

Response of carbon dioxide, water, and energy exchange of peat and marl wetlands in the Florida Everglades to changes in hydroperiod

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1) Objective: To determine the total CO₂ balance and the relative magnitudes of the photosynthetic and geochemical CO₂ exchange processes in peat and marl forming wetlands of the Florida Everglades in response to changes in hydroperiod, a factor highly sensitive to climate change and the dominant control over ecosystem structure and function in Everglades marsh.

2) Research Questions: 1) What are the CO₂ balances of Everglades peat and marl forming wetlands?; 2) What are the relative contributions of physiologically-based exchange and abiotic carbon precipitation to the net CO₂ flux?; 3) What are the responses of the CO₂ exchange processes to hydroperiod?; 4) How does the contribution of macrophyte CO₂ flux vary with hydroperiod across the landscape?

3) Location: The research will be conducted in long and short-hydroperiod marsh (Shark River Slough and Taylor Slough, respectively) of Everglades National Park, Florida. The two study sites will be co-located near water level recorders, nutrient auto-samplers, and productivity sample sites of the Florida Coastal Everglades (FCE) LTER program.

4) Methods: The project will combine eddy covariance, chamber-based, and geochemical measurements of CO₂ flux with traditional biometric approaches to estimate net and gross primary production at peat and marl sites in the Everglades. Concurrent hydrological and climate data will be analyzed using statistical and modeling approaches to evaluate the hydrological and other potential drivers of physiological and abiotic fixation of CO₂. An ecosystem productivity model parameterized from information obtained from sample transects and newly available hydrological maps will scale macrophyte productivity in response to hydrological variation across the landscape.

5) Deliverables: The two study sites will fill a deficiency in the AmeriFlux network both in terms of the South Florida Everglades Ecoregion and of wetlands in general. Wetlands are particularly important because they are among the most productive of all ecosystems and have the potential to store or lose large amounts of carbon. Deliverables will include: 1) The first estimates of the components of CO₂ exchange of Everglades peat and marl forming wetlands; 2) The first estimates of the relative contributions of the physiology of macrophytes, of the physiology of periphyton, and of calcification to the CO₂ exchange of Everglades marsh; 3) An improved understanding of the response of physiological and abiotic CO₂ exchange of Everglades marsh to changes in hydroperiod; 4) A first estimation of how the contribution of macrophyte CO₂ fluxes vary with hydroperiod across the landscape in response to climate change and water management.