ESTIMATING IMPORTANCE OF HYDROLOGIC CONDITIONS ON NUTRIENT RETENTION BY WETLACULTURE MESOCOSM SYSTEMS IN THE FORMER GREAT BLACK SWAMP

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Human-induced non-point sources of nitrogen and phosphorus have contributed to the world's widely common occurrence of harmful algal blooms, such as the serious eutrophication issue of western Lake Erie and south Florida's coastlines. Wetlands have long been considered as an effective way to remove nutrients before the runoff entering rivers or lakes. A new term "wetlaculture" and its practice were recently described and is currently under investigation to describe a landscape consisting of rotating 'wetlands and agriculture'. A wetlaculture mesocosm experiment has been set up on agricultural land in Defiance, Ohio, the northwestern edge of the former 4,000 km^2 'Great Black Swamp' which was drained entirely in the 19th century. The mesocosm compound consisting of twenty-eight 379 L Rubbermaid tubs, was constructed in 2017 and planted in October 2017 with the sedge *Schoenoplectus tabernaemontani*. Nearby ditch water containing agricultural runoff is pumped weekly into an elevated water feed tank system, with a sampling hydroperiod. The mesocosms were randomly assigned to a 7x2x2 hydrologic experiment involving 2 water depths (0 and 30 cm standing water above the soil surface) and 2 hydraulic loading rates (10 and 30 cm/week). Inflow and outflow water samples from each wetland mesocosms are collected and analyzed for soluble reactive phosphorus, total phosphorus(TP), nitrate+nitrite, total Kjeldahl nitrogen and total nitrogen(TN), every two other weeks during sampling hydroperiods. Data in 2018 and 2019 suggest the Defiance mesocosm wetlands have already become nutrient sinks with a positive removal rate of TP (72±1% (n=345)) and TN (34±3% (n=302)), respectively. There are statistically significant decreases between the inflow and outflow of TP (0.150±0.019 mg-P L^{-1} and 0.042±0.002 mg-P L^{-1}, $p<0.01$) and TN (5.879±0.121 mg-N L^{-1} and 3.762±0.198 mg-N L^{-1}, $p<0.01$). The mesocosm wetland systems show effective nutrient reduction with all four hydrologic treatments. This study will provide valuable information on restoring wetlands from farmlands in the former Great Black Swamp strategically focused on reducing the nutrient loading to western Lake Erie from the Maumee River Basin. Eventually, dynamic and spatial mathematical models basing on wetlaculture mesocosm data will be developed to predict the behavior of created and restored wetlands at a landscape-scale.

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