

A Simple GIS Approach for Estimating Lake Volume from Limited Data

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Lake volume provides key information for estimating residence time or modeling pollutants. Methods for calculating lake volume have relied on dated technologies (e.g. planimeters) or used potentially inaccurate assumptions (e.g. volume of a frustum of a cone). Modern GIS provides improved methods; however, these methods require detailed bathymetric data which may be unavailable. Obviously, GIS technology cannot correct for a lack of data. It can provide methods that better use limited data. I developed a method to model bathymetry and estimate the volume of a lake with only maximum depth and a lake shoreline layer. Using a simple linear transformation, I estimate depth as a function of distance from shoreline and then calculate lake volume. I tested this method with bathymetry data from lakes in New Hampshire. Preliminary results support the assumption of depth as a function of distance. Also, the simple GIS method better estimates lake volume than does the formula for volume of a cone. This approach has broad implications in the assessment of lake condition from broad-scale surveys and should provide improved hydrologic and contaminant models 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.