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Habitat constraints on the functional significance of soil microbial communities

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An underlying assumption of most ecosystem models is that soil microbial communities are functionally equivalent; in other words, that microbial activity under given set of conditions is not dependent on the composition or diversity of the communities. Although a number of studies have suggested that this assumption is incorrect, ecosystem models can adequately describe ecosystem processes, such as soil C dynamics, without an explicit description of microbial functioning. Here, we provide a mechanistic basis for reconciling this apparent discrepancy. In a reciprocal transplant experiment, we show that microbial communities are not always functionally equivalent. The data suggest that when the supply of substrate is restricted, then the functioning of different microbial communities cannot be distinguished, but when the supply is less restricted, the intrinsic functional differences among communities can be expressed. When the supply of C is restricted then C dynamics are related to the properties of the physical and chemical environment of the soil. We conclude that soil C dynamics may depend on microbial community structure or diversity in environments such as the rhizosphere or the litter layer, but are less likely to do so in oligotrophic environments such as the mineral layers of soil.