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Assessment of conservation practices for control of agricultural NO3 losses in the Choptank basin

Many agricultural conservation practices designed to reduce watershed N export have been tested only at the field scale. Some practices, such as restoration of wetlands and riparian areas, may enhance denitrification of agricultural nitrate. However, denitrification has not been well quantified at watershed scales because it varies greatly in time and space. Nonetheless, denitrification may largely account for the observation that only 10-30% of anthropogenic N inputs to coastal plain watersheds dominated by agriculture is discharged via streams. This strong attenuation, as well as variability of the attenuation, makes it difficult to assess the effectiveness of agricultural conservation practices. To address this issue, we have been investigating the watershed-scale effects of conservation practices in the Choptank basin on the Delmarva Peninsula, where streams are enriched with agricultural NO3 from their basins. To assess N attenuation by natural processes, we are quantifying denitrification in groundwater by measuring (1) excess groundwater N2 associated with NO3 depletion, and (2) isotopic composition of NO3 (15N, 18O). Excess N2 in groundwater is spatially variable and is lost when groundwater is exposed to the atmosphere; therefore, we are linking excess N2 with the isotopic composition of NO3 in groundwater, which is conserved when exposed to the atmosphere. An additional advantage is that the isotopic composition can potentially integrate the spatial and temporal variability of denitrification within the upstream basin. Excess N2 and the 15N and 18O of NO3 in ground and stream waters of the Choptank show evidence of denitrification, particularly in hydric soils of agricultural lands and adjacent riparian zones. Rates of denitrification by land use, soil type, and/or soil drainage class can be used to estimate watershed removal of agricultural NO3 and compute minimum application rates of conservation practices required for statistically detectable reductions in NO3 of streams in basins dominated by agriculture.

Author: Thomas R. Fisher
University Affliation: University of Maryland
Co-Author(s): T. E. Jordan, K. W. Staver, M. L. Fogel, A. J. Sutton, and A. B.Gustafson