WATER RESOURCES RESEARCH GRANT PROPOSAL

Project ID: MO3041

Title: Spatial Distribution, Geochemistry, and Sources of Phosphorus and Metals in Bottom Sediments in the James River Arm of Table Rock Lake

Focus Categories: Water Quality, Nutrients

Keywords: sediment, nutrients, water quality

Start Date: 03/01/2001

End Date: 02/28/2002

Federal Funds: $17,265

Non-Federal Matching Funds: $34,685

Congressional District: 7th

Principal Investigator:
Robert T. Pavlowsky
Associate Professor, Southwest Missouri State University

Abstract

Phosphorus (P) contamination has caused concerns about the long-term status of water quality in Table Rock Lake and the major rivers in its watershed. The James River arm (JRA) of Table Rock Lake is one of the most contaminated areas in the lake. It is 30 miles long and receives runoff from 20 major tributaries and 50 smaller streams. The sources of P to the JRA are linked to sewage treatment plant effluents, septic system failure, widespread beef and dairy cattle agriculture, and urban/suburban growth. High bacteria counts, frequent fishkills, and extensive algal blooms tend to occur in the JRA during the summer low-flow period when water temperatures are high, dissolved oxygen levels are low, and river P concentrations are not diluted or mixed very well. Information linking source locations within the watershed to P contamination in the James River arm is needed to plan water quality management efforts and complete a Total Maximum Daily Load (TMDL) in order to meet federal water quality standards. This study describes the spatial distribution of P and toxic metals in the bottom sediments of the JRA. Both P and metals tend to be absorbed by sediment particles rather than remain dissolved in the water column. Hence, bottom sediments may represent an important semi-permanent sink for these contaminants in the lake. Furthermore, contaminated sediments may also act as a secondary source of pollution to the lake when seasonal redox conditions cause the desorption of contaminants back into the water column and/or currents resuspend contaminated particles.

The objectives of the proposed project are: (1) map the watershed characteristics of the JRA and the original river valley using GIS/GPS technology; (2) collect 300 bottom sediment samples and quantify the physical and geochemical composition of the recent bottom sediments; (3) use sequential chemical extraction methods to identify the geochemical forms and mobility of P and metals in the sediment; and (4) develop contaminant maps for the lake bottom and use statistical models to describe the spatial trends. This research will advance the scientific understanding of sediment and contaminant transport within the river-lake transition zone. Further, this study offers the potential to provide inroads into the combined use of GIS-based spatial technologies and sediment quality process models for the development, calibration, and implementation of TMDLs.

The results of this study will be used to identify the important sources of phosphorus and metal contaminants to the James River Arm and to support the planning of pollution management plans by government agencies. Information will be disseminated in the classroom, at professional meetings, via on-line web sites, and in journals. Much of the sampling, sediment analysis, and GIS work will occur within the context of a summer course on watershed monitoring taught by Pavlowsky. It is expected that this project will support the thesis work of one graduate student and allow for training of 3 undergraduate and 6 graduate students. This project represents the next step in a sediment quality-based research and monitoring program at SMSU which presently involves watershed-scale studies of the James River, Little Sac River, and Upper Spring River in Missouri and the Kings River in Arkansas.