Geophysical Research Abstracts
Vol. 18, EGU2016-2549, 2016
EGU General Assembly 2016


# SOM storage and pool distribution in forest soils along climatic and altitudinal gradients across Switzerland

Sia Gosheva (1,2), Mirjam Müller (1,3), Lorenz Walthert (1), Stephan Zimmermann (1), Pascal A. Niklaus (2), Beatriz R. González Domínguez (3), Samuel Abiven (3), and Frank Hagedorn (1)

(1) Forest Soils and Biogeochemistry, Swiss Federal Institute of Forest, Snow and Landscape Research (WSL), Birmensdorf, Switzerland (sia.gosheva@wsl.ch), (2) Institute of Evolutional Biology and Environmental Studies, University of Zurich, Zurich, Switzerland , (3) Soil Science and Biogeochemistry Unit, Department of Geography, University of Zurich, Zurich, Switzerland

Soil organic matter (SOM) plays a key role for a number of soil and ecosystem functions. Yet our quantitative understanding of the main driving factors is uncertain. SOM consists of a continuum of compounds ranging from slightly altered plant residues, known as particulate OM (POM) to mineral-associated OM (mOM). POM is the most rapidly cycling and hence vulnerable fraction of SOM. Therefore, it might respond particularly sensitive to climate change. In grassland soils, SOM content as well as the contribution of POM was found to increase with increasing elevation, which suggests that climate exerts a major control on SOM stability and storage. Little is known, however, for forest soils where a substantial fraction of POM is stored in the organic layer.

In our study based on 1000 soil profiles, we explore the controlling factors of SOM stocks and the distribution of POM in the organic layer as well as within mineral soils in forests across Switzerland. We hypothesize that (i) elevation and hence climate have rather negligible effects on carbon (C) stocks, but exert large effects on SOM quality (contribution of POM, SOM depth distribution, and C/N ratio); (ii) furthermore, we postulate to find an elevational effect on C stocks in the organic layer but not in the mineral soil. We examined SOM stocks in the organic layer and the mineral soil of 1000 soil profiles. Mineral soils (0-20cm) from a subset of 54 sites were separated into free light fraction and occluded light fraction, representing POM, while fine heavy fraction and coarse heavy fraction represented the mineral-associated OM. The sites, all located in Swiss forests, were distributed along a great elevational gradient ranging between 277 and 2207 m a.s.l., and spanning a gradient in mean annual temperatures (MAT) from 0.6 to 11.9 °C, and mean annual precipitation (MAP) from 704 to 2340 mm.

Our results indicate that POM and C/N ratio are more closely related to elevation and climate compared to mOM. For C stocks in the organic layer, we observed a positive relationship with elevation and a negative one with MAT. Linear regression analysis indicated SOC stocks in the organic layer to decrease by over 60% with an increase in MAT by 5°C. In the mineral soil, MAT and elevation had no effect; however, SOC stocks correlated positively with MAP. The elevational changes occurred on both calcareous and acidic bedrock. Similarly to the organic layer, we found an increase in POM-fractions with an increasing elevation and MAP but not for mOM. In particular, MAP seems important for the POM in the mineral soil, while MAT affects the organic layer. Consequently, a warmer and drier climate could lead to a deterioration of SOM, especially at high elevations. This could possibly cause a redistribution of carbon pools and C losses from forest soils.