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Project: Partitioning of nitrous oxide production by stable isotope approaches

Brief overview:

Stable Isotopes

The GU working group has developed experimental and data analysis tools for investigating the soil nitrogen cycle by use of stable isotopes, with a specific focus on quantifying gross transformation rates and investigation nitrous oxide production pathways. The project will apply these tools to reveal the dominant nitrous oxide production pathways in agricultural soils and linking biogeochemical processes to microbial communities.

Partitioning of nitrous oxide production by stable isotope approaches

This project will apply the state of the art 15N-methodology, developed within the research group. Nitrous oxide is produced by several functional microbial groups in soil, using different substrates. The project will use 15N-labelling techniques to identify the sources of N_2O emissions from intact soils and to quantify the gross rates of underlying nitrogen red/ox transformations (nitrification and denitrification). The differentiation and quantification of these sources has the ultimate goal of improving the structure of biogeochemical models of N_2O emissions by providing revised conceptual backgrounds. The focus of the project lies on the partitioning of N_2O production into different pathways, investigations of nitrite dynamics, an often overlooked important part of the nitrogen cycle, and to investigate the competition for nitrate by dissimilatory processes. In addition, secondments to other groups within NORA will aim at linking biogeochemical cycles (gross transformations) with soil microbial community structures, in order to reveal the relationship between function and microbial community in soil. Part of the project will be conducted jointly with ESR6.

Two important dissimilatory processes reduce nitrate in soils: denitrification and dissimilatory nitrate reduction to ammonium (DNRA). DNRA is of great importance given that mineral N-compounds (nutrients) are retained in a less mobile form, while N-gas losses through denitrification are diminished. For 2014, we aim to investigate the competition of both processes for nitrate in agricultural soils by quantification of gross N-transformation rates using complex 15N tracing models, and microbial community fingerprinting. For the latter, we anticipate collaboration with the *Swedish University of Agricultural Sciences (SLU).* Our hypotheses are: 1) the importance of DNRA compared to denitrification increases in soils with high organic matter content (high C/N03- ratio), and 2) under more reducing (anoxic) conditions or variable redox conditions.

For 2015, we initially planned collaboration with the *University of Aberdeen* in order to investigate N mineralization and nitrification processes. Currently, we aim at an extension toward a community project including all partners working with soil processes (e.g. *UMB, UNIAbd, SLU, UGOT, INRA)* given that NORA involves different complementary aspects of the N-cycle. This project is suggested in order to thoroughly investigate the selective pressure of proximal soil factors on N-transformations and N_20 production. On beforehand, the hypotheses and methodology will be developed jointly (e.g. through web-discussions on the NORA intranet site).