LOTIC INTERSITE NITROGEN EXPERIMENT II

Rates and Mechanisms of Nitrate Retention in Streams: From Stream Reaches to Landscapes

Issues:

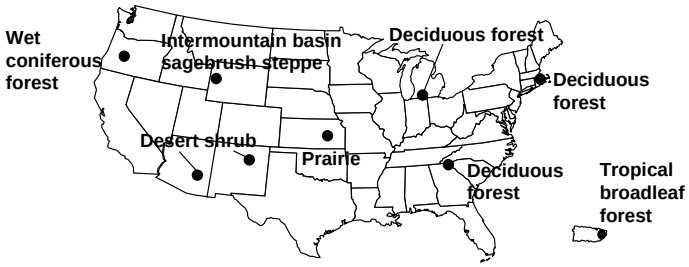
- Excess nitrogen (N) in the environment from fertilizers, human and animal wastes, & air pollution
- Recent evidence that small streams are important sites for taking up and retaining N pollutants, thereby preventing pollution downstream
- Humans may be reducing the N retention capacity of small streams as a result of changes in land use

Research Project:

- Multi-site study of N uptake and retention in streams and the effects of human land use change on stream N retention

Experimental Design:

- 3 reference (native vegetation), 3 agricultural, 3 urbanized streams chosen in 8 different regions of the U.S. (total of 72 small streams with widely varying characteristics)



- Measure physical, chemical, and biological characteristics of each stream (variables that may explain variation in N retention rates)
- Measure rates of stream metabolism by algae and microbes (potentially related to N uptake)
- 24-hour addition to each stream of tracer levels of nitrate in the form of ^{15}N (a stable, naturally occurring isotope of N that has no environmental impact), allowing nitrate transport and retention to be tracked
- Measure ^{15}N uptake within the stream (e.g., by algae on rocks or microbes on detritus)
- Measure ^{15}N lost via denitrification (i.e., ^{15}N converted into N gases by bacteria in sediments)

Landscape Analysis:

- Stream N retention model developed for each region using experimental data
- Model applied to entire drainage network of one larger river basin in each region to predict N flux through the entire system
- Model predictions compared against results of an extensive survey sampling of stream N concentrations throughout each basin

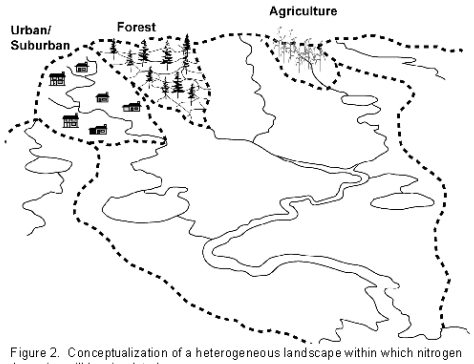


Figure 2. Conceptualization of a heterogeneous landscape within which nitrogen dynamics will be simulated.

Products:

- Analysis of rates of N cycling across broad range of streams in different biomes
- Understanding what stream characteristics are most important in N retention
- Clarifying how human alteration of stream channels and landscapes alters stream N retention
- Developing information useful for restoring or enhancing stream N retention capacity

Participating institutions:

The University of Tennessee, Arizona State University, Institute of Ecosystems Studies, Kansas State University, Marine Biological Laboratory, Michigan State University, University of Notre Dame, Oregon State University, University of Georgia, University of New Hampshire, University of New Mexico, University of Wyoming, and Virginia Tech.,