Geophysical Research Abstracts
Vol. 16, EGU2014-12007, 2014
EGU General Assembly 2014

Dynamics of phosphorus fractions after land-use abandonment in relation to carbon, nitrogen, and microbial community composition

Marie Spohn
Germany (marie.spohn@uni-bayreuth.de)

Former agricultural land-use has strong legacy effects on biogeochemical cycles as well as on plant and microbial community composition in secondary ecosystems. Since many forests and grasslands have previously been cultivated it is important to understand long-term effects of former arable land use on these ecosystems. We studied the temporal dimension of the impact of former agricultural land use on soil total organic C (TOC), nitrogen (N), phosphorus (P) fractions, and microbial community structure in two chronosequences of abandoned vineyards, differing in exposition and slope. We found that more TOC accumulated in soils of south- than in southwest-exposed sites, which can be attributed to the drier microclimate that decreases organic matter decomposition. TOC concentrations were significantly positive correlated with total nitrogen (TN) concentrations ($R=0.99$, $p<0.05$), indicating a close relation between TOC and TN accumulation. We showed for the first time - according to our knowledge - a very slow depletion of P from the soil organic matter (SOM) after cessation of cultivation. This suggests that SOM is an effective intermediate storage of fertilizer-derived P, which slowly releases P. In contrast, labile P concentrations decreased quickly during the first 25 years of land use-abandonment. A linear relation between microbial C and TOC ($R=0.83$, $p<0.05$) was found, suggesting that soil microorganisms were predominantly substrate limited. The ratio of arbuscular mycorrhizal fungi (AMF)/bacteria increased strongly during the first decade after land-use abandonment, indicating a quick recovery of AMF most likely due to the fast colonization of the sites by herbaceous plants. Along with an increase in the abundance of trees the ratio of arbuscular mycorrhizal fungi (AMF)/bacteria decreased again. No changes were found in the total fungi/bacteria ratio during secondary succession. In conclusion, our results suggest that SOM is an effective intermediate storage of fertilizer-derived P, which slowly releases P, but still contains high amounts of P even more than 100 years after land-use abandonment. This has important implications for conservation management as it shows that organic P stocks have to be taken into account for estimating the development potentials of formerly cultivated sites for plant conservation.