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Fungal diversity controls the temperature sensitivity of soil organic matter decomposition under drought stress

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Soil respiration, the production, transport and efflux of CO2 in soils, is typically the main source of CO2 in terrestrial ecosystems. Microbial-mediated decomposition of soil organic matter (SOM) ultimately makes a considerable contribution to soil respiration and it is strongly sensitive to climate. Despite the central role of microbes in decomposition of SOM, few studies have been conducted on how microbial community ecology may affect this large CO2 flux. This lack of research rests on the belief that the high degree of functional redundancy in soils compensates for any given change in microbial community composition. Here we show that fungal community was more resilient to 10 years of severe drought than bacterial community and that fungal diversity was the best predictor of the sensitivity of SOM decomposition to temperature (Q10). The results highlight the important role of fungi in decomposition of terrestrial SOM, especially under the harsh environmental conditions of Mediterranean ecosystems, where models predict even drier future conditions. Our results also hold up the hypotheses that diversified communities may make a better use of available resources. Fungal biomass and diversity need therefore to be extensively and intensively explored in order to understand soil CO2 emissions from the different types of ecosystems, especially in the frame of current human-driven alteration of the carbon cycle and the resulting climate change.