2017

Biophysical drivers of carbon dioxide and methane fluxes in a restored tidal freshwater wetland

Ellen Stuart-Haëntjens
Virginia Commonwealth University, goodrichstej@mymail.vcu.edu

Scott C. Neubauer
Virginia Commonwealth University, sneubauer@vcu.edu

William Shuart
Virginia Commonwealth University, wshuart@vcu.edu

Christopher M. Gough
Virginia Commonwealth University, cmgough@vcu.edu

Follow this and additional works at: http://scholarscompass.vcu.edu/rice_symp

Part of the Terrestrial and Aquatic Ecology Commons

© The Author

Downloaded from
http://scholarscompass.vcu.edu/rice_symp/21

This Poster is brought to you for free and open access by the Rice Rivers Center at VCU Scholars Compass. It has been accepted for inclusion in Rice Rivers Center Research Symposium by an authorized administrator of VCU Scholars Compass. For more information, please contact libcompass@vcu.edu.
I. Background and Mapped Location
- Wetlands store large amounts of carbon (C) in biomass and soils, playing a crucial role in offsetting greenhouse gas (GHG) emissions; however, they also account for 30% of global yearly CH4 emissions.
- Anthropogenic disturbance has led to the decline of natural wetlands throughout the United States, with a corresponding increase in created and restored wetlands.
- Studies characterizing biogeochemical processes in restored forested wetlands, particularly those that are both tidal and freshwater, are lacking but essential for informing science-based carbon management.
- The Rice Rivers Center flux tower (yellow triangle) and solar panel locations (yellow dot) are on the eastern bank in the northern tidal portion of the VCU Rice Rivers Center wetland. The flux footprint is outlined in a yellow semi-circle, with prevailing winds from the west. Red dots mark the locations of chamber-flux, water level, and soil carbon measurements.
- Restored and reference wetlands are 500 m apart and connect to the James River in the southern Chesapeake Bay watershed.

II. Site and Instrument Specifications
- The restored wetland at VCU’s Rice Rivers Center was originally a tidal forested wetland before it was clear-cut and damned to create a lake in the early 1900s.
- Tidal hydrology was restored in 2011 and the site now contains a mixture of native grasses, bald cypress (Taxodium distichum), black willow (Salix nigra), red maple (Acer rubrum), musclewood (Carpinus caroliniana), and loblolly pine (Pinus taeda).
- Flux tower instrumentation is 6 m above the marsh surface (twice canopy height), while the flux tower fetch extends 200 m.
- The diurnal time series of CO2 (a, b), CH4 flux (c, d), and temperature (e, f) at the Rice Rivers Center in January and April 2017. Negative values indicate gas uptake (a-d). The solid line represents the mean value.

III. Research Objectives
- Carbon fluxes in a restored tidal freshwater wetland: 1. Quantify CO2 and CH4 exchange (flux); 2. Interpret underlying biological and physical drivers of ecosystem-scale wetland-atmosphere C exchange and sequestration.
- Compare a restored wetland to a natural reference wetland: 1. Pair chamber CO2 and CH4 fluxes and soil C measurements in adjacent established and restored wetlands to evaluate the extent to which restoration activities reestablish C cycling processes.

IV. 2017 CO2 and CH4 Fluxes
- The amplitude of CO2 flux exchange increased from January to April, but mean half-hourly fluxes were similar in early growing and dormant seasons (a, b). CH4 fluxes were lower during January, and more dynamic in April, likely due to increased methanogen microbial activity as well as passive diffusion through vegetation.

V. Future Work
- Compare chamber-based CO2 and CH4 fluxes and soil C to quantitatively compare C cycling function between restored and established wetlands.
- Within the tower footprint, characterize spatial variation in CO2 and CH4 fluxes by landform, vegetation type, and hydrology over the course of a year.