ABSTRACT

Title: Effects of soil warming on the carbon and nitrogen cycles and their interactions in temperate forests: implications for land-atmosphere feedbacks

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The objectives of the proposed research are to use our ongoing soil warming study to: 1) quantify how soil carbon and nitrogen dynamics in a temperate forest are changed in response to a sustained 5^{o}C soil temperature increase; 2) quantify how carbon accumulation rates in the trees are affected by this soil warming; 3) quantify how the capacity of a temperate forest ecosystem to store carbon is affected by alterations of the carbon and nitrogen cycles in response to warming.

Two of the major results of our original NIGEC-supported soil warming study were that warming stimulated the decay of a labile soil carbon pool, and that it also increased the availability of inorganic nitrogen to plants. The three questions to be answered in the proposed research are: Has the increase in available nitrogen led to an increase in carbon storage in the vegetation? If “yes, “how much and what is the temporal pattern? What is the balance between the carbon lost from the soil and the carbon stored in the vegetation in response to soil warming?

The research will be conducted at an extant large-area soil warming installation at the Harvard Forest in Petersham, Massachusetts.

In warmed and control plots we will make a series of plant and soil measurements that will quantify changes in C storage and give us insight into how those changes may be related to N cycling changes in the warmed plots. A number of these measurements will provide us with mechanistic insights to plant and soil responses to warming. Measurements will include: 1) annual woody increment; 2) litterfall; 3) fine-root stocks and dynamics 4) CO_2 and $^{14}CO_2$ efflux from the soil surface; and 5) net N mineralization and net nitrification rates. We have experience in using all of these methods.

This research is designed to increase our understanding of how global warming will affect the capacity of temperate forest ecosystems to store carbon. The work explores the how soil warming changes the interactions between the carbon and nitrogen cycles, and how these changes affect and-atmosphere feedbacks. The findings of the study will be published in high- profile, peer-review journals.