Geophysical Research Abstracts
Vol. 17, EGU2015-15293, 2015
EGU General Assembly 2015

Drought regulates the C and N cycling in soil depending on plant community composition

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Drought consequences on carbon (C) and nutrients cycling have been well explored, but little is known about interactions in the rhizosphere under various plant community composition. We compared drought effects on microbial biomass carbon (MBC) and on enzyme activities in the rhizosphere of three plants grown individually or in mixture: two grasses (Lolium perenne and Festuca arundinacea) and one legume (Medicago sativa). The activities of extracellular enzymes involved in C cycle (xylanase, β-cellobiosidase and β-glucosidase) and nitrogen (N) cycle (chitinase and Leucine-aminopeptidase) were compared to MBC changes. The MBC was highly correlated with root biomass. MBC increased in response to drought in soil under the plant mixture, whereas it showed variable trends under monocultures. Drought and plant species composition were responsible for more than 90% of the variation of enzyme activities. Most enzyme activities decreased in unplanted soil in response to drought. The activity of the enzyme involved in the N cycle increased strongly under mixture and two out of three monocultures, indicating an increased N demand under drought conditions. The activities of enzymes involved in the C cycle in soil under mixture (1) generally were lower during drought compared to soil under monocultures and (2) were unchanged or tended to decrease, while they were more likely to increase under monocultures. This has an important ecological consequence: the decomposition of plant residues and soil organic matter will be slower under drought when plants are grown in mixture compared to monocultures.