Project title

Imprints of priming effects on soil organic matter isotope signatures.

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1. Aim

The experimental setup of the Multi-site Experiment II: Variation of litter decomposition across a European Gradient provides an ideal opportunity to study the impact of excess dissolved nitrogen and carbon on the so called priming effect and to determine whether changes in isotopic signatures and SOM quantity and quality are detectable over relatively short time scales (< 5 years).

2. Research questions and Hypothesis

Predictions have suggested that warmer soils should stimulate decomposition and increase nutrient availability, which, in turn will stimulate plant production more than decomposition and increase ecosystem C storage (Hobbie et al., 2002, Shaver et al.,1992). Results from nitrogen fertilization experiments of arctic tundra, (Mack et al., 2004) show the opposite response to increased nutrient availability; although the soils were not limiting in organic N they were limited in available inorganic N. In Mack's experiments decomposition was stimulated more than plant production, leading to a net loss of C from the ecosystem suggesting that inorganic N availability is the possible driving force of organic matter decomposition. Fountain et., al (2011) also suggest that microbial degradation of recalcitrant SOM (priming effect) is modulated by the available soil solution nutrient status.

Using isotopic signatures of organic matter and possibly specific organic matter fractions, it should be possible to track the initial responses to the priming effects on organic matter breakdown.
Previous work has shown there is a strong correlation between C:N ratio of soil organic matter and $\delta^{13}C$ ($P<0.0001$) and total organic matter C ($P<0.0001$) Hood et al., (2002.) . We propose to investigate whether it is possible to detect early changes in organic matter quantity and quality due to priming effects using stable isotope signatures of bulk soil and possibly easily extractable OM fractions.

3. Spatial and temporal coverage

Forest and grassland habitats across Europe

4. Parameters used/needed

Parameter group (theme)	Selected parameter	Details about the parameter	Should be taken from existing data (yes/no)	Feasibility/constraints regarding existing data	Should be recorded in field (A5 work) (yes/no)	feasibility/ constraints regarding field sampling
1) Climate and physical variability	Annual mean air temperature	standard meteorological method; annual mean values of as much as possible years	yes	no problem here because the accuracy is not so important	no	
	Annual precipitation sum	standard meteorological method; annual values of as much as possible years	yes	no problem here because the accuracy is not so important	no	
2) Biogeochemistry data	Total organic nitrogen and total organic carbon and their respective isotopy, analysis will be conducted in Vienna.	Soil samples from the 0-10, 10-20 and 20-50 soil horizons from each treatment plot, coarsely sieved 0.5 cm, homogenized, sub sampled and oven dried at 60°C and dispatched to Vienna for isotope analysis.	If archived soil samples are available from T=0 prior to initial application of treatments it would be great to have just a gram or so of well homogenized soil sample. From the horizon depths described. However if only other depths are available please supply them we can always account for them.		yes	Samples should be collected from where the litter bags were not lying over directly. It would be best to have the longest lag between initial and second sampling to allow for buildup of isotope signals. I suggest that the sampling be done in end September/mid October 2012.
	Nitrogen input via fertilizers and/or lifestock and output via harvest and grazing	Only relevant for grassland; annual sum of total nitrogen from fertilizer or livestock		estimates from statistical data or livestock data	no	
3) Structure and function of the ecosystems, communities and populations	NPP	Above ground if possible g m^2			yes	It would be good to see for production decomposition balance.

	% legume cover in the grassland plots	Percent cover of N fixing plants made using visual assessment usually it would be % clover cover	Yes		yes	The change in % legume will have an impact on the 15N value so it would be good to have a rough estimate of the population change of these functional groups.
4) Human population and economy	land use	depending on land use type (forestry, grassland management) different categories, will be provided	yes	none	no	

5. METHODS USED

Trend identification

6. EXPECTED RESULTS

Differences in isotope signatures dependent on priming effects of treatment, with amplified effects from north to south.

7. REFERENCES

Hobbie, S. E., Nadelhoffer, K. J. & Hogberg, P. A synthesis: The role of nutrients as constraints on carbon balances in boreal and arctic regions. Plant Soil 242, 163–170 (2002).

Hood, R., Mayr, L. and McTiernan, K. 2002. Measuring isotopic signatures in water-soluble organic carbon. In: Nuclear Techniques in Integrated Plant Nutrient, Water and Soil Management. Proceedings of an International Symposium, 16 – 20 October 2000, Vienna, Austria. IAEA-C&S-11 and IAEA-C&S-11/C, pp. 384 – 389.

Mack M C Schuur, EAG, Bret-Harte, MS, Shaver,GR and Chapin,FS. 2004 "Ecosystem carbon storage in arctic tundra reduced by long-term nutrient fertilization," Nature, 431:440-3,

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