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WATER RESOURCES

Abstraction alters nitrogen cycling

Despite policy mandates to improve water quality, such as the Clean Water Act, nitrogen pollution continues to degrade freshwater quality throughout the USA. Effective management is hampered by a lack of understanding of water supply processes and their impacts on nitrogen cycling. In particular, groundwater and surface water abstraction temporally store nitrogen in terrestrial systems, but the broader effect of abstraction on nitrogen fluxes is poorly constrained.

Elizabeth Flint, of the British Geological Survey and Lancaster University, and colleagues quantified nitrogen fluxes (as nitrate-N, NO_3–N) related to freshwater abstraction in the contiguous United States using publicly reported data. Annually, 417 kt NO_3–N was retained via abstraction, equivalent to 57% of annual riverine denitrification. In California, the abstraction flux was almost equal to riverine N export to the ocean. Irrigation and thermoelectric water uses were responsible for most (>70%) of this flux at the national level, but public water supply and self-service domestic water were particularly important contributors in the northeast. The source of the water impacted the flux — groundwater measurements in this study had higher nitrate concentrations than surface water, leading to proportionally outsized abstraction fluxes of NO_3–N. A portion of the abstracted nitrogen leaks back into the environment from water mains, especially in urban areas, or is moved between watersheds (such as in California), further perturbing local nitrogen cycling and contributing to groundwater and downstream nitrogen loads.

Credit: Getty/Fotosearch

These fluxes must be accounted for when quantifying nitrogen budgets relevant to water quality management. This need is especially acute in urban areas, where nitrogen leakage back into the environment is greatest.

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ORIGINAL ARTICLE Flint, E. M., Ascott, M. J., Gooddy, D. C., Stahl, M. O. & Surridge, B. W. J. Water supply processes are responsible for significant nitrogen fluxes across the United States. *Glob. Biogeochem. Cycles* **36**, e2022GB007340 (2022)