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Ex situ irrigation of Atacama soil stimulates bacterial respiration but does not induce changes in the microbial community

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The Atacama Desert constitutes one of the most extreme habitats on Earth, due to extremely low water availability. Yet, surprisingly diverse microbial communities have been reported even in hyperarid soils. The present microorganisms are thought to remain in a dormant state under the water-depleted conditions, but that they are able to re-activate should water become available. To evaluate the impact of water availability on microbial activity and community composition, we conducted an ex situ irrigation experiment with soils collected from an aridity gradient in the North of the Atacama Desert.
Soil samples were incubated for two weeks under different water regimes and bacterial respiration was measured via oxygen respiration. Water addition did indeed induce bacterial activity, with differences between water regimes and in dependence on soil sample depth and aridity at the sampling site, although hyperarid sites showed only slight to no activity. Including glucose as a substrate resulted in measurable acitivity even at the hyperarid sites, showing that the collected soils were not only water-, but also carbon-limited.
We subsequently performed bacterial community analysis based on 16S rRNA gene sequencing for the least arid and consequently most active site. Despite measurable activity over two weeks, soil wetting did not result in detectable changes of the bacterial community. In contrast, the bacterial community between sample depths differed in composition.
Our data indicate that soil wetting triggers bacterial activity in the semi-arid soils we collected, but that these soils are also nutrient-depleted. Thus, a rainfall event alone would not induce high bacterial activity or even growth in Atacama soils of the chosen region, without significant nutrient introduction at the same time.