Differences in watershed-level event scale dynamics of stormwater nutrient concentrations with changes in urban forest of Saint Paul, Minnesota, USA

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Concerns surrounding urban water management continue to grow with increasing urbanization and extreme weather events due to climate change. Issues such as flooding, nutrient pollution, and declining water quality of recreational lakes cause concerns for public health and safety and protection of infrastructure. Trees are frequently considered to influence stormwater quantity and quality and have high urban stormwater management potential. Due to urban development and redesign, resident preferences, or the land use history of an area, tree canopy cover and diversity can vary across a city and therefore provide variation in the efficiency of stormwater management. Data and place-based studies focused on the specific, measurable effects of trees on urban watersheds will support more resilient urban planning and further define the benefits and trade-offs of including trees in urban watersheds.

Compared to natural systems, urban areas have a multitude of different contaminants and high variation in contaminant loads. The high density of impervious surfaces and diverse land uses in cities typically elevate contaminants in stormwater. Little is known about how changes in urban forests could affect event scale dynamics of nutrient concentrations in urban watersheds. Current studies are being done as part of long-term ecosystem research examining water and nutrient fluxes associated with urban trees. We aim to further elucidate the tradeoffs of trees in urban systems (eg. leaves filter atmospheric deposition, but can pollute waterways when they fall) through the collection of bi-directional data of water use and nutrient flows.

In this study, we examine if stormwater nutrient exports are sensitive to changes in urban tree canopy cover and the fraction of canopy comprised by street trees in selected watersheds in Saint Paul, MN. Through coupling remote sensing and tree inventory-based estimates of tree canopy cover with historical measurements of urban discharge quantity and quality, we evaluate the relationship between urban tree cover and stormwater quality between the years of 2007 - 2022.