The next phase of coastal oligotrophic ecosystems research by the Florida Coastal Everglades LTER Program

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SITE DESCRIPTION
The Florida Coastal Everglades (FCE) LTER site is located entirely within the boundaries of Everglades National Park. Everglades National Park is part of the greater Everglades ecosystem which extends north to Lake Okeechobee and the Kissimmee River. FCE sites occur along transects oriented with the natural flow of water in Everglades National Park’s two main drainage basins: Shark River Slough and Taylor Slough. Oligotrophy is a defining characteristic of FCE, and FCE ecotones are biogeochemically “inside down” because the source of limiting nutrients is the ocean, not the watershed. The region experiences a dry season from November to May and a wet season from June to October. The coastal Everglades covers a large area that is effectively topographically flat, and is thus susceptible to dramatic transgressive changes in response to sea level rise. Hurricanes and storms are common, and add “pulse” disturbance features to this slow “press” of rising sea level.

RESEARCH FOCUS
FCE research focuses on population and ecosystem dynamics in the oligohaline ecotone regions of Taylor Slough and Shark River Slough, where freshwater and estuarine vegetation mix. In the next phase of FCE research (FCE II, 2006-2012), our conceptual emphasis will be on: 1) oligohaline ecotone dynamics; 2) hydrologic, climatological, and human drivers that affect those dynamics, and; 3) processes that regulate biophysical inputs to the ecotone from upstream freshwater Everglades marshes and the estuary proper. The overarching theme of FCE II follows this evolution of ideas: In the coastal Everglades landscape, population and ecosystem-level dynamics are controlled by the relative importance of water sources, water residence time, and local biotic processes. This phenomenon is best exemplified in the oligohaline ecotone, where these 3 factors interact most strongly and vary over many temporal and spatial scales.

THE GREATER EVERGLADES
Human influence on the Everglades became significant only about 100 years ago. At that time, there were fewer than 2000 non-native people living in south Florida, while today there are over 6 million. During the last century, human activity has dramatically altered the Everglades, reducing it to half its original extent and compartmentalizing the remaining system with over 2500 km of canals and levees. Over 95% of the people living in south Florida get their drinking water from the shallow Biscayne aquifer, which is recharged in near real time by the Everglades. Human activities tied to water management and Everglades Restoration continue to directly affect both freshwater and groundwater inputs. The FCE LTER site is thus an excellent laboratory for understanding how coastal ecosystem dynamics respond to, and influence, human activities in the coastal zone.

HUMAN IMPACTS ON THE EVERGLADES

THE TAYLOR SLOUGH (TS/Ph) TRANSECT

EVERGLADES RESTORATION AND THE “GRAND EXPERIMENT”
Everglades Restoration is the experimental, BACI-style template for FCE. During FCE II, a major restoration project will remove a key levee (a portion of the Tamiami Trail) and construct a bridge at the head of our Shark River Slough transect. This “Grand Experiment” will cause a considerable increase in freshwater flow to only one of our transects. Our FCE II central hypotheses are directed at understanding the results of this major change.

Hypothesis 1 (H1): Increasing inputs of fresh water will enhance oligotrophy in nutrient-poor coastal systems, because the inflowing water has low nutrient content; this dynamic will be most pronounced in the oligohaline ecotone.
Hypothesis 2 (H2): An increase in freshwater inflow will increase the physical transport of detrital organic matter to the oligohaline ecotone, which will enhance estuarine productivity. The quality of these allochthonous detrital inputs will be controlled by upstream ecological processes.
Hypothesis 3 (H3): Water residence time, groundwater inputs, and tidal energy interact with climatic and disturbance regimes to modify ecological pattern and process in oligotrophic estuaries; this dynamic will be most pronounced in the oligohaline ecotone.