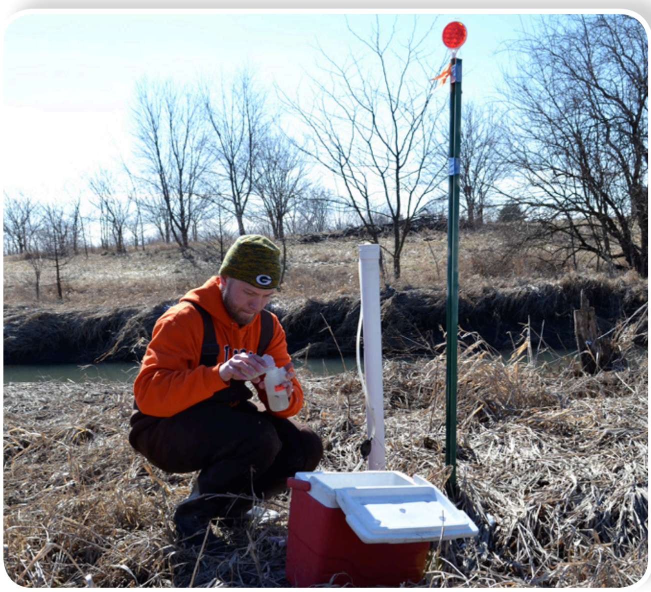
Wetlands Remove Tile Nitrate with Little N_2O Emissions

Loss of nitrate from agricultural fields to surface waters leads to water quality problems, especially from areas that are extensively tile drained. To reduce these nitrate losses, a wide range of in-field and edge-of-field practices have been proposed, including constructed wetlands. In the May–June issue of the *Journal of Environmental Quality*, researchers re-evaluated constructed wetlands established nearly 20 years earlier for their current effectiveness in removing nitrate from tile drainage water. Along with this re-evaluation, they measured the production and flux of greenhouse gases: carbon dioxide, nitrous oxide, and methane.

The wetlands removed 56% of the total inlet nitrate load, likely through denitrification in the wetland. Additional removal of nitrate occurred in seepage water by the riparian buffer strip along each berm (6.1% of the inlet load, for a total nitrate removal of 62%). The dominant greenhouse gas emitted from the wetlands was carbon dioxide, with little methane. Nitrous oxide fluxes were between 3.7 and 13% of the total cumulative greenhouse gas flux, and were only ~2% of the total nitrate removed by the wetlands. Overall, these wetlands continue to effectively remove nitrate at rates similar to those measured following construction, with relatively little greenhouse gas loss.

Adapted from Groh, T.A., L.E. Gentry, and M.B. David. 2015. Nitrogen removal and greenhouse gas emissions from constructed wetlands receiving tile drainage water. J. Environ. Qual. 44(3): 1001-1010. View the full open access article online at http://dx.doi.org/doi:10.2134/jeq2014.10.0415



Lead author Tyler Groh sampling a groundwater monitoring well in the buffer strip near the Embarras River to determine nitrate removal of seepage water from the constructed wetland.

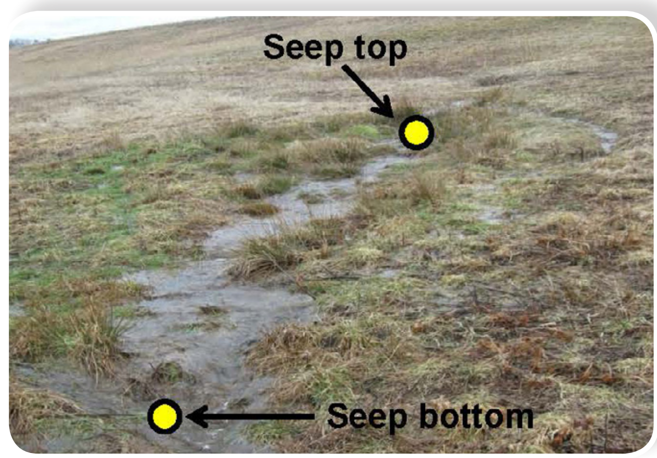
Effect of nitrogen management on seep and stream water quality

Riparian seepage zones are key hydrologic features in many Appalachian agricultural headwater watersheds. Seeps often supply most of the streamflow in these watersheds and connect nitrogen-rich groundwater systems to surface waters. Identifying factors that affect nitrogen losses from seeps to headwater streams is critical to developing sound management strategies for water quality protection. In a study in the May-June issue of the *Journal of Environmental Quality*, researchers from Penn State University and the USDA-ARS examined the impacts of land-applied nitrogen sources and in-seep nitrogen cycling on nitrate concentrations in seeps and streams of two small agricultural watersheds in central Pennsylvania.

The authors found that spatially variable nitrogen applications to cropped fields upslope of the riparian zone were linked with nitrate concentrations in seeps. Seeps in both watersheds were able to retain or remove some nitrate (up to 37%) along their surface flow paths. But the overwhelming influence of land management on nitrate concentrations in seeps was still detectable at their point of confluence with the stream.

Findings from this study point to nitrate leaching from upslope farm fields as the primary driver of nitrate losses from seeps to streams in agricultural headwater watersheds. Thus, appropriate management strategies, such as cover crops, limiting fall/winter nutrient applications, and decision-support tools, should be targeted to these areas to reduce stream water nitrate levels.

Adapted from Williams, M.R., A.R. Buda, H.A. Elliott, A.S. Collick, C. Dell, and P.J.A. Kleinman. 2015. Linking nitrogen management, seep chemistry, and stream water quality in two agricultural headwater watersheds. J. Environ. Qual. 44(3):910–920. View the full article online at http://dx.doi.org/doi:10.2134/jeq2014.10.0412.



Riparian seepage zone at an agricultural headwater watershed in Pennsylvania.