Report for 2001NY1561B: An interactive, Internet-based, nonpoint source pollution modeling system for improving landscape management

- Other Publications:
  - An Interactive, Internet-based, non-point source pollution modeling system

Report Follows:

Problem and Research Objectives:

In deciding how to improve water quality in a watershed, managers may ask: what are the most effective BMPs for improving water quality in a given region? How would current water quality conditions change with an adjustment in landuse? How much change would implementation of a BMP create in pollutant runoff such as total nitrogen, total phosphorus, suspended solids, lead or zinc? This proposal addresses the creation of a tool for use on the Internet by both planners and community members to answers these questions. This tool will enable watershed management agencies to visualize the use of BMPs in landscape management and will help community members gain a better understanding of their watershed.

The research objective is to provide easy and widespread access to a landscape planning model and information that will facilitate stakeholder involvement and consensus building in watershed management. This project would improve a previously created watershed simulation model. Data will be available from on-going work in the Cattaraugus and Irondequoit watersheds in NY. The resulting design can potentially be applied, through additional efforts and data collection, to other watersheds in the State. The proposed interactive, Internet-based tool allows users to apply landscape changes and view model results from the basin level down to an individual stream segment.

Methodology:

This project involves literature review, data collection, water quality model enhancement and testing, and web site development. Recent work has compiled digital data layers for land use, soils, rainfall, elevation, stream segments and drainage basins for the New York tributaries to the Great Lakes. These data layers will be the basis for the surface water nonpoint source, GIS-based, pollution screening model developed by Adamus and Bergman (1995). This model calculates the volume of runoff using runoff coefficients for landuse and soil categories and predicts sediment and pollutant loading using known concentrations given each landuse type. We will use a slightly improved model to predict loading of total nitrogen, total phosphorus, lead, zinc and suspended solids to each stream segment. Predictions of the model will be tested using STORET water chemistry data available in both watersheds.

Principal Findings & Significance:

Patterns of land use have a direct linkage to downstream water quantity and quality because they act as sources of contaminants, influence the degree of filtering of these contaminants, and influence the magnitude of runoff which transports the contaminants to the receiving water body. However, often town planners, highway departments, and other local government officials may not be aware of these connections or the influence of land use planning decisions on water resources. Over the past year, we have been developing an Internet-based education tool that is readily available and easy to use by local government officials, as well as public schools and other interested stakeholders. A simple model has been developed that integrates information from 1994 remote imagery-based land use maps, soils maps, and digital elevation models for two watersheds in western New York. Using this model, we have developed rough estimates of the loadings of total phosphorus, total nitrogen, suspended sediment, and lead and zinc that result from different land use scenarios. The Internet user will be able to select among six different land use scenarios in each of the watersheds to determine the effect of changing land use or adding various best management practices. Specifically, the six scenarios are: current land use conditions (as of 1994), pre-human development as a reference condition, addition of streamside buffers

throughout each watershed, addition of constructed wetlands for controlling stormwater runoff, improvement of soil management practices in agricultural areas, and increased development for its degrading impacts on water quality. The model and its outputs are largely completed and we are currently translating this information into the Web-based format with appropriate accompanying text. We anticipate the Web site will be available in September, 2002.

Publication:

The project will provide online means for users to interactively create water quality simulations over the Internet. Users will define an area for modeling by choosing one of the two watersheds (see Figure 2). They will then have the opportunity to zoom in/zoom out or create a box around their region of interest. Larger selected regions will be modeled with coarser data to enable the model to run at acceptable speeds. The user will then choose a scenario to model:

Produce predictions of pollutants given the current state;
Apply a BMP to the selected area and model the future state;
Compare the results of one BMP with another BMP to determine effectiveness of different BMPs on different regions;

BMPs to be modeled include such pollution prevention measures as streamside buffers, changes in land use, creation of wetlands, and improved soil management practices.

The results of each model simulation will be displayed to the user on the screen in an easy to interpret format, using GIS maps and graphs.