Report for 2004NY48B: Regional water quality tools for identifying high runoff risk areas in watersheds.

- Other Publications:
  - Agnew, L., M.T. Walter, P. Gerard-Marchant, A. Lembo, Jr., S. Lyon, L.D. Goehring, T.S. Steenhuis, 2004,Variable source area hydrology applications to water quality rrotection and risk assessment: Bridging science and practice (04-00XX), NABEC 2004, Northeast Agricultural and Biological Engineering Conference, University Park, PA, June 27-30, 2004.
- Articles in Refereed Scientific Journals:
  - Agnew, L.J., A. Lembo, V. Collins, P. Gerard-Marchant, T.S. Steenhuis, M.T. Walter, 2005, Identifying hydrologically sensitive areas: Bridging science and application, Journal of Environmental Management, In press. Lyon, S.W., A.J. Lembo, M.T. Walter, T.S. Steenhuis, 2005, Defining probability of saturation with indicator kriging on hard and soft data, Advances in Water Resources, In press.
  - Lyon, S.W., A.J. Lembo, M.T. Walter, T.S. Steenhuis, 2005, Defining probability of saturation with indicator kriging on hard and soft data, Advances in Water Resources, In press.
- Dissertations:
  - Agnew, Laura J., 2004, Identifying hydrologically sensitive areas: Bridging science and application, MS Dissertation, Department of Biological and Environmental Engineering, CALS, Cornell University, Ithaca, NY. Collins, Virginia, 2004, A regional tool for hydrologically sensitive area identification in the northeastern United States, Masters of Engineering, Department of Biological and Environmental Engineering, CALS, Cornell University, Ithaca, NY.
  - Collins, Virginia, 2004, A regional tool for hydrologically sensitive area identification in the northeastern United States, Masters of Engineering, Department of Biological and Environmental Engineering, CALS, Cornell University, Ithaca, NY.

Report Follows

Title: **Regional Water Quality Tools for Identifying High Runoff Risk Areas in Watersheds**

Introduction

Despite several decades of attention to the problem, nonpoint source (NPS) pollution from agricultural land continues to be an acute regional problem. The pollutant transport components of most water quality management strategies continue to lag several decades behind current scientific understanding of the relevant hydrological and transport processes. Runoff is perhaps the most substantial NPS pollutant transport mechanism. Recently the research group in Cornell University's Soil and Water Lab (SWL) has proposed water quality protection strategies based on saturation excess and variable source area (VSA) hydrology, hydrological concepts that have been well established since the in the 1960's but not been incorporated into the water quality dogma. SWL, a national leader in developing new NPS pollution control strategies based on the most current hydrological science, has developed the concept of hydrologically sensitive areas (HSAs), which are those areas in a watershed most prone to saturate and generate runoff (overland flow). The focus of this project is to develop user-friendly ways to identify where and when HSAs will occur in landscapes of the Northeastern U.S.

Project Description

The ultimate goal of this project was to develop tools to "increase the capability of … county or municpal governments to… protect their water resources, especially… methods which provide quantified bases for decision-making (FY2004 RFP)." The primary specific goal of this project is to develop and evaluate new GIS-based, computational tools for identifying HSAs in Northeastern US landscapes, i.e., areas that are especially prone to generating runoff. This project has four distinct tasks: 1) determine monthly probabilities of generating runoff using a physically-based, fully distributed hydrological model applied to 6 to 12 twelve watersheds; 2) Overlay "proxy parameters" (based on topography or stream proximity) on maps of runoff probability developed task (1) and evaluate the statistical agreement between the runoff probability and the "proxy parameters;" 3) Evaluate the degree of similarity in the relationships among different watersheds to determine how regionally consistent proposed tools are 4) Determine which months are statistically different from each other in order to ascertain whether monthly, seasonal, or some other distribution of hydrological sensitivity is warranted. As part of this project we would also like to launch a usable Internet-based tool.

Principal findings and Notable achievements

The primary accomplishment of this project is the establishment of a simple relationship between landscape topography and risk of runoff generation. The relationships change throughout the year, but in a consistent and predictable way. As part of task (2) we also investigated relationship between runoff risk and proximity to stream and found that the relationships were substantially more inconsistent, although the relationships we found could be used if no reliable topographic data were available or if one needs a quick field-tool.

We determined runoff risks for eight basins from Connecticut, Pennsylvania, and New York (Task 1). In accordance with task (3), we found that the topography-runoff risk relationships are relatively similar among different watersheds and agreed well with our small duration (~ 8 months) of field measurements.

We are currently developing a point-and-click, interactive Internet-mapping tool for identifying HSAs in upstate New York. This activity has been unexpectedly difficult because Internet-mapping software is still rapidly developing and we have had to try several different platforms. We have decided on Manifold (GIS) and we will be launching tools for Delaware and Tompkins County this summer. Although we initiated this project on schedule, funding was substantially delayed and we anticipate using the remaining funds to complete this final phase, i.e., launching prototype Internet tools.

New External Proposal (these build substantially on this project)

Title: Integrating data and models from the Cannonsville, NY watershed to assess short- and long-term effects of phosphorus BMPs in the Northeast
Agency: USDA – CEAP
Request: $659,995 (in review)
Duration: 2005 to 2008 (3 yrs)
Cooperators/Affiliations: Steenhuis*, Shoemaker*, Walter*, Stedinger*, Richards, Geohring, (Cornell Univ.), Qui* (NJIT), Gburek, (USDA-ARS, Penn State University), Schneiderman, Thongs, Zion (NYC-DEP), McHale (USGS).

Other related proposals are currently in development with primary cooperators from Cornell Univ. (M.T. Walter, Art Lembo, the Biological and Environmental Engineering Soil and Water Lab and other faculty), Pennsylvania State University (Dr. Gburek), the NYC-DEP (Drs. Schneiderman, Zion, Thongs), Walton NRCS office (Gary Lemon), and environmental planners in Tompkins County (Kate Hacket and Deborah Gross). We anticipate that continued enthusiastic working relationships with the primary investigators noted above will continue for many years.