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Project: Community ecology of microbial communities regulating soil N_2O emissions

The aim is to identify soil factors and ecological processes that drive activity and assembly of denitrifying and nitrous oxide (N_2O) reducing communities in arable soils. Increased knowledge of factors promoting soil N_2O reducing communities and their activity is essential to undertake proper actions for N management in agriculture and improve the terrestrial climate regulation service. Both long-term agricultural field sites and microcosm experiments will be used to address the aims. Controlled experiments are useful to determine the causal effects of i) environmental factors and ecological processes on assembly of N_2O reducing communities and ii) community assembly processes on N_2O reduction and net N_2O emissions. The ultimate goal is to find what promotes the N_2O reducing communities and their activity, and relate that to soil management. Moreover, if N_2O reduction is associated to specific community members, these are candidate indicators of N_2O sinks. Nitrogen fertilization is known to change the bacterial community structure in soil.

Specific tasks during the first year:

Project Ia and Ib: Directional changes caused by N-fertilization will impact net N20 emissions from agricultural soils and the relative increase in specific taxa will determine a soil's net source or sink capacity. This hypothesis will be tested in two complementary studies focusing on different time scales:

Ia) Effects of N-fertilization will be determined on the overall bacterial community as well as the denitrifying and nitrous oxide (N20) reducing communities using 15 long-term field trials in which fertilized (high N level) and non-fertilized soils will be compared. These experiments allow for pairwise comparison between treatments at each site as well as for seeking general trends across sites. Chemical as well as physical properties of the soil samples will be determined since the soils have different geological origin and history. These properties are considered in relation to treatment effects when comparing across sites. The bacterial community will be characterized taxonomically using barcoded 454 pyrosequencing/Illumina of 16S rRNA genes and the N 20 reducing communities will be based on the gene *nosZ* coding for the N20 reductase in a phyloecological framework.

1b) In a common-garden microcosm experiment, soils from the long-term sites will be incubated with ammonium nitrate during one year and effects will be determined at different time points. This project will be initiated during year 1 and continue in year 2.

Projects year 2-4:

Causal effects of soil properties and ecological process that drive assembly of N20 reducing communities as well as communities performing DNRA (dissimilatory nitrate reduction to ammonium), and how community assembly processes affect N20 reduction and net N20 emissions will be tested in controlled microcosm experiments. Main parameters to test are C/N ratios and types of C. This project involves collaboration with University of Gothenburg and Yara International and includes secondments to Gothenburg and Hanninghof. Collaboration and exchange with INRA, Dijon is also planned at a later stage in the project and the specifics as well as the time point for secondment will be defined later.