Effects of tree roots on the composition and distribution of organic matter in forest soils

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Little is known about how trees and their roots may influence the spatial distribution and chemical composition of soil organic matter (SOM) in subsoils with subsequent effects on soil organic carbon (SOC) storage and turnover. Tree distribution may be a major determinant governing pattern and composition of OM in forest soils [1].

Two approaches allow to identify the soil compartment affected by roots. One approach is to investigate the distribution of species specific cutin and suberin biomarkers to provide proxies for shoot- and root-derived OC. The amount and distribution of suberin-derived lipids in soil clearly reflect the specific root system of different tree species [2]. Trees create patches in a forest where they significantly affect soil OC distribution and composition. This is associated with distinct microbial community composition as deduced from amino sugar biomarker analysis.

Another approach directly investigates the composition of the soil in the rhizosphere which is sampled separately from the bulk soil [3]. Here we find that trees cause significant vertical differences with POM dominated SOC pools in the upper soil layers, and SOC pools that are dominated by organo-mineral associations with the clay fraction in the deeper soil layers. Our results imply that these differences are strongly influenced by the roots of the trees. The SOC contents of the rhizosphere soil are more than three times as high as the SOC contents of the subsoil. The clay fractions in the vicinity of roots show higher SOC contents and higher proportions of O/N alkyl C with respect to non-rhizosphere soil, pointing to the rhizosphere as a hotspot for the formation of organo-mineral associations.

Our results demonstrate that tree roots significantly affect properties and OM distribution in forest soils. Their effect is specifically of importance in the subsoil.

[1] Spielvogel *et al*. (2016) *Geoderma* **267**, 112-122. [2] Spielvogel *et al*. (2014) *Plant and Soil* **381**, 95-110. [3] Angst *et al*. (2016) *Geoderma* **264**, 179-187.