USDA-CSREES 2006 National Water Quality Conference

Edge-of-field nitrogen sinks

The idea that areas between agricultural fields and streams can function as "sinks," absorbing nitrogen moving out of fields in surface or ground water, originated in studies in the 1970s in agricultural watersheds characterized by high fertilizer inputs, extensive forested riparian zones, and low watershed nitrogen export. Processes absorbing nitrogen in edge-of-field areas include plant uptake, storage in soil organic matter (biotic and abiotic) and denitrification, the conversion of reactive nitrogen to gas. Protection and restoration of riparian zones is now a major component of watershed water quality programs throughout the world, and there have been active recent efforts to develop more aggressive approaches for interception and treatment of agricultural runoff and drainage water including controlled drainage, constructed wetlands, bioreactors (denitrification trenches, in-line reactors).

There are several critical unresolved issues relating to the use of edge-of-field sinks to control nitrogen exports from rural watersheds. Most of these issues arise from the spatially explicit nature of edge-of-field sinks, which creates several specific challenges for watershed planning and implementation. There is a great need for application of state-of-the-art spatial tools (LIDAR, high resolution geographic information systems, advanced eco-hydrological modeling) to identify just where conservation and/or restoration of edge-of-field sinks is likely to produce significant water quality improvements. In areas where natural riparian zones are not likely to be effective, new more aggressive approaches need to be applied. A final challenge is that land use and climate change can alter hydrologic connections between fields and streams, with major effects on the performance of edge-of-field sinks. There is a strong need for coupling implementation of edge-of-field sinks with monitoring and modeling activities so that we can build up an integrated understanding of their function over the long-term.

Author: Peter Groffman