AN INVESTIGATION OF NITRATE REMOVAL IN A FIRST-ORDER AGRICULTURAL STREAM

L. Kellman
Department of Earth Sciences, St. Francis Xavier University (lkellman@stfx.ca; Fax 902-867-2457)

Nitrate removal along a 180 m length of a first-order stream draining an agricultural watershed was investigated at an experimental water quality station in Eastern Canada; in-situ stream and shallow groundwater monitoring was coupled with laboratory experiments carried out on intact stream sediment cores. Downstream nitrate losses were assumed to be a function of groundwater dilution through the sandy sediments underlying the stream, bacterial removal, or vegetative uptake. A series of stream nitrate and bromide addition experiments were carried out in order to conduct a mass balance study of stream dilution with low-nitrate groundwater. Net removal during transport through bacterial processes such as denitrification were evaluated by measuring nitrate concentrations of water overlying intact stream sediment cores in the laboratory. Isotopic analyses of nitrate-N were conducted to look for denitrification signatures. Results suggest that although laboratory core experiments point to high net nitrate removal rates, this was not consistent with field observations, where groundwater dilution could account for observed changes in nitrate concentrations during transport. This apparent disparity between simulated laboratory and in-situ stream removal rates may be a function of the physical transport processes controlling exchanges between stream bottom sediments and the overlying water. These results suggest that caution must be exercised in extrapolating potentials for nitrate removal measured in laboratory experiments to the field, and outlines the importance of considering hydrological transport mechanisms that may control these exchanges.