Science Societies

Complex Hydrology and Variability of Nitrogen Sources in a Karst Watershed

October 15, 2024

USGS hydrologist Hilary Dozier measures streamflow above a covered bridge along Fishing Creek in Pennsylvania. Photo by John Clune, USGS.

The highest stream baseflow nitrate concentrations are often associated with intensive agricultural land use and carbonate geology. Focused management efforts in agricultural carbonate settings with rapid transit times could be effective approaches for reducing nitrogen loads to streams. However, the complex hydrologic network in agricultural carbonate watersheds presents a challenge: Water and excess nitrogen in these landscapes, called karsts, can travel rapidly underground through a complex network of dissolved pathways in the carbonate rock before discharging to streams and springs.

To inform the management and monitoring efforts of nitrogen, researchers with the USGS used near-simultaneous measurements of water quality across multiple stream and spring locations in Pennsylvania's Fishing Creek watershed during seasonal high and low stream baseflow. They found that the main sources of nitrogen include manure, fertilizer, and wastewater with a low potential for denitrification. Depending on the season or location in the watershed, the nitrogen load shifted among losing and gaining stream sections.

Establishing monitoring at fixed locations without near-simultaneous sampling could be problematic when assessing management progress. The short travel time of water in karst areas has the potential to reduce nitrogen rapidly, but inputs, conservation effectiveness, and legacy nutrients confound progress.

Adapted from

Clune, J. W., Cravotta, C. A., Husic, A., Dozier, H. J., & Schimdt, K. E. (2024). Complex hydrology and variability of nitrogen sources in a karst watershed. *Journal of*

Environmental Quality, 53, 492–507. https://doi.org/10.1002/jeq2.20578

Environmental Quality, 53, 492–507. https://doi.org/10.1002/jeq2.20578

Text © . The authors. CC BY-NC-ND 4.0. Except where otherwise noted, images are subject to copyright. Any reuse without express permission from the copyright owner is prohibited.