

Estimating Ecosystem Responses to Changes in Mercury Loading: Lessons from the METAALICUS Project

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Abstract

The Mercury Experiment to Assess Atmospheric Loadings in Canada and the US (METAALICUS) project is a whole-ecosystem, mercury (Hg) loading experiment specifically designed to examine the relation between atmospheric mercury deposition and fish Hg concentrations. This project was prompted by the observation that we lacked clear evidence whether a changes atmospheric Hg deposition might lead to a corresponding change in fish Hg, and at what time scales. To address this information need, a multi-national team of scientists was formed to devise a whole-ecosystem, Hg-dosing study, whereby mercury would be deliberately added to an entire watershed. The study is being conducted at the Experimental Lakes Area (ELA), which is located in northwestern Ontario, Canada. Whole-ecosystem manipulation studies have a distinct advantage over small-scale (lab scale) studies, in that natural processes and complexities that are present in watersheds are accounted for in the scientific results. Starting in the spring of 2001, the METAALICUS team been dosing the Lake 658 watershed with about 20 ug/m²/y (about 3 to 4 times the current atmospheric load). The applied Hg is in the form of enriched stable isotopes, which can be analytically distinguished from previously existing ambient Hg, or currently depositing Hg. For Lake 658, about 70% of the Hg load is from runoff. Thus, in order to predict ecosystem-level responses to changes in atmospheric loading, it is critical to understand the linkages between deposition and Hg in runoff. The use of isotopically enriched Hg as a tracer has provided insights into watershed cycling of Hg that were previously unattainable. Results from this study have allowed for the construction of simple numerical models that provide estimates of the response times for Lake 658. In addition, if this model is generally applicable to other watersheds, insights into ranges in response times, and their controlling factors, can be ascertained and will be presented.

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