Geophysical Research Abstracts
Vol. 20, EGU2018-9948, 2018
EGU General Assembly 2018

Changes in nutrient content and stoichiometry in soil and soil microbial biomass over a 52 year chronosequence from post-mining arable land

Jessica Clayton, Kathleen Lemanski, and Michael Bonkowski
Universität zu Köln, Institute of Zoology , Terrestrial Ecology, Germany (j.clayton@uni-koeln.de)

Restored agricultural lands from post brown-coal mines in West Germany provide a unique opportunity to study changes in soil properties over time due to continuous mining and simultaneous restoration. The Chronosequence soils studied here comprise of samples taken from agricultural fields (Field soils) with ages spanning 1-52 years after time of restoration. Samples were also taken from the undisturbed grass strips (Grass soils) which border each crop field, giving also the opportunity to investigate the effects of agricultural disturbance and plant coverage as well as soil age. In this investigation we measured the soil carbon (C), nitrogen (N), and phosphorus (P) content, soil stoichiometric ratios (C:N:P) and the respective proportions in the microbial biomass (Cmic:Nmic:Pmic).

It was found that nutrient content (C, N and P) and microbial biomass (Cmic, Nmic and Pmic) were the same in Field and Grass soils aged 1-10 years and all increased slightly with increasing age. However, after 10 years we saw a clear difference in the restoration trajectory between Field and Grass soils. In the Field soils, the nutrient content and microbial biomass ceased to further increase over time and remained constant up to 52 years. Whereas in Grass soils aged > 10 years, a significant increases in nutrient content and microbial biomass was observed compared to the Field soils of the same age. This result indicates that the restored arable land has the potential to accumulate higher microbial biomass and nutrient content, when given sufficient time, but is failing to achieve this due to the high level of disturbance and removal of plant biomass. In relative terms, we found a higher C:N ratio in Grass soils compared to Field, suggesting that Field soils also have proportionally less C than the Grass soils. There was no difference between microbial stoichiometric Cmic:Nmic ratios in Field and Grass soils aged 10-52 years, despite the difference in soil C:N ratio, implying that microbial stoichiometry is homeostatic.

Differences in nutrient limitation were also observed: Young Field soils had the lowest N limitation, even compared to the undisturbed and unmanaged Grass soils of the same age, suggesting that the restoration process with a legume plant cover in the first few years alleviates N limitation. This effect is however short lived, as older Field soils showed an increased N limitation. In contrast, C and N limitation in Grass soils were lower in the older soils compared to younger, suggesting that unlike the Field soils nutrient limitation in undisturbed soils decreases with increasing age after restoration.