Past and Prospective Effects of N Deposition on Carbon Cycling and Nutrient Retention in the Delaware River Basin

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Abstract

This research will analyze the effects of nitrogen deposition, cation depletion, climate change, and land use change in the Delaware River Basin (DRB) using a spatially explicit process model, PnET-CN, with high specificity for forested watersheds in the Northeast and mid-Atlantic regions. The model predicts the net primary productivity (NPP), carbon storage, water yield, nitrogen export, nitrogen retention in forested watersheds. We are using the model to investigate how changes in environmental variables, separately or interactively, affect carbon and nutrient processes, and the function and structure of forest ecosystems using scenarios of N deposition, elevated CO2, climate change and forest management within the Delaware River Basin. Preliminary results suggest that the chronic N increase in the past 70 years has increased forest productivity by 22%, forest biomass by 11% and soil organic matter by 22%. Increased N deposition is the major cause for enhanced C sequestration in the forested watershed of the DRB, with elevated CO2 secondary in importance for enhancing growth (12%). The historic increase of atmospheric CO2 resulted in the largest C gains in forest living biomass (18%). The combination of rising N deposition and CO2 has increased C in forest biomass by 38% and in soil organic matter by 28%. The current N leaching losses from the DRB forested watersheds is estimated at 1.7 Kg/ha/yr with N retention rate at 83%. The impact of ozone and calcium depletion due to acidic deposition will be added as enhancements to this modeling study for sensitive areas in the Basin.

Keywords: nitrogen deposition, forest productivity, nitrogen retention, water yield

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