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Graduate Research – [Dean Baas](#)

Dissertation Subject: Identifying the Impact of Land Use on Phosphorus Sources, Pathways and Fate Utilizing Biogeochemical Fingerprinting

Dual Major PhD: Biosystems Engineering and Environmental Geosciences

Non-point source phosphorus pollution is a major contributor to the eutrophication of lakes and streams. Agriculture is considered to be one of the dominant sources of non-point phosphorus through the loss of nutrients from fertilization, tillage, and manure management practices. Urban development is another large source of phosphorus loading.

Recent research has characterized the biogeochemical fingerprint of land use in surface waters in Grand Traverse Bay. Solute and trace element concentrations were related to agricultural activities, urban areas, and forested regions.

The Purpose of the project is to extend these concepts of land use and biogeochemical fingerprinting to surface runoff and the understanding of non-point phosphorus sourcing, pathways, and fate. This research is part of the three year USDA Cooperative State Research, Education, and Extension Service (CSREES) Grant, Enhancing Phosphorus Reductions Strategies in the Kalamazoo River Basin.

The Kalamazoo River is a primarily agricultural watershed draining 2,020 square miles in Southwest Lower Michigan. The river has a legacy of serious industrial and nutrient pollution. One major water quality problem is phosphorus enrichment of Lake Allegan, an impoundment located twenty-one river miles upstream of Lake Michigan. A Total Daily Maximum Load (TMDL) was developed and a target set for phosphorus requiring a 50 percent seasonal non-point source reduction. The Kalamazoo River/Lake Allegan TMDL is nationally recognized for its watershed-wide, community-based approach.

The goal of this project is to reduce phosphorus loadings to the Kalamazoo River Watershed through stakeholder-driven research, extension and facilitation. This will be achieved through three interrelated sets of efforts, with the TMDL Implementation Committee playing a central role.

Research objectives in this project will characterize daily phosphorus loadings, and identify and quantify non-point source phosphorus contributors through analysis and correlation of biogeochemical markers relating water quality to land use.

The research plan consists of the installation of five autosamplers providing daily composite water samples. One is located on an agriculturally dominated tributary, two isolate a four mile stretch of urban runoff, the fourth the output of a major impoundment, and the last the inlet to the impaired waterbody. Figures 1 and 2 show a typical installation. In addition, grab samples are being obtained at numerous locations for extensive biogeochemical analysis.



Fig. 1: Autosampler Site



Fig. 2: Sampling Equipment

These data will form the basis for extension activities including 1) creation and validation of a volunteer monitoring program in the watershed for phosphorus; 2) development and delivery of more targeted phosphorus reduction education programs to residents and key stakeholder groups; 3) facilitation to increase effectiveness and sustainability of the TMDL Implementation Committee; and 4) dissemination of the Kalamazoo TMDL implementation model through the CSREES Regional Extension Water Quality Team.