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Microbial communities and SOM dynamics along a precipitation gradient

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Many microbial communities are not resistant to changes in their environment, and the subsequently new and structurally distinct communities are not always functionally redundant with their predecessors. As a result, environmental change can lead to long-term changes in microbially-mediated ecosystem processes. More specifically, changes in soil moisture regimes can alter microbial physiology and resource demands, and therefore alter how microbes process soil organic matter (SOM). To better understand how current and future precipitation regimes can influence microbial communities and SOM transformations, we assessed microbial community structure and activity in soils reciprocally transplanted across four sites within a grassland precipitation gradient of 485 to 1003 mm y-1.

We show that the soil microbial communities residing at these sites are compositionally distinct from each other, and C mineralization rates and microbial biomass C are highly correlated with contemporary site soil moisture. After sols had been subjected to altered precipitation regimes for1.5 and 2.5 years, microbial community structure shifted. Copiotrophs were more abundant relative to oligotrophs in soils experiencing the largest shifts from their native precipitation regimes, and oligotrophs were more dominant in the soils under the most severe soil moisture stress. In general, microbial community structure, in soils from the driest site, was more resistant to change when subjected to novel precipitation regimes. SOM processing rates were distinct in all transplanted soils from their native controls. These changes were dependent on a significant interaction between the initial microbial community structure and the degree of change in precipitation regime, suggesting the importance of initial microbial community structure as a determinant of future structural trajectories, which can drive SOM transformations. Soils transplanted to drier sites with more variable precipitation exhibited lower mass specific respiration and lower rates of SOM break-down and C mineralization. Our data suggest that although soil C mineralization is strongly coupled with the current soil moisture regime, the form of these relationships is dictated by antecedent community structure and relatively recent moisture regimes.