

## Using GIS to Estimate Lake Volume from Limited Data

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Estimates of lake volume are necessary for estimating residence time or modeling pollutants. Modern GIS methods for calculating lake volume improve upon more dated technologies (e.g. planimeters) and do not require potentially inaccurate assumptions (e.g. volume of a frustum of a cone), but most GIS methods do require detailed bathymetric data which may be unavailable. Obviously, GIS technology cannot correct for a lack of data; however, it can facilitate development of methods that better use limited data. Thus, I developed a method to model bathymetry and estimate the volume of a lake with a limited set of data that consists only of a maximum depth measurement and a lake shoreline layer. Using a simple linear transformation, I estimate depth as a function of distance from shoreline and with the resultant information estimate lake volume. I applied and tested this method with bathymetry data of numerous lakes in New Hampshire. Preliminary results indicate that the assumption of depth as a function of distance is appropriate and the simple GIS method has lower overall error than using the traditional frustum of a cone to estimate lake volume. This approach has broad implications in the assessment of lake condition from national surveys (e.g. USEPAs National Lakes Assessment) and should improve upon models of nutrients, contaminants, and hydrology even in the absence of detailed bathymetric data.

Keywords: Geographic Information System; Lake morphology; Bathymetry;

Purpose: A component of the US EPA's Ecosystem Services Research Program is to understand aquatic services provided in Northeastern lakes and ponds. Much of the research centered on these services relies upon modeled estimates of nutrients and other stressors. Lake volume is a key component of many of these models and better estimates of lake volume based on limited data, which is often the case with broad scale studies of lakes, results in better modeled estimates. Thus, this research will improve our ability to understand lakes, nutrients and the services we derive from those lakes.