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 changes and can substantially impact terrestrial nitrogen (N) cycling. The extreme arid conditions may induce shifts in the ammonia-oxidizing community's structure and affect the status of soil inorganic N pools. Due to its functional potential, understanding how drought affects the nitrification process and the resilience degree of the involved nitrifiers is fundamental. Here, we investigated how ammonia-oxidizing bacteria (AOB), archaea (AOA), and comammox respond to simulated drought under a rain-out shelter experiment in a long-term DOK field trial comparing organic and conventional agricultural practices. This study is part of the MICROSERVICES (BiodivERsA) project to predict the effect of climate change on ecosystem functions in the European wheat cropping system. We assessed the structure and size of ammonia-oxidizers by analyzing their *amoA* gene sequence data and quantifying the abundances of the *amoA* gene via quantitative real-time PCR.

We found that drought triggered responses in the structure and size of ammonia-oxidizing communities. The structure of AOA and comammox communities were the most affected by drought, and importantly, the drought effect strength was distinct across farming systems. The drought effects on the community structure were more pronounced in the biodynamic (organic) farming system than in the other two conventional systems. The *amoA* gene abundances revealed that the community size was also influenced by drought with different magnitudes among groups, where comammox Clade B has greater sensitivity to drought. We also found that drought linked to agricultural management practices showed by significant interaction effects of drought and farming system on the community size of all groups of ammonia-oxidizers, except in AOB community. The overall data suggest the effect of drought was modulated by farming system and the modulation were varied among ammonia-oxidizer members on the structure and size of the community. Our findings highlight the potential importance of fertilization regime and agricultural management practices on the ammonia-oxidizing community in response to drought.