Tradeoffs in Nutrient Retention and Greenhouse Gas Fluxes in Restored Agricultural Wetlands

Justin Murdock *and Zoe Porter*
Tennessee Tech University, Cookeville, TN, USA

The return of ecosystem services within restored agricultural wetlands is a major goal of the USDA Agricultural Conservation Easement Program. In the Mississippi River basin, nutrient retention by floodplain agricultural wetlands is an important restoration focus to reduce nutrient transport to the Gulf of Mexico and help mitigate Gulf hypoxia. Nutrient retention in restored wetlands is well documented; however, wetlands can release nutrients during inundation and be a significant source of greenhouse gases (GHG). This study aims to identify potential tradeoffs in nutrient sequestration and GHG production under different wetland restoration practices. We are collecting seasonal measurements of nutrient and GHG flux rates across dominant restoration practices in three WREP easements in west Tennessee using soil core flow-through incubations. Initial findings show that during flooding, nitrogen and phosphorus are being retained in all habitats, with lower variation in retention in the shallow groundwater compared to what occurs at the soil/floodwater interface. The highest denitrification rates occurred in areas that dry between floods and contain herbaceous vegetation. The greatest GHG production occurred in areas that were continuously inundated between floods. Tradeoffs with N_2 flux and GHG fluxes happened, as higher nitrous oxide (N_2O) rates occurred when N_2 rates were higher. Methane (CH_4) fluxes were unrelated to N_2 or N_2O fluxes, or soil oxygen demand, but were correlated to preflood soil moisture for both surface water and shallow groundwater, suggesting soil water content increased CH_4 production across habitats. Given these potential tradeoffs in nutrient and GHG fluxes, gaining a better understanding of the soil and vegetation conditions that optimize each nutrient and gas flux rate is critical to meeting multiple restoration goals, and creating restoration designs and hydrology management strategies that target specific ecosystem services.