# Carbon Dynamics of the Greater Everglades Watershed and Implications of Climate Change

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Low-latitude wetland watersheds are a significant component of the terrestrial carbon (C) cycle, but are highly vulnerable to the dual pressures of land use and climate change. We are using the Greater Everglades to evaluate the response of these watersheds to environmental change. Eddy covariance (EC) measurements of $CO_2$, $CH_4$, and $H_2O$ were collected along a hydrologic gradient at three sites: pine flatwoods (no $CH_4$), seasonal depression marsh, and sawgrass peatland. Over the past three years, the flatwoods averaged an uptake of 96 g C-$CO_2$ $m^{-2}$ $yr^{-1}$ and showed little seasonality. Both wetlands had seasonal patterns related to water depth, with C-$CO_2$ uptake averaging 131 g $m^{-2}$ $yr^{-1}$ in the depression marsh and 177 g $m^{-2}$ $yr^{-1}$ in the peatland. Methane emissions from the depression marsh (66 g C $m^{-2}$ $yr^{-1}$) were nearly double that of the peatland (38 g C $m^{-2}$ $yr^{-1}$), possibly due to the marsh's more variable water table and shallower organic soils. Evapotranspiration (ET) was also greater in the wetland sites and strongly associated with open water, as canopy biomass reduced water loss from the sawgrass peatland compared to the more sparsely vegetated depression marsh. Leaf gas exchange comparisons suggest potential feedbacks to autogenic wetland drying resulting from shrub encroachment. Shrubs had lower water use efficiency but double the LAI of sedge communities, resulting in net wetland water loss. Closed chambers with OTCs showed increased C exchange with 2-3$^{o}$C daytime warming, with a 50-60% increase in net C uptake at the depression marsh and flatwoods despite increased ecosystem respiration.

A combination of GPR, gas traps and time-lapse cameras in the field and laboratory are investigating gas build-up and release at high spatial (i.e. centimeter) and temporal (i.e. sub-hourly) scales, as well as how peat thickness and seasonality may influence gas releases. A novel algorithm using ground penetrating radar (GPR) soil surveys and wetland surface area from aerial images estimated depression marsh soils contribute 89 Gg C within the Disney Wilderness Preserve alone. Litter incubations showed surface decomposition was nearly 3x greater in the pine flatwoods (324 g biomass $m^{-2}$ $yr^{-1}$) compared to the wetlands. Root productivity was also greatest in the flatwoods (90 g biomass $m^{-2}$ $yr^{-1}$) compared to the wetlands (10-16 g $m^{-2}$ $yr^{-1}$), with the majority of new roots produced at depths of 4-12 cm. Our findings are informing terrestrial ecosystem models to evaluate the atmospheric forcing of wetland watersheds under future climate scenarios.