Poster #1-1

Nitrogen Fertilization Increases Carbon Use Efficiency of Soil Microbial Communities Across 10 Long-term N Fertilization Studies

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Soils store more carbon (C) than both the atmosphere and vegetation combined. Thus, any changes in the rate at which soil microbes release CO_2 into the atmosphere through respiration has critical implications for atmospheric CO_2 concentrations and ultimately Earth's climate. Historically, N deposition has altered the decomposition of soil C in temperate forests. While most studies show reduced decomposition of soil C under long-term N fertilization, the underlying mechanisms that drives this reduction remain unclear. We hypothesized that elevated soil N as the result of N fertilization may reduce the need for microbes to mine N from soil organic matter (SOM) resulting in a community shift that favors microbial scavengers over miners. As such, there is a greater return on extracellular enzyme investment, higher microbial carbon use efficiency (CUE) and enhanced production of microbial necromass. Given that microbial necromass is the precursor of stable SOM, these shifts in CUE and turnover may also contribute to greater soil C protection. To test this hypothesis, we measured microbial community CUE in fertilized and control plots across ten long-term N fertilization experiments spanning Eastern temperate forests. We incubated soils in the lab with ^{13}C labelled glucose and measured the fraction of this substrate released during respiration vs. what was incorporated into microbial DNA. We found that long term N fertilization increased micorbial CUE as respiration of ^{13}C glucose was lower in N fertilized soils along with greater incorporation of ^{13}C into DNA. Moreover, we found that N deposition enhanced microbial turnover. Collectively, our results suggest that shifts in CUE and turnover may be an important mechanism that explains reduced soil respiration across N fertilization studies as well as enhanced soil C stocks, owing to microbial necromass being the primary precursor of stable SOM.