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Spatial And Temporal Dynamics Of Land Use Impacts On Water Quality In Watershed Systems

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Abstract

ABSTRACT SPATIAL AND TEMPORAL DYNAMICS OF LAND USE IMPACTS ON WATER QUALITY IN WATERSHED SYSTEMS SEPTEMBER 2007 OLGA TSVETKOVA, B.S., NOVGOROD STATE UNIVERSITY, RUSSIA M.S., UNIVERSITY OF MASSACHUSETTS AMHERST Directed by: Professor Timothy O. Randhir Predicting land use change and assessing watershed tradeoffs between the watershed system components through system simulation helps to determine future nutrient and sediment load reductions needed to obtain a particular water quality standard. This also helps to examine the tradeoffs among nutrient and sediment load reductions that achieve the same water quality objective. Tradeoff assessment is a useful tool to meet agricultural and urban needs in regard protecting water quality. The purpose of this study has been to develop and apply a spatial temporal dynamic simulation model for the land use change and a hydrologic dynamic simulation model for the estimation of the tradeoffs relationships between watershed contaminants and attributes. The Spatial – temporal dynamic model is applied to one of the subbasins within the Blackstone River Watershed to predict potential land use changes in the subbasin. Results show that the increase in urban land use in the watershed is associated with the decline in agricultural and forest land. The overall preliminary results show that urbanization could become a serious problem in the future. The results emphasize the need to protect agricultural area in rapidly changing watersheds. In the watershed tradeoffs simulation modeling, the effect of land use change on water quality is simulated using the Soil and Water Assessment Tool. The methodology is applied to the Blackstone River watershed and its 115 subbasins. Regression statistics as well as graphical techniques are used for accurate evaluation of the model. Water quality and quantity estimated using an array of equations to simulate watershed processes. It is observed that a fairly high variability exists for soluble phosphorus, mineral phosphorus, and sediment yield. The tradeoff relationships between watershed components are described by tradeoff equations and graphically. The regression results indicate that the highest correlations exist between nitrate and surface runoff and between mineral phosphorus and sediment yield. The final tradeoff matrix is developed for the study watershed and could be used to assess various policies that include policies on nutrients, water resources, and land use.

First Advisor

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