



## **USDA-CSREES 2007 National Water Quality Conference**

### **Enhancing phosphorus reduction strategies through biogeochemical research in a TMDL watershed**

The Kalamazoo River, an agricultural watershed draining 5,232 square kilometers in Southwest Lower Michigan, has a legacy of industrial and nutrient pollution. One major water quality problem is phosphorus enrichment of Lake Allegan. A total maximum daily load (TMDL) was developed for phosphorus requiring a 50 percent seasonal non-point source (NPS) reduction. Identification and quantification of NPS phosphorus processes is important for developing reduction strategies. This research proposes that NPS phosphorus sources, fate, and pathways can be identified using in-stream biogeochemical indicators. In 2004, a USDA-CSREES grant funded a three year project to enhance phosphorus reduction strategies in the Lake Allegan/Kalamazoo River TMDL watershed. Research included collecting biogeochemical data to characterize the phosphorus processes. Total phosphorus data were acquired through a combination of daily auto-sampling and weekly grab sampling. Physical and chemical data were obtained through weekly grab sampling. Synoptic samplings utilizing clean sampling techniques provided trace element data. Preliminary data shows NPS phosphorus export coefficients from 4 – 8 kg/sq-km for agriculture and 8 – 16 kg/sq-km for urban land uses. Two agriculturally dominate sub watersheds exhibited different phosphorus forms (70 % versus 15% total dissolved phosphorus) impacting the choice and effectiveness of conservation practices. Two impoundments provided a sink for 15 - 22 % of inlet phosphorus. A third impoundment sourced an amount (6,800 kg) equivalent to the inlet phosphorus load through biological activity during the growing season and contributed 23 % of the phosphorus load to Lake Allegan. This sourcing compensated for phosphorus reductions upstream of the impoundment and was identified as a major factor for the watershed response to quality improvements. The Kalamazoo River/Lake Allegan TMDL is nationally recognized for its watershed-wide, community-based approach. This project provides a model for the enhancement of a stakeholder driven TMDL process through the integration of research, education, and extension programs.

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