Evidence of Geologic Phosphorus as the Source of Contamination in Newnans Lake

L M Long[1], M J Cohen[2]
[1]University of Florida, School of Natural Resources and Environment, Gainesville, FL, USA
[2]University of Florida, School of Forest Resources and Conservation, Gainesville, FL, USA

Eutrophication due to phosphorus inputs is a critical problem in the Newnans Lake basin east of Gainesville, Florida. The watershed is underlain by the Hawthorn Formation, but the interaction between the phosphatic clays of that layer and the surface water is largely unknown. Our objective in this study was to investigate the spatial pattern of P loading into the lake, and to discern anthropogenic vs. geologic P sources. We examined multiple lines of evidence for geologic P: covariance with land use, covariance with N, covariance with depth to the Hawthorn layer and covariance with F (derived from fluorapatite, one of the Hawthorn Layers phosphatic minerals). We found the correlation between SRP and F to be +0.79 overall, with a range from -0.57 at high elevation urban sites to +0.98 at sites lower in the basin clearly in contact with Hawthorn clays. Despite the support of the hypothesis that geologic P is dominant, there are large and unexplained deficits in lake water and P budgets. All of our measurements we taken during a regionally significant drought (2006-2007), and we hypothesized that intermediate aquifer seepage into the lake accounts for the lake water deficit during base flow conditions, and that the flow is strongly SRP enriched. We measured groundwater seepage in 14 wells around the perimeter of the lake and determined the magnitude and timing of water flow and P loading, and whether the source of the P was geologic in origin using natural tracers such as F. The importance of geologic P presents management challenges given the recent development of pollutant load reduction goals in preparation for TMDL implementation. Understanding the ways in which human activities accelerate geologic loading, and managing landscape sinks for P (e.g., wetlands) become potentially more important management objectives than identifying and controlling relatively minor direct anthropogenic sources.

Keywords: Newnans Lake, phosphorus, groundwater seepage, Hawthorn Layer