THE EFFECTS OF NITROGEN ADDITION ON THE BELOWGROUND CARBON CYCLE IN TEMPERATE FORESTS AND DESERT

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ABSTRACT

Human activities such as fossil fuel and fertilizer-use have doubled the amount of biologically active nitrogen entering ecosystems each year [*Vitousek et al.*, 1997]. N is the limiting nutrient in many ecosystems and N availability has been shown to affect plant, root, and soil respiration. For several temperate forests, experimental addition of N is associated with a decline in soil CO_2 efflux [*Bowden et al.*, 2004; *Burton et al.*, 2004; *Nohrstedt et al.*, 1989; *Swanston et al.*, 2004]. This decline could be due to either (1) decreased allocation of C to root metabolism and growth because N demand of plants can be met with less energy expended belowground, or (2) decomposition rate due to changes in leaf or root tissue chemistry, or to changes in the decomposer community. In contrast, the few studies of more water limited systems do not show decreased soil respiration fluxes [*Schaeffer et al.*, 2003; *Verburg et al.*, 2004], which could reflect hydrologic control of belowground C allocation. We will use radiocarbon measurements in soil organic matter and heterotrophically respired CO_2 to distinguish between these hypotheses. Atmospheric ^{14}C peaked in the 1960s due to atomic weapons testing and has subsequently been declining, thus the radiocarbon signature of organic material can be used to determine the year in which the C was fixed. Differences in ^{14}C of soil organic matter and heterotrophically respired CO_2, soil C contents, and respiration rates, sampled in treatment and control plots can be used to determine if the ecosystems are responding differently to N addition and if the source of respiration changes between treatments. We will report measurements made at two sites: (1) the Bear Brook watershed in eastern Maine, which consists of two 10ha plots, a control and another that receives 34 kg N/ha/yr with sections of hardwood and conifer stands in each plot, and (2) N amendment plots in creosote desert shrub in Joshua Tree National Park, California. We will report measurements at ten 10x10m plots, five receiving no N additions, and five receiving 30 kg N/ha/yr.

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