Science Societies

Distinguishing Phosphorus Sources With Edge-of-Field Water Quality Data

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A tile drain outlet in Ohio where USDA-ARS scientists measure wa- ter quality. Photo by Jed Stinner, USDA-ARS.

Agricultural phosphorus (P) losses are a major cause of harmful algal blooms in many freshwater ecosystems, including Lake Erie. New applications of P fertilizer and old pools of soil P can both contribute. Quantifying their relative contributions is critical for designing more effective mitigation practices.

A research team modified an established modeling approach—weighted regressions on time, discharge, and season (WRTDS)—to analyze edge‐of‐field tile drain data from eight Ohio fields. After applying P fertilizer, dissolved reactive phosphorus (DRP) concentrations predicted by their novel model, weighted regressions on discharge and season (WRDS), was compared to edge‐of‐field observations. When observed concentrations exceeded predictions, the difference was attributed to the new source. Across 15 applications, new fertilizer sources contributed on average 37 g of DRP ha^{-1} to tile DRP losses. The team estimated that 0–17% of total tile DRP losses were due to new fertilizer P across the fields with 83–100% attributed to the old soil P source.

The studied fields had infrequent applications of fertilizer and no manure, so extending this analysis to additional fields is important to understand broader patterns. The WRDS approach can assess contributions of old and new nutrient loss sources where edge‐of‐field data are available.

Adapted from Osterholz, W., Shedekar, V., Simpson, Z., & King, K. (2023). Resolving new and old phosphorus source contributions to subsurface tile drainage with weighted regressions on discharge and season. *Journal of Environmental Quality*, *52*, 100–112. https://doi.org/10.1002/jeq2.20426
