Wednesday, August 4, 2010 - 3:25 PM

SYMP 13-6: Responses of soil nitrite-oxidizers to global environmental changes

Audrey Niboyet[1], Eléonore Attard[1], Laure Barthes[2], Christopher B. Field[3], Nadine Guillaumaud[1], Bruce A. Hungate[4], Paul W. Leadley[2], Catherine Lerondelle[1], Thomas Pommier[1], Maria Tourna[1], Akihiko Terada[5], Franck Poly[1], and Xavier Le Roux[1]. (1) Université de Lyon, (2) Université Paris-Sud 11, (3) Carnegie Institution for Science, (4) Northern Arizona University, (5) Technical University of Denmark

Background/Question/Methods

There is increasing evidence that global change can alter the structure of plant communities with large impacts on the functioning of terrestrial ecosystems. However, little is known about the impact of global change on soil microbial communities. In particular, the response of soil nitrite-oxidizers microorganisms that mediate the second step of nitrification, a key process of the nitrogen cycle, has never been investigated.

Here, we examined the effects of four main global environmental changes on the activity, the abundance and the diversity of soil nitrite-oxidizers in an annual grassland ecosystem as part of the Jasper Ridge Global Change Experiment (CA, USA). This experiment includes four treatments - CO_2, temperature, precipitation and nitrogen - with two levels per treatment (ambient and elevated, with elevated treatment based on prediction for the end of the century), and all of their factorial combinations. We measured potential nitrite oxidation, the abundance of soil *Nitrobacter*- and *Nitrospira*-like nitrite-oxidizers (using quantitative PCR targeting *nxrA* and 16S rRNA gene, respectively) and the diversity of soil *Nitrobacter*-like nitrite-oxidizers (using cloning-sequencing targeting the *nxrA* gene) in each treatment combination at the end of the 7^{th} and 8^{th} growing seasons under treatments. Furthermore, we analyzed to what extent changes in the activity of the soil nitrite-oxidizers result from changes in their abundance or diversity.

Results/Conclusions

Simulated global environmental changes significantly altered the activity, as well as the abundance and the diversity of soil nitrite-oxidizers. Potential nitrite oxidation decreased with increased precipitation and increased with elevated CO_2 when combined with added nitrogen or precipitation. The abundance of soil *Nitrobacter*-like nitrite-oxidizers also decreased with increased precipitation and increased with elevated levels of CO_2 and nitrogen. In contrast, the abundance of soil *Nitrospira*-like nitrite-oxidizers increased with enhanced precipitation and decreased with elevated levels of CO_2 and temperature. Finally, the structure of the soil *Nitrobacter*-like nitrite-oxidizers was significantly altered by the treatments. Consistent with results reported by Attard *et al.* (2010) for agroecosystems, we found that changes in potential rates of nitrite oxidation in response to treatments were partly explained by changes in the abundance of soil

Nitrobacter-like nitrite-oxidizers, but not by changes in the abundance of soil *Nitrospira*-like nitrite-oxidizers, suggesting that *Nitrobacter*-like nitrite-oxidizers were the main functional players of the soil nitrite-oxidizing microbial community.

Our study provides evidence that global change could alter the abundance and diversity of soil nitrite-oxidizers, with potential impacts for soil nitrogen cycling.