Dr. Audrey Sawyer, Assistant Professor in the School of Earth Sciences at The Ohio State University completed an Ohio Water Resources center funded project through the USGS 104(b) subaward. The project, "**Quantifying direct groundwater discharge to Lake Erie and vulnerability to hidden nutrient loads**," examined the contributions of dissolved nutrients in groundwater to nutrient loading in Lake Erie. Produced maps of direct groundwater discharge rates and identified coastal areas that are vulnerable to groundwater-borne nutrient loads can be used as a tool for implementation of low-coastal development strategies.

Harmful algal blooms (HABs) have proliferated in Lake Erie and are proving to be one of the largest environmental challenges. The discharge rates of streams and rivers into lakes are easily measured, and the concentration of nutrients can be quantified. However, groundwater, which seeps from the lakebed over broad areas, also contains dissolved nutrients and is a more difficult source to measure. Dr. Sawyer used a combination of geospatial analysis (water budget method) and field measurement (Figure 1) of groundwater seepage rates and nutrient concentrations to identify coastal areas that are vulnerable to nutrient inputs from groundwater.

Figure 1 A student captures groundwater in bags using seepage meters along Lake Erie's coast.

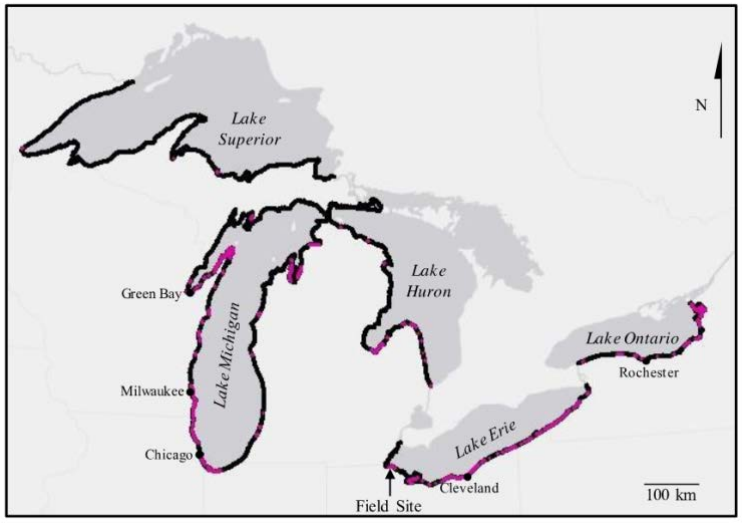

Figure 2 Vulnerability of Great Lakes to contaminant inputs from ground water. Bright color represent vulnerable areas.

The principle findings of this study show that 43% of the U.S. Great Lakes' coast is vulnerable to groundwater-borne nutrients and Lake Erie has the greatest fraction of vulnerable shoreline (Figure 2). Furthermore, lakebed sediments are a source of dissolved phosphorous at discharge zones and some nitrate removal occurs along groundwater flow paths prior to discharge.

The map developed during this research project is freely available and may help tailor strategies aimed toward reducing nutrient loading in Lake Erie and other lake systems.

To access map data, go to https://zenodo.org/record/1011074#.W4hb585KiUk.

Researcher profile. Dr. Audrey Sawyer is a hydrogeologist focused on two themes: 1. Understanding interactions between surface water and groundwater in streams, rivers, estuaries, and coasts, and 2. Determining hydrologic controls on the movement of nutrients, contaminants, and heat in watersheds.