Influence of microbial surface litter decomposer communities on CO_2 emissions from natural soils

Sanna Sevanto[*1], Rae DeVan[2], John Heneghan[1], Brent Newman[1], M. Francesca Cotrufo[3], Michaeline Albright[2], John Dunbar[2]

[1]Earth and Environmental Science Division, Los Alamos National Laboratory, Los Alamos, New Mexico

[2]Bioscience Division, Los Alamos National Laboratory, Los Alamos, New Mexico

[3]Department of Soil and Crop Science, Colorado State University, Fort Collins, Colorado

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Project Goals

1) Test the influence of surface litter decomposer communities that differ in dissolved organic carbon (DOC) production on carbon cycling, balance and emissions in natural soil.

2) Establish predictive links between carbon emissions, DOC production, and carbon transport to deeper soil layers during surface litter decomposition.

Abstract

Respiration flux resulting from litter decomposition is one of the major components counteracting reduction of atmospheric CO_2 content by plant carbon uptake in natural ecosystems. Respiration fluxes can range from 10 to 50% of the ecosystem-scale gross primary production, and turn ecosystems from carbon sinks to carbon sources when plant carbon uptake is hindered by natural disturbances such as drought or unusually warm winters at high latitudes where sunlight is too low for photosynthetic production. In the litter decomposition process, as soil microbes metabolize litter, some of the carbon is immediately released into the atmosphere as CO_2, while some stays in the soil in other forms including dissolved organic carbon (DOC). DOC that travels to deeper layers of the soil is a significant contributor to soil carbon stocks. The LANL Microbial Carbon Cycling SFA has previously identified microbial decomposer communities that differ in the amounts of CO_2 and DOC produced during early phases of plant litter decomposition in controlled microcosm systems. In this experiment, our goal was to test the impact of microbial composition on carbon flow in a more complex and realistic system. To do this, we inoculated natural, arid-soil cores containing ^{13}C-labelled blue

grama grass (*Bouteloua gracilis*) litter with microbial communities previously shown to produce either high or low DOC extremes. Our preliminary results show increased CO_2 flux from soil cores inoculated with the high DOC communities compared to those inoculated with low DOC communities or controls. From a carbon balance perspective this suggests that CO_2 and DOC production during litter decomposition are not always inversely correlated, but can also be additive. We expect that further data analysis will reveal if the additive effect was due to faster decomposition, and/or presence of specific microbial communities, and if DOC production was affected by the natural soil environment.

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