75. Diversity of ammonia-oxidizing archaea in soils under managed and native conditions

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The impact of an expanded bioenergy industry on soil and atmospheric chemistry remain unknown. Reduced nitrogen (R-Nr) application is required for enhanced plant growth. Nitrifying microorganisms in soil convert R-Nr to more mobile and biologically less favorable oxidized forms, reducing crop yields and increasing production of detrimental fugitive gases. Ammonia oxidizing Archaea (AOA) are often observed in high abundances in soils, and are implicated as the dominant assemblage responsible for the first step of nitrification, ammonia oxidation to nitrite. However, little information regarding their role in nitrification in soils of biofuels cultivars is available. To that end, the goal of this project was to assess whether differing soil types and nitrogen delivery strategies: 1) impacted the abundance, distribution, and diversity of nitrifying assemblages, 2) altered the release of different fugitive gases 3) altered broader components of microbial diversity and metabolic activities associated with the nitrogen cycle.

Ammonia oxidizing archaea (AOA) contribute to a significant portion of ammonia oxidation in soil. These organisms compete with plants for available N, having significant impacts on plant proliferation, as well as production of fugitive gases. AOA community distribution patterns are influenced by multiple factors, of which, biogeography has emerged as an important variable. Developing an understanding of community differences in AOA amid differing land management types may provide tools to understand differences in N use efficiency and other, broader impacts of AOA on soil and atmospheric biogeochemistry.

The goal of this study was to assess whether agriculturally managed soils displayed shifts in AOA community diversity in contrast to non---managed soils located in close proximity. Soil was collected from two sites in eastern Washington where AOA community diversity patterns have previously been examined in soils influenced by long---term management practices. At both sites soil was collected from the surface horizon (0---15 cm) of the adjacent native shrub---steppe (dominated by bunchgrass) and from switchgrass cultivated fields. AOA communities were evaluated by terminal restriction fragment length polymorphism (TRFLP) targeting subunit A of the *Archaeal* ammonia monooxygenase and analyzed using multivariate statistical approaches. At both the slightly alkalkine and slightly acidic agricultural stations, significant differences in AOA community diversity were observed based on the contribution of differing terminal restriction fragments (TRFs) to managed and native soils based on analysis of similarity (ANOSIM, R value greater than 0.6 $p<0.05$). In contrast, native soils displayed higher similarity to one---another, despite significant spatial separation, than either agriculturally influenced site. In native soils located adjacent to a slightly acidic switchgrass cultivated site, TRFs affiliated with members of the genus *Nitrososphaera* were highly detected that were of significantly lower abundance in cultivated sites. In contrast, TRFs attributed to *Nitrosotalea* were dominant in the switchgrass cultivated site, but were substantially lower in the cultivated site. In addition, a higher number of TRFs were observed in the non---managed areas, indicative of a more diverse AOA community. At the slightly alkaline site, similar differences between native and cultivated AOA communities were also observed. However, the most abundant TRFs in the native soils were non---detectable in the cultivated areas, suggesting a complete replacement of native ecotypes. Preliminary TRF identification suggests different phylogentically distinct members of the genus *Nitrosophaera* are responsible for the observed shifts between native and cultivated soils. Taken together, our results suggest that agricultural land---management significantly alters AOA community diversity patterns. These results will be used to assess whether these soils are also attributed with differing rates of nitrogen usage and production of fugitive gases, parameters that would be useful for modeling the impacts of switchgrass cultivation on nitrogen cycling soil ecosystems.