Farming system modulates the effect of drought on ammonia-oxidizing communities

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Severe droughts are predicted to occur across Europe due to climate change. Such drought events can substantially impact terrestrial nitrogen (N) cycling as well as the corresponding microbial communities. Here, we investigated how ammonia-oxidizing bacteria (AOB), archaea (AOA), and comammox respond to simulated drought under a rain-out shelter experiment in the DOK long-term field trial comparing different organic and conventional agricultural practices. This study is part of the MICROSERVICES (BiodivERsA) project to understand and predict the effect of climate change on crop-associated microbiomes and their ecosystem functions. For this purpose, we monitored the diversity, the composition, and the abundance of ammonia-oxidizers during five months by Illumina-based amplicon sequencing and quantitative real-time PCR using the *amoA* gene as molecular marker.

We found that the effect of drought varied depending on the ammonia-oxidizing community but also on the agricultural practices. The community structure of AOA and comammox were more strongly affected by drought than that of AOB. Drought also had a stronger impact on the community structure in the biodynamic (organic) farming system than in both the mixed and mineral fertilized conventional systems. The abundance of ammonia oxidizers was also influenced by drought with comammox clade B exhibiting the strongest sensitivity to drought. We found a significant interaction between drought and agricultural practices on the abundance of all groups of ammonia-oxidizers except AOB. Overall, our study showed that the impact of drought on ammonia oxidizers was modulated by agricultural practices and varied with time as well as among members of ammonia-oxidizers. These results highlight the importance of agricultural management practices for the response of the ammonia-oxidizing community to drought.