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ABSTRACT SUBMISSION

Title: Temporal Trends in Stream N Concentrations and Biogeochemical Responses to Disturbances in Long-Term Reference Watersheds

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Abstract

Across the country, long-term monitoring of small, headwater streams with minimal human impacts is done at a select number of sites. Reference watersheds in US Forest Service Experimental Forests and Ranges have long-term data and metadata on water quality and quantity for forested sites. Because these sites span a variety of climatic conditions, they are uniquely positioned for analyses of stream solute concentration responses to natural disturbances as well as changes in climate and atmospheric deposition across different biomes.
Here we synthesize stream nitrogen (N) data collected in 22 reference watersheds in 7 Experimental Forests over 12 to 43 years to examine a) trends in NO3-N and NH4-N concentrations over time, b) the spatial variability in stream N concentrations and in temporal trends, and c) the relationships between trends in stream N concentration and trends in atmospheric deposition or stream discharge. Additionally, we analyze data from a total of 33 disturbance events in 8 Experimental Forests to quantify both the magnitude and duration of stream N responses to disturbances including insect outbreaks, fires, and hurricanes.
We found high temporal and spatial variability in stream N concentrations and trends within some Experimental Forests, while other Experimental Forests showed high levels of synchrony between watersheds. The majority of the watersheds showed declining or no trends in stream N over the last 12 and 21 years. In general, these reference forested streams have low N concentrations, even though they occur across a broad range of atmospheric nutrient inputs. Our results suggest that proximity is not a reliable predictor of temporal trends and that local factors (i.e., aspect of the basin, vegetation, geology, etc.) may be more relevant than regional factors. Additionally, stream N concentration trends show shifts among time within some watersheds; these vary with both the length and timing of data collection. Because controls of N exports from headwater streams vary across spatial and temporal scales, our findings highlight the importance of multisite long-term stream chemistry studies with continuous data across a wide range of ecoregions and climatic drivers.

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