

**Nitrate dynamics in a heavily fertilized agricultural watershed:  
identification of sources and reduction processes using natural abundances of N-15**

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Nitrate loading of surface and ground waters is a widespread problem, particularly in agricultural areas where loading of mineral N fertilizers and animal manure is intensive. Analyses of the stable isotopes of nitrate-nitrogen ( $^{15}\text{N}/^{14}\text{N}$ ) have been used to identify groundwater nitrate sources, as different nitrate sources have distinct isotopic ratios. Problems arise in the implementation of this technique, however, as the isotopic ratio can be altered when nitrate is reduced (denitrification). Although this presents a problem in using N-15 values to identify sources of nitrate contamination, it provides a great deal of information about the biogeochemical cycling of nitrate, and points to zones where denitrification is an important process.

The present study was conducted in a 500 hectare agricultural watershed located within the St. Lawrence Lowlands where the use of mineral fertilizers and pig manure as N- sources is extensive. Nitrate concentrations and N-15 values have been monitored in streams, tile drains, streamside soil water and streamside shallow groundwater zones in order to characterize both the potential of these zones to reduce nitrate and the degree to which these zones retain the nitrate N-15 source signatures. Changes in nitrate N-15 values consistent with denitrification have been measured in streams and saturated soil water zones.