Cary Institute of Ecosystem Studies

Senior Research Fellow
PhD, University of Georgia
groffmanp@caryinstitute.org

Peter Groffman, Microbial Ecologist

Research mission:

- Understand the role of microbial processes in ecosystem nutrient cycling, water and air quality, greenhouse gas fluxes, and soil carbon storage
- Assess ecological response to environmental change across forest, urban, agricultural, and wetland ecosystems

Summary:

Peter Groffman studies how microbial processes drive biogeochemical processes, especially those related to carbon and nitrogen dynamics, with a particular focus on nitrogen gas fluxes from soil to the atmosphere. His work encompasses rural and urban ecosystems, and is primarily centered at two Long Term Ecological Research sites located in Hubbard Brook, New Hampshire, and Baltimore, Maryland.

As a result of climate change, forests in the northeastern US are experiencing reduced winter snow cover. This change leaves the forest soil exposed to subfreezing temperatures for extended periods. Without a layer of insulating snow, important biological activity that usually continues throughout the winter stops. Freezing damages tender tree roots. Increased winter rain washes nitrogen and phosphorus — nutrients critical to tree growth — out of the soil, threatening forest productivity and water quality. Bare soils produce more nitrous oxide and consume less methane — both potent greenhouse gases. Understanding these processes will inform forest management as climate warms.

Urbanization is a global trend marked by increasing homogenization of the landscape; imagine the cookie cutter properties that characterize 'suburbia'. Understanding the drivers and effects of landscape homogenization will help predict the impacts of urban land use change and its effects on carbon storage, nitrogen pollution, and human wellbeing on multiple spatial scales.

Groffman is also a professor at the City University of New York Advanced Science Research Center at the Graduate Center and the Brooklyn College Department of Earth and Environmental Sciences.

Select publications:

Groffman PM, Suchy AK, Locke DH, et al. 2023. **Hydro-bio-geo-socio-chemical interactions and the sustainability of residential landscapes**. *PNAS Nexus*.

Mason RE, Craine JM, Lany NK … Groffman PM, et al. 2022. **Evidence, causes, and consequences of declining nitrogen availability in terrestrial ecosystems**. *Science*.

Groffman PM, Driscoll CT, Durán J, Campbell JL, et al. 2018. **Nitrogen oligotrophication in northern hardwood forests**. *Biogeochemistry*.

Groffman PM, Cadenasso ML, Cavender-Bares J, Childers DL, et al. 2017. **Moving towards a new urban systems science**. *Ecosystems*.

Groffman PM, Avolio M, Cavender-Bares J, Bettez ND, et al. 2017. **Ecological homogenization of residential macrosystems**. *Nature Ecology and Evolution*.

Groffman PM, Rustad LE, Templer PH, Campbell JL, et al. 2012. **Climate change effects are manifest in complex and surprising ways in the northern hardwood forest**. *BioScience*.

P.O. Box AB, 2801 Sharon Turnpike
Millbrook, New York 12545
845 677-5343
www.caryinstitute.org

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