Tidal Freshwater Wetland Research on The Santee Experimental Forest – Hydrology and Carbon Dynamics

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Despite the growing interest in "blue carbon", there is relatively little information on carbon stocks and dynamics in tidal freshwater wetlands. As the only USDA experimental forest containing tidal forested wetlands, the Santee Experimental Forest (SEF) is in a unique position to contribute research to this important forest resource. With that goal, we established a field research facility encompassing multiple research sites along a gradient of tidal influence that include a freshwater tidal marsh, a freshwater tidal forested wetland, and a nontidal forested wetland, all located along the East Branch of the Cooper River and its tributaries, which are important inputs to the Charleston estuary. These sites are instrumented to monitor water level, temperature, conductivity and dissolved oxygen, and soil moisture, temperature, and oxidation reduction potential; stream flow and water quality are also measured in the tidal and nontidal reaches.

Previous research out of the SEF has shown that tidal freshwater streams can function as reservoirs to sustain higher water tables than in nontidal forested wetlands, creating wetter soils and likely affecting carbon dynamics. Other work has demonstrated the importance of microtopography in mediating greenhouse gas fluxes, with hollows typically being stronger sources of methane emissions. At each of the current research sites, CH_4 and CO_2 fluxes are measured monthly at three plots, at high and low tide in the tidal sites, and in both hummocks and hollows in the two forested sites where microtopographic variation is present. We now have one complete year of gas flux data along this tidal gradient, which further demonstrates the relationship between landscape position and greenhouse gas fluxes. We also analyze how these fluxes are impacted by water level, soil moisture, and degree of tidal influence, and discuss diffusive v. ebullitive CH_4 fluxes.