Quantifying Nutrient Retention by Lake Erie Coastal Wetlands

Project Location

Old Woman Creek National Estuarine Research Reserve, Ohio

Project Duration

November 2017 to October 2019

Project Lead

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Project Type

Collaborative Research – generating science that informs decisions

Project Partners

- City of Sandusky
- Erie Soil and Water Conservation District
- Ohio Department of Natural Resources, Ohio Coastal Management Program
- Ohio State University
- The Nature Conservancy Ohio
- University of Toledo
- U.S. Geological Survey, Great Lakes Science Center

Overview

The return of large harmful algal blooms to Lake Erie, as well as low oxygen levels (hypoxia) in lake bottom waters, have led to an intensified effort to understand, predict, and reduce nutrient loading to the lake. Coastal wetland restoration has been identified as a management tool for achieving an international goal of 40 percent reduction in phosphorus loading to Lake Erie. For example, wetland restoration is central to nutrient reduction plans for Sandusky Bay, Ohio. However, the capacity of different coastal wetlands to retain nutrients and improve water quality is not well understood.

This project will address key information gaps identified by land managers, regulators, and conservation groups involved in coastal wetland restoration and management efforts around Lake Erie. Specifically, these groups require more precise estimates of nutrient retention in wetlands in order to inform decisions around wetland management, hydrologic reconnection of diked wetlands, and the potential creation of coastal wetlands to manage nutrient run-off. The ability to quantify and communicate the role of wetlands in nutrient management is critical for the development of achievable plans for meeting agreed upon water quality targets for Lake Erie and Sandusky Bay.

Anticipated Benefits

- Project results will help guide wetland management, restoration, and construction efforts to maximize nutrient and sediment loading reductions to the Western Basin of Lake Erie and other locations.
- Diverse participants will collaborate to guide the development of new tools to evaluate and communicate the potential to manage wetlands for their water quality services.

Project Approach

The project team includes researchers and resource management professionals from diverse organizations who hope to apply project findings to their own work. Additionally, the team will convene a Collaborative Learning Group to reach a broader set of potential end users and stakeholders. The group will meet quarterly to provide input on key questions about pilot site selection, available data sets, the format of research products, and how to integrate results into decision-support tools and policy discussions.

During the first phase of the project, the research team will develop and test a statistical model for assessing phosphorus assimilation capacity at Old Woman Creek Reserve, which has a long-term monitoring program that measures water quality at the inlet and outlet of the estuary. The team will then apply and evaluate their statistical model in other wetland sites that have shorter-term data, including a diked wetland in Ohio (Crane Creek) and several wetlands in North Carolina that were constructed to treat urban and suburban run-off. Nutrient data from other wetland sites will be aggregated and assessed using a similar model, when possible, to look for patterns in how coastal wetlands retain nutrients. In consultation with the Collaborative Learning Group, the team will develop tools that will help resource managers conduct the field work and data analysis to estimate nutrient assimilation capacity of their wetlands and assess the potential impacts of management decisions.

Targeted End Users and Anticipated Products

Research products are intended to benefit organizations involved in wetland management and restoration, including the Ohio Department of Natural Resources Office of Coastal Management, the Nature Conservancy Ohio, Soil and Water Conservation Districts, the City of Sandusky, and entities that manage coastal marshes around the western basin of Lake Erie, such as private hunting clubs and Ducks Unlimited. The project will generate a few specific products that will be readily applicable. These include:

- Annual and seasonal estimates of nutrient assimilation capacity for Old Woman Creek estuary;
- Estimates of nutrient assimilation capacity for other types of wetlands;
- Development of a new statistical method (Bayesian change point model) and an assessment of its utility in wetland systems with short-term nutrient data; and
- Tools to help other groups assess nutrient retention in their wetland systems and evaluate the potential impacts of restoration or hydrologic management decisions. This includes a protocol for short-term monitoring as well as the R code and an Excel-based tool to allow others to apply the statistical analyses developed and tested through this project.

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