Do plant species and climate warming influence nitrification and ammonia oxidiser community structure?

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Ecosystem diversity comprises plant, animal and microbial diversity. Whereas much research focuses on plant and animal diversity, research on microbial diversity has so far been limited. However, within the soils, microorganisms are responsible for key functions such as organic matter decomposition and mineralisation, in particular within the C and N cycles. Ammonia oxidising bacteria (AOB) are responsible for the first, rate-limiting step of the nitrification process. In this study, we investigate the impacts of plant species and climate warming on the diversity of AOBs in the rhizosphere and bulk soil and the relation between community structure of AOBs and nitrate production.

Rhizosphere and bulk soil was sampled from monocultures of grassland species belonging to three functional groups (three grass species, three nitrogen (N) fixers and three non-N-fixing dicots) grown for one year in sunlit, climate-controlled (ambient / ambient+3°C) chambers. The functioning of the nitrifying bacteria was assessed through potential nitrification assays. AOB community structure was analysed through DGGE after PCR of 16 SrDNA.

Distinct grouping of AOB clusters was observed among functional groups of plant species at 2-6 cm depth. AOB clusters (Cl.) I, II and III were found under all species and in non-planted soil, whereas Cl. VI and VII appeared additionally under non-N-fixing dicots and Cl. VII under N fixers. There were no rhizosphere and temperature effects. Potential nitrification was higher in planted soil compared to bulk soil. In the lower soil horizon (10-14 cm) we measured distinct rhizosphere effects, depending on the temperature treatment. These impacts were marked on Cl. I-IV-VI-VII.

In conclusion, this study indicated a relationship between plant species and AOB community structure. However, no clear link between AOB diversity and potential nitrification could be established.