



WATER RESOURCES RESEARCH GRANT PROPOSAL

Title: Development of Statewide Nutrient Loading Coefficients Through Geographic Information System Aided Analysis

Focus Categories: NPP, NU, SW

Keywords: Eutrophication, Geographic Information Systems, Land Use, Impervious Surfaces, Land-Water Interactions, Nutrient Loading Coefficients, Phosphorous, Riparian Vegetation, Spatial Analysis, Water Quality Modeling, Watershed Management.

Duration: 1 March 1999 to 31 May 2000

FY 1999 Federal Funds: \$22,362

FY 1999 Non-Federal Funds: \$37,415

Principle Investigator(s): Jeffrey A. Schloss, University of New Hampshire Cooperative Extension Water and Marine Resources Jody Connor, NH Department of Environmental Services

Congressional District of University: NH-1

Background and Problem Statement

The waters of New Hampshire represent a valuable water resource contributing to the state's economic base through recreation, tourism, and real estate revenues. Some lakes and rivers serve as current or potential water supplies. For most residents (as indicated by boating and fishing registrations) our waters help to insure a high quality of life. New Hampshire currently leads all of the New England states in the rate of new development and redevelopment. The long-term consequences of the resulting pressure and demands on the state's precious water resources remain unknown. Of particular concern is the response of our waters to increasing non-point source pollutant loadings due to watershed development and land use activities. While watershed nutrient budget measurements and modeling have been attempted on a number of watersheds in the state, the recent cut in the Clean Lakes Program funding (Section 314) has limited the resources for current and future watershed diagnostic studies. No attempt has been made to review the existing data provided from previous studies and investigate whether statewide nutrient loading coefficients can be developed using the powerful statistical and spatial analysis tools now available

Current lake water quality models utilized for management and diagnostic purposes (when direct water nutrient budgets have not been measured) rely heavily on nutrient export coefficients derived from out of state or limited (in terms of geographic area) data from Hubbard Brook, NH. This research proposal intends to finally make an effort to

review and integrate together the existing data available from local, state, university, and federal watershed studies. Developing export coefficients from existing studies conducted over different areas of the state would allow for the use of predictive watershed loadings with a greater confidence. Such coefficients would also allow for the efficient use of limited resources and provide baseline and benchmark data from which future studies can benefit.

Statement of Expected Results/Benefits/Information Transfer

The proposed investigation would allow for the improvement of predictive models used for watershed planning and management. The benefits of this are wide ranging from assisting watershed stewardship education efforts throughout the state and region to providing existing watershed based programs like the EPA Basins Model Initiative, the statewide Unified Watershed Assessment Initiative (under the federal Clean Water Action Program) as well as the regional initiative (US EPA Region 1 and NE states) to develop total daily maximum loading criteria (TMDLs).

The investigation will also increase our understanding of how landscape level factors such as impervious areas, soil complex characteristics, watershed slope and riparian buffers impact the delivery of non-point source dilution to our receiving waters of concern. Such information would be useful to further our modeling efforts of New Hampshire's pristine lakes and rivers (and similar systems throughout our region). It would also serve to illustrate the importance (and justification) of proposed and existing regulations, and best management practices, to decision-makers and the public.

Nature, Scope and Research Objectives

This project will incorporate statistical (both conventional and spatially based) analysis and GIS visualization to determine nutrient export coefficients for typical subwatersheds found throughout New Hampshire. The scope of the work will be limited to past and on-going watershed studies to supply the data for analysis, although limited field verification methods are proposed as described below. Phosphorous (as total phosphorous) will be the primary nutrient of concern as it has been found to be the limiting nutrient for eutrophication in lake watersheds in the region. If enough nitrogen data exists, it will also be analyzed to whatever extent is possible. NOTE: We envision this effort as a single year project. Results from this project and the data compiled may be utilized in following years to improve lake response models and other modeling efforts if future funding is available. More specific objectives to be addressed include:

1. What is the range of export coefficients for various landcover types found throughout New Hampshire?
2. Can the differences between export coefficients be better explained by incorporating other descriptive data available that range through a series of spatial scales (landscape level to local factors)?

3. Can a better understanding of the impacts of imperviousness, disturbed land extent, shoreline development and riparian buffer areas be developed as a results of the GIS and spatial analyses?
4. What improvement will occur with the use of these newly derived coefficients over existing coefficients currently used?