

Understanding the Great Lakes: It Is More Than Just Phosphorus

Alan D. Steinman

Annis Water Resources Institute, Grand Valley State University, Muskegon, MI, USA

The Laurentian Great Lakes (GL) contain 20% of the world's surface fresh water, spanning more than 1,200 kilometers from west to east. Composed of Lakes Superior, Michigan, Huron, Erie, and Ontario, the GL basin is home to over 38 million residents of two countries, eight states, and two provinces. These inland seas contain 22,573 km³ of fresh water and are being subjected to numerous stressors, including excess runoff stimulating harmful algal blooms, over 180 aquatic invasive species, toxic sediments from prior industrial activities, and loss of critical habitat, among others.

Although the five Great Lakes are often thought of as a single unit by people living outside the Basin, in reality there are significant differences in their ecology, hydrology, and anthropogenically-induced stressors. In this talk, I will describe the general features among the Great Lakes, review their differences and commonalities, and briefly describe a few restoration efforts and habitats with an emphasis on biogeochemical processes. Specifically, these examples will address 1) phosphorus (P), which caused massive benthic algal blooms in the 1970s but was thought to be controlled through the Clean Water Act and has returned in a different form; 2) a wetland restoration project that has successfully reduced water column P concentrations from 1500 µg/L to 30 µg/L; 3) the biogeochemistry and productivity in Great Lakes freshwater estuaries; and 4) unique sinkhole ecosystems, whose microbial communities depend on ancient venting groundwater for their metabolic existence.

The talk will conclude with science-related recommendations for the future, which are designed to generate the necessary knowledge to better understand this critical aquatic system.