park (FCE LTER), South Florida from August 1999 to Present ver 8. Environmental Data Initiative. https://doi.org/10.6073/pasta/75ba1cbaaf6bd2f600c63b26e4075820.

Troxler, T. and D. Childers. 2020. Water Levels from the Taylor Slough, Everglades National Park (FCE LTER), South Florida from April 1996 to 2012 ver 8. Environmental Data Initiative. https://doi.org/10.6073/pasta/3193b02e99a16f874ef3e1b63ca295e2.

Troxler, T. and D. Childers. 2020. Water Levels from the Taylor Slough, Everglades National Park (FCE), South Florida from August 1999 to Present ver 9. Environmental Data Initiative. https://doi.org/10.6073/pasta/5d308344e7340f90723dd4cd2e61f61f.

Twilley, R., V. Rivera-Monroy, and E. Castaneda. 2019. Mangrove Forest Growth from the Shark River Slough, Everglades National Park (FCE), South Florida from January 1995 to Present ver 4. Environmental Data Initiative. https://doi.org/10.6073/pasta/7ec8a89997863f2864b98e62b6535bde.

Wilson, B. and T. Troxler. 2018. Biomass data from the Peat Collapse-Saltwater Intrusion Field Experiment within Everglades National Park (FCE), collected from October 2014 to September 2016 ver 1. Environmental Data Initiative. https://doi.org/10.6073/pasta/6a18d0ec3a960a82b6989c18f01205b2.

Wilson, B. and T. Troxler. 2018. Flux data from the Peat Collapse-Saltwater Intrusion Field Experiment within Everglades National Park, collected from October 2014 to September 2016 ver 1. Environmental Data Initiative. https://doi.org/10.6073/pasta/a84048bfa2552499fad8d80f313db008.

Wilson, B. and T. Troxler. 2018. Leaf nutrient and root biomass data from the Peat Collapse-Saltwater Intrusion Field Experiment within Everglades National Park (FCE), collected from October 2014 to September 2016 ver 1. Environmental Data Initiative. https://doi.org/10.6073/pasta/0412d0e992558af65cf22110ef8f0e1b.

Wilson, B. and T. Troxler. 2018. Modeled flux data from the Peat Collapse-Saltwater Intrusion Field Experiment within Everglades National Park (FCE), collected from October 2014 to September 2016 ver 1. Environmental Data Initiative. https://doi.org/10.6073/pasta/54104d869d122b20b4bcfa3cf8acad1c.

Wilson, B. and T. Troxler. 2019. Nutrient data from the Peat Collapse-Saltwater Intrusion Field Experiment from brackish and freshwater sites within Everglades National Park, Florida (FCE LTER), collected from October 2014 to September 2016 ver 4. Environmental Data Initiative. https://doi.org/10.6073/pasta/adc510f0d772128a19c545cc6c8a7df1.

Yoder, L. and R. Roy Chowdhury. 2018. Institutional Dimensions of Restoring Everglades Water Quality - Social Capital Analysis (FCE), Florida Everglades Agricultural Area from September 2014 to July 2015 ver 1. Environmental Data Initiative. https://doi.org/10.6073/pasta/05944589bc8b526ead9b1df50797e00a.

Yoder, L. and R. Roy Chowdhury. 2018. Institutional Dimensions of Restoring Everglades Water Quality -Interview Notes (FCE), September 2014-July 2015 ver 2. Environmental Data Initiative. https://doi.org/10.6073/pasta/94d1f65d4c822af1150bc9e7694e59d1.