WATER RESOURCES RESEARCH GRANT PROPOSAL

Project ID: 2005MT47B

Title: Geographic analysis of land use/land cover change and its relation to nitrogen export in a developing mountain landscape

Project Type: Research

Focus Categories: Surface Water, Non Point Pollution, Models

Keywords: streamwater quality, synoptic sampling, terrain analysis, land use/land cover change, nitrogen export, isotopes

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Non-Federal Matching Funds: $34,000

Congressional District: At Large

Principal Investigators:
Brian Leonard McGlynn
Montana State University

Kristin Gardner

Abstract

Southwestern Montana has experienced rapid growth in recent years; 16 counties grew by more than 14% between 1990 -2000; Ravalli and Gallatin counties alone grew 34 and 44 percent, respectively (MSGC, 2004). Human alteration of the patterns of land use/land cover (LULC) on the earth surface is one of the most profound impacts on natural ecosystems. Understanding the consequences of LULC change is a critical issue. At the watershed scale, we expect that not only the amount and type of landscape alteration, but also the spatial patterns and geographic location, will dictate the corresponding impacts on streamwater quality. Therefore, we hypothesize that geographic or spatial arrangement of LULC in the landscape is a principal control on both the spatial and temporal patterns of streamwater nitrogen (N). This research develops innovative methods to examine the impact of geographic location and spatial pattern of LULC change on stream water quality by combining spatially distributed field sampling of water quality parameters and digital terrain analysis with a new N export coefficient model. The export coefficient

model will be validated by performing novel isotopic analysis using 15N and 18O of NO3- to identify streamwater nitrate sources. The relationships quantified in the export coefficient model and validated by field sampling will 1) help assess watershed N status and the spatial and geographic characteristics that control watershed N export, and 2) provide land managers with a tool to identify areas vulnerable to N export and thus the ability to guide lower impact development. The results of our study will provide insight into the impact of human alteration of natural landscapes on streamwater quality. Although our research focuses on mountain resort development in high elevation settings, our concepts and methodologies will be widely applicable to other landscapes.