Poster #1-66

Theoretical and Empirical Support that Plant Roots Stimulate the Decomposition of Protected, But Not Unprotected, Soil Carbon

Jessica A. M. Moore[1], Benjamin N. Sulman[2], Melanie A. Mayes[3], and Aimée T. Classen[4]

[1]Department of Ecology & Evolutionary Biology, University of Tennessee, Knoxville, TN
[2]Program in Atmospheric and Oceanic Sciences, Princeton University, Princeton, NJ
[3]Environmental Sciences Division and Climate Change Science Institute, Oak Ridge National Laboratory, Oak Ridge, TN
[4]The Rubenstein School of Environment & Natural Resources, University of Vermont, Burlington, VT

Contact: Aimee.Classen@uvm.edu

BER Program: TES
Project: University Award

Roots release carbon (C) into soil where it is consumed by microbes and then released as CO_2 or stabilized in soil, thus altering soil C pools. We hypothesized that root inputs increase decomposition of soil C, and we expected decomposition of soil C that is protected from microbes to be more sensitive to root inputs than unprotected soil C. We quantified how root inputs affect soil C decomposition using a rhizosphere C model − Carbon, Organisms, Rhizosphere, and Protection in the Soil Environment model (CORPSE) − and a field experiment that manipulated root density. We empirically tracked decomposition of two isotopically labeled substrates that differed in their energetic demands for decomposition, leaf material and starch. Protected C decomposition in CORPSE increased with root inputs, and leaf material decomposition in the field study increased with root density. Unprotected C decomposition in CORPSE and starch decomposition in the field study were unchanged by root inputs. Microbial biomass and beta-glucosidase activity increased with root inputs. Root-microbe interactions affected pools of C differently via changes in microbial biomass and enzyme activity. Protected C decomposition was sensitive to root inputs while unprotected C decomposition was not. Environmental changes influencing root-microbe interactions could, therefore, alter soil C stocks and biogeochemical cycling.