



WATER RESOURCES RESEARCH GRANT PROPOSAL

Project ID: 2003AR50B

Title: Evaluating the Influence of Lake Francis on Phosphorus Concentrations and Transport at the Illinois River

Project Type: Research

Focus Categories: Water Quality, Sediments, Surface Water

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Congressional District: Third

Principal Investigators: Soerens, Thomas; Limp, W.

Abstract: The recent development of a total phosphorus criterion (0.037 milligrams per liter numeric water-quality standard) for Oklahoma Scenic Rivers has brought the Illinois River Basin back into sharp focus in Arkansas. Five out of the six Oklahoma Scenic Rivers are branches or tributaries of the Illinois River. The Arkansas-Oklahoma Compact Commission meets annually to present and discuss phosphorus concentrations and loads at the Illinois River and other trans-state boundary watershed in Arkansas and Oklahoma. The Compact has agreed on a 40 percent reduction in the annual phosphorus load transported applicable to both states; however, the fall 2002 meeting of the environmental and engineering committee revealed conflicting trends at the state border. Arkansas noted decreasing phosphorus loads whereas Oklahoma observed increasing phosphorus loads, and the only thing in between these sites is a small impoundment, Lake Francis. Thus, our overall goal is to investigate the influence of Lake Francis on phosphorus concentrations and transport in the Illinois River between northwest Arkansas and northeast Oklahoma.

We propose to accomplish this goal with three objectives:

(1) Evaluate changes phosphorus concentrations and loads at U.S. Geological Survey stream gages upstream and downstream of Lake Francis.

- (2) Estimate aerobic and anaerobic phosphorus fluxes from Lake Francis sediments.
- (3) Assess sediment-phosphorus interactions between bottom sediments and overlying water column. This project complements and extends work previously conducted in the Illinois River Basin by Drs. Thomas S. Soerens, Brian E. Haggard and Philip A. Moore, Jr. on phosphorus transport and loads during base flow and surface runoff conditions. We will examine historical water-quality and streamflow data from the U.S. Geological Survey to determine long-term changes in phosphorus concentrations at sites upstream and downstream of Lake Francis; this data will also be used to estimate phosphorus loads during base flow and surface runoff conditions from 1997 through 2002. We will compare phosphorus loads during these flow regimes to determine when Lake Francis is a source or sink of phosphorus. We will also collect intact sediment columns from Lake Francis to estimate the aerobic and anaerobic phosphorus release and sediments from the top 5-cm to evaluate sediment – phosphorus interactions near the sediment – water interface. These specific measures will enable us to determine the relative magnitude of sediment phosphorus release and/or buffering capacity at different locations and under aerobic/anaerobic conditions. Because the costs of reducing phosphorus loads by 40 percent and complying with Oklahoma’s water-quality standards are considerable, these results will provide valuable information and direction regarding watershed phosphorus management strategies in the Illinois River Basin. For example, if bottom sediments in Lake Francis are a potential phosphorus source, then Arkansas and Oklahoma must consider the impact of this small impoundment on watershed management strategies. In this situation, Lake Francis may inhibit Arkansas’ efforts to improve water quality at the Illinois River. Furthermore, the bottom sediments may require some chemical treatment to reduce sediment – phosphorus interactions, resulting in reduced phosphorus concentrations and transport across the Arkansas and Oklahoma border. This research should also provide information on phosphorus dynamics that will be of more general interest and applicability.

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