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Thinking globally or acting locally? Belowground biotic responses to local- and broad- scale variations in mountain soils

Alexia Stokes¹ and the Co-authors*

¹(alexia.stokes@cirad.fr)

*A full list of authors appears at the end of the abstract

Soil is a hyper-heterogeneous environment, and how plants respond to changes in belowground variations in microclimate, soil properties and biota is extremely difficult to disentangle. Environmental gradients have been proposed as useful to help understand how root traits mediate plant responses to soil hyper-heterogeneity, and if in turn, there is a feedback mechanism that then impacts soil processes.

We present data from studies of forests and prairies situated along temperate elevational gradients. We measured functional traits from individual plant species and also in species mixtures at the community level. Distinct patterns in aboveground traits were found with increasing altitude. However, even though there were changes in soil biota, physical and chemical properties along gradients, we show that at the species level, several plant root traits were more sensitive to variations in local soil properties, compared to global variations along the elevation gradient. At the community level however, patterns of trait variation in individual species were often masked. Earthworm populations were also mostly driven by local soil properties, and elevation and plant species composition had only an indirect effect on population size. We also demonstrate that increased diversity in soil microbial communities was linked to the species composition of vegetation at a local level, rather than broad scale soil or climate characteristics.

Results will be discussed with regard to their impact on shaping soil processes such as carbon stockage, aggregation and hydraulic conductivity. Integrating these data into conceptual models of mountain ecosystem functioning is a challenging next step.

Co-authors: M. Weemstra, M. Bounous, G. Freschet, L. Jimenez, N. Cruz, F. Anthelme, L. Merino-Martin, B. Marin-Castro, D. Hernandez, H. Rey, I. Barois, A. Mohamed, Z. Mao, Q. Gabriac, C. Pimentel-Reyes, S. Fournier, M. Morales-Martinez, T. Decaens, K. Sieron, G. Angeles, C. Roumet,