ELS2014 –The Earth Living Skin: Soil, Life and Climate Changes
EGU – SSS Conference
Bari | Italy | 22 – 25 September 2014
ELS2014-65-1

Soil and plant community characteristics governing soil hydraulic properties in a grassland biodiversity experiment

Christine Fischer (1,2), Jana Tischer (1), Christiane Roscher (3), Nico Eisenhauer (4), Janneke Ravenek (5), Gerd Gleixner (2), Attinger Sabine (1,6), Britta Jensen (7), Hans de Kroon (5), Liesje Mommer (8), Stefan Scheu (7), Hildebrandt Anke (1,2)

(1) Institute of Geosciences, Friedrich Schiller University Jena, Institute for Geosciences, Burgweg 11, D-07749 Jena, Germany, (2) Max Planck Institute for Biogeochemistry, PO Box 100164, 07701 Jena, Germany, (3) UFZ, Helmholtz Centre for Environmental Research, Department of Community Ecology, Theodor-Lieser-Straße 4, 06120 Halle, Germany, (4) Institute of Ecology, Friedrich Schiller University Jena, Institute of Ecology, Dornburger Straße 159, 07743 Jena, Germany, (5) Experimental Plant Ecology, Institute for Water and Wetland Research, Radboud University Nijmegen, PO Box 9010, 6500 GL Nijmegen, The Netherlands, (6) UFZ, Helmholtz Centre of Environmental Research, Department of Computational Hydrosystems, Permoserstraße 15, 04318 Leipzig, Germany, (7) J.F. Blumenbach Institute of Zoology and Anthropology, Georg August University of Göttingen, Berliner Straße 28, 37073 Göttingen, Germany, (8) Nature Conservation and Plant Ecology Group, Wageningen University, Droevendaalsesteeg 3a, Wageningen, The Netherlands

Background and aims: Hydraulic properties such as infiltration capacity play an important role for soil erosion, run-off and water availability to plants and for the prediction and management of ecosystem processes. While a number of studies showed that vegetation influences soil hydraulic properties, limited knowledge exists of how plant species diversity might influence soil hydraulic properties.
Methods: We quantified the change in infiltration capacity affected by soil structural parameters (bulk density, porosity and soil organic carbon content) with plant communities of different species richness (1 to 60 species) and functional group composition (grasses, legumes, small herbs, tall herbs) in a grassland biodiversity experiment (Jena Experiment) covering a gradient in soil texture. We conducted two infiltration measurement campaigns (May and October 2012) using a hood infiltrometer.
Results: Although the spatial variation of the infiltration rate and the interactions among soil- and vegetation characteristics are very complex, our research shows that plant species richness systematically increased infiltration capacity of the topsoil in the studied grassland in both seasons. The presence/absence of particular plant functional groups did not affect the infiltration capacity. Path analysis suggests that bulk density (or inversely porosity) and soil organic carbon play an important role in mediating plant diversity effects on infiltration capacity. Plant species richness correlated positively with soil organic carbon content and porosity, while negatively with bulk density with subsequent effects on infiltration capacity. Texture did not correlate with the infiltration capacity at any time. In May earthworm biomass increased water infiltration, but this effect was not attributable to changes in soil structural parameters.
Conclusions: The present multivariate approach identifies important ecological drivers of soil hydraulic properties suggesting the significant of complex interactions between plant species richness, earthworms and soil structural parameters on saturated soil hydraulic properties, while showing little impact of soil texture.