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GRADUATE STUDENT CLIMATE ADAPTATION PARTNERS (GRADCAP) WEBINAR SERIES

AN APPALACHIAN BREAKDOWN: CARBON STORAGE IN A TEMPERATE DECIDUOUS FOREST RESPONDS TO OVER 28 YEARS OF NITROGEN ADDITIONS

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A study of long-term, experimental nitrogen additions in West Virginia, simulating acid rain, showed that high nitrogen levels can increase wood production and decrease respiratory losses of carbon from the soil, significantly enhancing the forest carbon sink.

Understanding how forests will respond to climate change and best forest management practices requires the understanding of how soil nitrogen availability influences forest soil and tree productivity. Forest productivity (and carbon accumulation) is often limited by soil nitrogen availability. Historically high levels of acid rain adding nitrogen to the soils of northeastern forests may have, in some forests, increased tree growth. Current predictions of increased forest productivity in response to climate changes (longer growing seasons and elevated atmospheric carbon dioxide levels) are contingent upon nitrogen availability and limitation in these forests.

We utilized a whole-watershed nitrogen addition experiment that began in 1989 in West Virginia to assess the long-term response of a temperate deciduous forest to nitrogen additions. Some key responses we observed were (1) an overall enhancement in aboveground biomass, (2) no change in aboveground inputs of leaf litter, (3) lower losses of carbon from forest floor decomposition, (4) a smaller stock of fine roots, and (5) an 11-16% decrease in the rate of carbon lost from the soil through respiration (see Figure 1). These results suggest that the forest soil has responded to nitrogen additions with fewer losses of carbon, suggesting greater carbon accumulation in the soil as well as aboveground woody biomass compared to a reference watershed that did not receive nitrogen additions. We are still unsure about how this enhanced soil carbon pool will respond to changes in climate. We hope to further investigate the resistance of this carbon to leaching losses or decomposition to improve predictions of the forest-atmosphere feedback of carbon exchange in a changing climate.

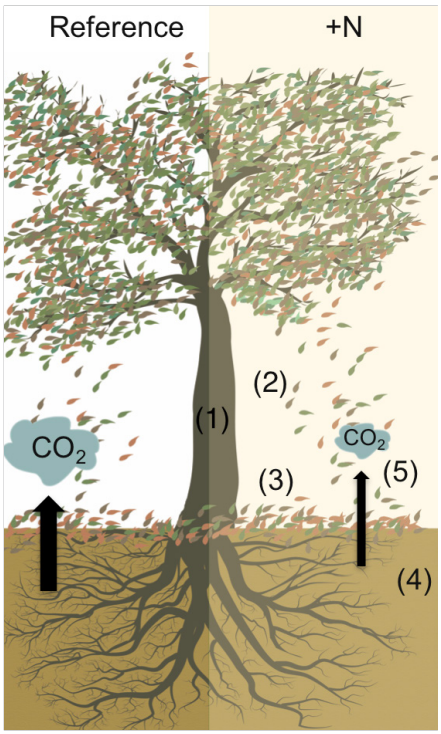

Figure 1. Summary of forest response to long-term nitrogen additions at the Fernow Experimental Forest. See text for details on results.

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