Geophysical Research Abstracts
Vol. 19, EGU2017-12201, 2017
EGU General Assembly 2017


# The resistance of the active microbiome as a fundamental compartment of soil quality in the face of climate change

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Arid and semiarid ecosystems will be severely affected by drought derived from climate change. Forest management can promote the adaptations of plant and microbial communities to drought. For instance, thinning reduces competition for resources through a decrease in tree density and the promotion of plant survival. The resistance of soil microbial communities must be strongly related to the soil quality. However, in order to evaluate these properties, the active (and not only the total) microbial community should be carefully assessed.
Here, we studied the functional and phylogenetic responses of the microbial community to six years of drought induced by rainfall exclusion and how thinning shapes its resistance to drought, in a semiarid ecosystem dominated by Pinus halepensis Mill. A multiOMIC approach was applied to reveal novel strategies against drought. The diversity and the composition of the total and active soil microbial communities were evaluated by 16S rRNA gene (bacteria) and ITS (fungal) sequencing, and by metaproteomics. The microbial biomass was analyzed by phospholipid fatty acids (PLFAs), and the microbially-mediated ecosystem multifunctionality was studied by the evaluation of enzyme activities related to C, N, and P dynamics. The microbial biomass and ecosystem multifunctionality decreased in plots subjected to drought, but this decrease was greater in unthinned plots. The diversity of the total bacterial and fungal communities were resistant to drought but were shaped by seasonal dynamics. However, the active community was more sensitive to drought and related to multifunctionality. Thinning in plots without drought increased the active diversity while the total diversity was not affected. Thinning promoted the resistance of multifunctionality to drought by changes in the active microbiome. Protein-based phylogeny was a better predictor of the impacts of drought and the adaptations of microbial communities. We highlight that the resistance of the microbial community and the active microbial community are ecological concepts strongly related to the concept of soil quality in the face of climate change.