Report as of FY2006 for 2006KY62B: "Linking Land Use to Water Quality in Northern Kentucky"

Publications

- Conference Proceedings:
  - Evans, Rebecca L. and Alicia Sullivan, 2007, Eutrophic Conditions in Three Northern Kentucky Streams, in Proceedings of the Kentucky Water Resources Annual Symposium, Kentucky Water Resources Research Institute, Lexington, Kentucky, p 91-92.

Report Follows

Problem and Research Objectives

Census Bureau data indicates that the Northern Kentucky region, with a population growth of more than 13.5% since 2000, is rapidly transforming from an agricultural to an urban landscape. With urbanization comes pollution and water quality degradation. Eutrophication, a highly productive condition caused by excess nutrient loading from agricultural runoff and/or treated sewage effluent from urbanized areas, causes noxious algal blooms promoting diurnal dissolved oxygen and pH swings that degrade water quality and aquatic habitat integrity. Water quality typically declines when impervious surfaces reach 10% of watershed area and at 25% channels incise, banks erode, and sediment load is transported downstream where it settles out and destroys physical habitat (Pelley, 2004). Though agriculture does contribute to nutrient enrichment, urbanization is currently the biggest threat to local and regional water resources in northern Kentucky. Urbanization leads to impaired chemical and physical conditions that negatively impact the biological component of surface waters. Though degraded water quality associated with both agricultural and urban land use is well documented, no data existed that described the trophic state of area streams or land use impacts.

There were three main objectives in this study. The first was to document the trophic status of 12 Mile Creek, Doe Run, and Banklick Creek by sampling bi-weekly for a year and comparing data to U.S. EPA criteria for water quality protection. Second, to assess the relationship between trophic indicators: pH, dissolved oxygen, conductivity, nitrogen and phosphorus concentrations, sestonic and benthic algal biomass, and phosphorus concentration in benthic algae in the sampled streams. And, finally, to examine the potential for developing a model of water quality parameters that quantifies land use impacts on northern Kentucky streams.

Methodology

This project was planned and carried out as a bi-weekly sampling regime of the three study sites. pH, oxygen, temperature, conductivity and total dissolved solids (TDS) were measured at streamside using calibrated, portable, field meters. Triplicate water samples were collected, stored on ice for transport and processed in the lab for measurement of sestonic algal biomass, total phosphorus, soluble reactive phosphorus, nitrate, and ammonia (nitrate and ammonia were used for estimation of total inorganic nitrogen). Duplicate (originally planned as triplicate) rock scrubs were taken from a random sample of bottom rocks at each site. The slurry produced from each rock scrub was collected and processed to measure total benthic algal biomass and phosphorus concentration per unit dry weight.

Principal Findings and Significance

We successfully completed all sampling dates as scheduled and all chemical analysis of samples has been completed. Data analysis is still being conducted because the dataset is so large and requires in depth statistical comparisons of multiple variables in multiple dimensions. Plans are to present final conclusions at the 2007 Kentucky

Academy of Sciences annual meeting in poster format as indicated in the original proposal. The additional data analysis will allow for completion of the data analysis and more robust conclusions. Preliminarily, we conclude that all 3 Northern Kentucky streams sampled as part of this study are eutrophic during some portion of the year. Land use variables appear to be most closely associated with the variation in seasonal eutrophic conditions and further data analysis may aid in quantifying this relationship.

The first objective in this study was to document the trophic status of 12 Mile Creek, Doe Run, and Banklick Creek by sampling bi-weekly for a year and comparing data to U.S. EPA criteria for water quality protection. This objective was met and completed as proposed.

The second objective was to assess the relationship between trophic indicators: pH, dissolved oxygen, conductivity, nitrogen and phosphorus concentrations, sestonic and benthic algal biomass, and phosphorus concentration in benthic algae in the sampled streams. This assessment is still underway in the form of statistical analyses. All data needed to meet this objective have been collected.

The third objective was to examine the potential for developing a model of water quality parameters that quantifies land use impacts on northern Kentucky streams. This objective is still being assessed by way of data analysis. As with the second objective, all data necessary to meet this objective have been collected.