Geophysical Research Abstracts
Vol. 20, EGU2018-6575, 2018
EGU General Assembly 2018

Organic matter in converted forest soils in Western Europe: disentangling the effects of edaphic factors and input differences on its composition

Olaf Brock (1), Annemieke Kooijman (1), Karen Vancampenhout (2), Klaas G.J. Nierop (3), Bart Muys (4), and Boris Jansen (1)

(1) IBED, University of Amsterdam, The Netherlands, (2) Cluster for Bioscience Engineering, KU Leuven, Belgium, (3) Earth Sciences - Organic Chemistry, Utrecht University, The Netherlands, (4) Earth and Environmental Sciences, KU Leuven, Belgium

Carbon sequestration in forest soils can play an important role in climate mitigation. For this to be effective not only the amount but also the molecular composition of the soil organic matter (SOM) is important. The last, because it influences decomposition processes, for instance by affecting the interaction between organic and inorganic soil particles. We studied how the SOM composition was affected by conversion of deciduous stands to mono-culture spruce plantations in the Mullerthal in Luxembourg and the Gaume in south-east Belgium. Both regions have a known and similar vegetation history on different lithologies, ranging from calcareous marls to decalcified sands. The different lithologies caused soils to be either in the Al-domain (low buffer capacity: 'poor' soils) or in the base-domain (high buffer capacity: 'rich' soils). Lignin and cutin/suberin biomarkers were identified applying thermally assisted hydrolysis and methylation (THM) using tetra methyl ammonium hydroxide (TMAH). Lignin was used to distinguish deciduous and coniferous litter sources, whereas cutin and suberin indicated the respective input of above- and belowground litter input. A Twinplot setup was used to be able to independently evaluate the effect of edaphic factors versus input differences on SOM composition.

We observed differences in molecular composition and also in decomposition state of lignin that were caused solely by input differences between adjacent deciduous and coniferous forest plots. However those tree type effects were much more pronounced on 'poorer' soils (low buffering capacity) or soils closer to a threshold than in soils that are comfortably in the middle of a soil process domain. This study showed for the first time that crossing of a threshold in soil buffering affects the carbon cycle that reaches down to the molecular composition of organic carbon. We conclude that the complex interplay of edaphic factors and tree species effects on the molecular composition and quantity of SOM shows the importance for a holistic approach on forest carbon cycle research that includes both biotic and abiotic factors.