

Exploring Impacts of Land-Use Change and Residential Land-Management Behavior on Water Quality in the Potomac Gorge, USA Via Participatory Modeling (27)

Dawn C. Parker, Robin Brake, Ryan Albert, Susan A. Crate, and R. Christian Jones

Department of Environmental Science and Policy

George Mason University

Fairfax, VA USA

Giselle Mora-Bourgeois

Urban Ecology Research Learning Alliance

National Parks Service (NPS)

Washington, DC, USA

This project integrates spatially explicit land use and water quality modeling with quantified land manager behaviors that are linked to water quality metrics. Model components are being unified into a spatially explicit scenario based participatory modeling tool that will be used to explore scenarios incorporating both land-cover change and potential changes in drivers of land manager behavior. This pilot project, based on the geographic and biologic realities in the Potomac Gorge of Maryland, Virginia, and the District of Columbia, will be generalizable to other areas of high biodiversity that are impacted and constrained by urbanization factors. The pilot study site is a protected river gorge that is situated in a heavily impacted and built-out metropolitan area. The partially protected river and riparian system contains over 400 documented occurrences of rare species and communities, significant upland forest stands, notable wetlands, and numerous seeps and springs harboring rare seepage invertebrates. Off-site impacts from roads and surrounding land use via the tributary stream system have been identified as the most significant threat to the rare aquatic resources in the Gorge.

Initially, the model product will be a hybrid composed of both existing and newly developed model components. Two water quality metrics are used: nitrate+nitrite and changes in runoff quantity. Statistical modeling based on water quality monitoring data characterizes impacts of urbanization and potential water quality benefits from the historic application of Best Management building practices in the region. These statistical estimates, along with other loading parameters estimated for the region, will be incorporated into the PLOAD water quality model to look at changes in loadings of nitrate +nitrite. Changes in peak flow may be estimated using either the HSPF or L-THIA models. Land manager behavior, quantified through two previous surveys as well as a new survey that deals with gaps in the previous surveys, explores relationships between land management behaviors that affect water quality measures and land manager demographics, information, socioeconomic status, housing conditions, attitudes, and beliefs. In the short run, the model will incorporate urbanization projections from the SLEUTH model. In the long run, we hope to build an agent-based model of residential land markets, which will allow us to jointly model land-use change and the likely characteristics and behavior of new land managers. Model components will be unified in a spatially explicit, GIS based modeling tool that can be used to explore scenarios incorporating both land-cover change and potential changes in drivers of land management behavior. The model will be used to explore whether changes in land manager behavior can compensate for the detrimental effects of an increasingly urbanized landscape. This project is in collaboration with staff at the U.S. National

Park Service Center for Urban Ecology and with managers of the George Washington Memorial Parkway and the C&O Canal National Historical Park. Our presentation will discuss not only our progress on model development, but will also discuss the collaborative process and the challenges and opportunities it represents.

The abstract is submitted under the following possible themes:

- A. Land use and ecosystem interactions.
- B. Assessment tools for sustainable development.
- C. Socioeconomic, demographic, and other factors of land use change (incl. housing affordability).
- F. Land use and water interactions and quantity/quality issues.
- J. Managing public lands and protected areas.
- K. Land use policy making, effectiveness, alternatives, consequences (impacts).

and the following approach or method:

- 2. Multi-disciplinary/integrated

Key words: water quality, participatory, land manager behavior, Agent-based model, land-use change, biodiversity, protected areas, GIS