Whole Stream Responses to Nitrate Loading in Three Streams Draining Agricultural Landscapes in Washington, Maryland, and Nebraska

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Biographical Sketch
Mr Duff is a biologist with the US Geological Survey. His research interests focus on nitrogen, phosphorus, and carbon cycling in streams and near-stream groundwater. He uses a wide range of techniques to measure nutrient dynamics in streams ranging from small scale microbial process studies to whole-stream nutrient enrichments.

Whole-stream bromide injections were conducted in three streams draining orchard/dairy and row crop to quantify upstream-downstream discharge, groundwater input, effective storage area (As/A), and nitrate mass balance. Stream discharge ranged from 135-440 L/s, sediment organic matter from 2-24 g/kg AFDM, and stream water nitrate from 0.6-3.2 mg N/L. Nitrate load increased along all three reaches by 18–157 mg/s. Groundwater accounted for 5-18% of the discharge gain but an insignificant proportion of nitrate export from the reaches. The highest rates of nitrification (0.44 ug $N/cm^2/h$) and denitrification (1.62 ug $N/cm^2/h$) among streams were associated with the highest stream water nitrate concentrations, highest water temperature, highest content of sediment N and C, and relatively high As/A (0.11). Though the absolute rates of N loss predicted from the denitrification assays were high compared with pristine streams, as a proportion of nitrate transported the relative nitrate loss was low. These preliminary results suggest that even when sediments are conducive for denitrification, surface water interaction with the biota is insufficient to cause a high level of nitrate removal in low gradient agricultural streams.