

Title: The USGS National Water Quality Program: The Challenges of Understanding Nutrient-Biota Interactions in Streams and Rivers.

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The U.S. Geological Survey's National Water-Quality Assessment (NAWQA) Program has been studying nutrients in streams and rivers for 15 years for the purpose of understanding land use effects, loadings, and effects on stream biota. In response to the recognized need for more detailed nutrient-biota studies, NAWQA began an intensive study in 2002 of nutrient-biota interactions in agricultural areas across the Nation. The objective of this study is to improve our understanding of the interactions of nutrients, habitat, and biological community structure (algal/invertebrate assemblages) and function (stream metabolism and nutrient transformations). Each study area selected 30 independent, wadeable streams distributed along a nutrient gradient. Sites were selected using geodata, measured and predicted nutrient loads and concentrations, habitat, and stream size. Five study areas have completed their data collection, and three more are planned to start in FY06.

Preliminary results indicate a number of important findings. Agricultural streams can be habitat limited due to increased inputs of fine-grain sediment as a result of erosion, lack of riparian canopy, water diversions, and channel modifications. Thus, sampling biota (ie algal biomass) from differing and sometimes unstable substrate types (ie. fine sediment) can complicate the development of statistical models. It is also important to note that TN and TP may not always be the best nutrient indicator in a regression model and nutrient samples may in certain situations need to be collected prior to the biological sampling. Also, some stream were found to be nutrient saturated and therefore habitat characteristics like slope, substrate, temperature, and canopy (light) were the dominant explanatory variables. Quantifying primary producers can be complicated in some systems where macrophytes are the dominant primary producer, particularly in groundwater or irrigation water fed streams. In order to move the issue of developing nutrient criteria forward, there is a need to develop threshold response models for specific ecological indicators. These models require the recognition that nutrients do not just affect biota, but in fact nutrients, biota and physical processes interact in differing ways depending on the specific situation. While our study is focusing on wadable streams in agricultural settings, the lesson learned will provide insight to others regardless of land use or scale of river system. Furthermore, to bridge the gap between streams and rivers, some of the study findings will presented in light of ongoing NAWQA work focused on nutrient-biota relations in larger streams and rivers.