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Luiz Domeignoz Horta, Aymé Spor, David Bru, Marie-Christine Breuil, Florian Bizouard, Laurent L. Philippot

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Assessing soil biodiversity and role in ecosystem services



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Book of Abstracts

# PROGRAM AND ABSTRACTS

## THE FIRST GLOBAL **SOIL BIODIVERSITY** **CONFERENCE**



GLOBAL  
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INITIATIVE

December 2-5, 2014

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[P1.250]

## Role of microbial diversity in mitigating the emissions of the greenhouse gas n2o in relation to agricultural practices

L. Domeignoz-Horta\*, A. Spor, D. Bru, M-C. Breuil, F. Bizouard, L. Philippot  
INRA, France

Agriculture is the main source of terrestrial N<sub>2</sub>O emissions. This gas is the main depleting substance of the ozone layer and contributes to about 6% of total global warming. The unique known biological process able to convert N<sub>2</sub>O is its reduction to N<sub>2</sub> by organisms possessing the *nosZ* gene, which encodes the nitrous oxide reductase. A recent publication (Jones *et al.*, Nature Climate Change, in press) showed that the abundance and the diversity of a recently discovered clade of *nosZ*-carrying microorganisms are important players of soil N<sub>2</sub>O sink capacities. Therefore, enhancing the comprehension of the role of the abundance and the diversity of microbial populations in N<sub>2</sub>O emissions and looking for agricultural practices that could favour microbial populations able to reduce N<sub>2</sub>O into N<sub>2</sub> is key in determining N<sub>2</sub>O emissions mitigation strategies.

In this study, two experimental sites comprising nine management strategies that differ in crop rotation, tillage depth, fertilization, straw incorporation and cover crop were chosen. To characterize the activity of soil microbial communities, potential denitrification rates and N<sub>2</sub>O/N<sub>2</sub>O+N<sub>2</sub> emission ratios were measured. The abundance of the different microbial guilds involved in N-cycling was quantified by real-time PCR, and the diversity of the *nosZ* gene was determined by 454 pyrosequencing.

Our results suggest that the agricultural practices we tested were not sufficient to modify deeply the abundance and the diversity of denitrifying microbial communities related to the N<sub>2</sub>O emissions. However, the diversity and the abundance of these guilds were strongly dependent on the experimental site and responded to soil physico-chemical parameters (e.g.: pH, loam). We also confirmed the link between the diversity of *nosZ* microorganisms and the soil N<sub>2</sub>O sink capacity (Fig.1), which emphasize the importance of microbial diversity for ecosystem functioning.

### Explaining NosZII community structure in relation to N2O emissions

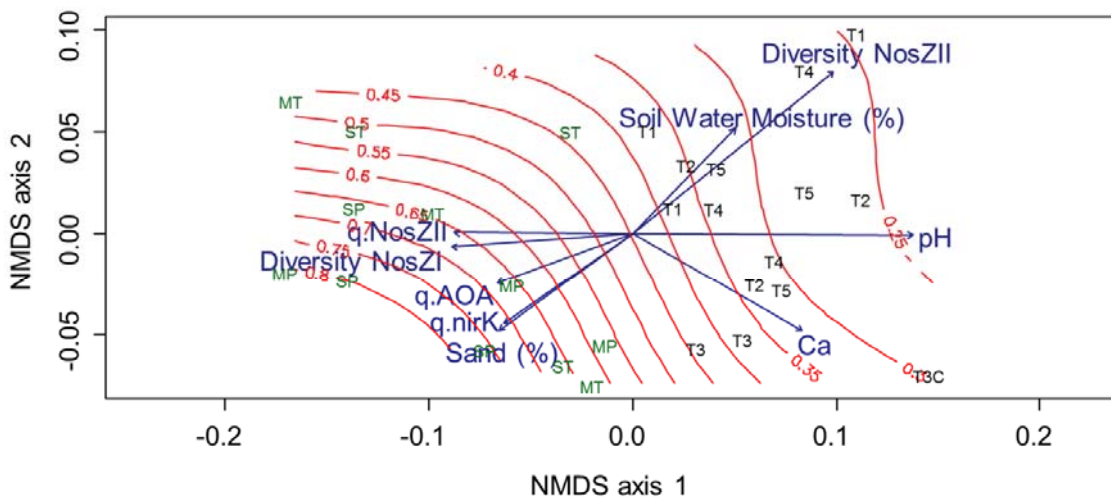


Fig1. NMDS ordination of weighted unfrac distance matrix (stress: 0.1094) at two sites (green and black). Red curves represent N<sub>2</sub>O emissions ratio gradient (higher ratio indicates higher N<sub>2</sub>O emissions). Significant explanatory variables represented as vectors in blue (p<0,1): diversity of NosZII (simpson diversity index for NosZII), diversity of NosZI (simpson diversity index for NosZI), Ca (calcium g/kg of soil), q.AOA, q.nirK and q.NosZII represent the quantification of ammonia oxidizing archaea, nitrite reductase bacteria nirK, and nitrous oxide reductase NosZII respectively by nbc/g soil. Sand and soil water moisture are expressed in percentage.

Keywords: N<sub>2</sub>O emissions, Denitrification, Agroecology, Functional Diversity