

Development of a participatory model to explore impacts of land-use change and residential land-management behaviour on water quality in the Potomac Gorge, USA

Draft abstract submitted for the Framing Land Use Dynamics 2 conference

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The Potomac Gorge, one of the most biologically significant areas in the eastern United States, stretches 24 Km from Great Falls, VA to Georgetown, DC, and its watershed comprises 36,000 Ha in Maryland, Virginia, and the District of Columbia. Located in an intensely urbanized landscape, this partially protected river and riparian system supports over 400 occurrences of rare communities and species, significant upland forest stands, notable wetlands, and numerous springs and seeps that harbor rare seepage invertebrates. The site is situated inside a heavily developed landscape, encompassing both urban and suburban areas of the Washington, DC metropolitan area. Off-site impacts from roads and surrounding land uses via tributary stream networks have been identified as one of the most significant threats to rare aquatic resources within the Gorge.

The goal of our project is to create a participatory modelling tool to be used by local stakeholders to explore the impacts of both land-use change and land-manager behaviour on water quality in tributary stream networks in the Gorge watershed. Potential stakeholder groups include park managers, regional governments, and local residents. Being a pilot project, with a small budget and time frame, the model will be a hybrid composed of both existing and newly developed model components. We focus on two water quality metrics: nitrate+nitrite and changes in runoff quantity. Statistical modelling based on water quality monitoring data is now underway to characterize 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 runoff quantity will be estimated using a curve number approach, likely via the L-THIA interface based on the TR-55 model. Land manager behaviour will be quantified through two previous surveys, as well as a new survey that is being developed for the project. Where gaps are found in previous surveys, the new survey will quantify relationships between land management behaviours that affect our water quality measures and land manager demographics, information, socioeconomic status, housing conditions, attitudes, and beliefs. In the short run, the land-use change component of the model will use regional land-use change projections developed using the SLEUTH model by C. Jantz et al. In the longer run, we hope to replace this component with an agent-based model of residential land markets, which will allow us to jointly model land-use change and the likely characteristics and behaviour of new land managers. Model components will be unified into a spatially explicit, GIS based modelling tool that can be used to explore scenarios incorporating both land-cover change and potential changes in drivers of land management behaviour. In general, the model can be used to explore whether changes in land manager behaviour can compensate for the detrimental effects of an increasingly urbanized landscape.

A major goal of this project is to develop a tool that will provide useful information to park managers and policy makers. Model development has occurred in collaboration with staff at the NPS 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:

* Modelling of land use changes

o Cellular automata and Multi Agent Models

o Modelling of Environmental and Ecological Effects

* Social, economic and environmental effects of land use change

o Hydrological Effects

o Water Management Systems