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Can isotopic signatures reveal reactive nitrogen priming of soil organic matter decompostion ?

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The newest meta-data analyses and the model based hypotheses state that global soil C storage is controlled by microbial scale processes of fungal competition for available nitrogen (N). However, the details of these microbe-dependent feedback mechanisms on N and C dynamics in European soils are largely unknown and contentious. Given global trends of increasing atmospheric N deposition and the continuing use of inorganic N fertilizer, the function of soils as a carbon sink is potentially under threat. Therefore, further research is urgently required in order to be able to provide reliable information on soil microbial responses for predictive climate change models.

Changes in nutrient status could result in a chain reaction of interacting microbial mechanisms which in turn could lead to the shifts in underlying ecosystem biogeochemical process rates. Recent meta-analysis has shown that plant fungal symbiont community structure, exerts a greater fundamental control over soil C storage than temperature, precipitation or net primary production. Based on the hypothesis that plant associated fungi effectively scavenge all available organic and inorganic N leaving little N for the growth of the free-living decomposer microbial community and preventing further breakdown of SOM

To investigate these possible effects we have sampled natural grassland and forest soils across a trans European gradient (ALTER-net-MSII Network) which have received additional inputs of inorganic nitrogen for the last five years and studied the impacts of nitrogen on the concentrations and isotope ratios of bulk soil organic matter (SOM) in addition to particular organic matter (POM) fractions, as early indicators of SOM decomposition.

Initial results suggest that isotope ratios combined with C:N ratios of SOM can be useful to tease out some underlying mechanisms of organic matter breakdown for example the impact of carbonate/pH on SOM decomposition. But more detailed analyses of specific soil fractions such as POM are required to see any impacts over these short time scales. The results and conclusions from these analyses will be presented.