Climate regulates the geographical distribution pattern of soil microorganisms in lakeshore wetlands by influencing edaphic properties and plant diversity

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Abstract

Soil microbes are key players in wetland ecosystems. The biogeography of bacterial and fungal communities and their underlying mechanisms for generating and maintaining lakeshore wetlands are important in microbial ecology but remain unclear. Here we investigated the biogeographical patterns and the factors shaping bacterial and fungal communities in lakeshore wetland soils at a regional scale in northern China. Our results revealed that the diversity of soil bacterial and fungal communities in lakeshore wetlands had significant geographical distribution patterns in both longitude and latitude gradients; and notably the geographical distribution pattern of α-diversity is mainly manifested in species richness. Climate, edaphic properties, and plant diversity together determined the geographical distribution patterns of bacterial and fungal community diversity, contributing 66.05% and 49.66% of the diversity variation, respectively. As droughts intensify, the assembly of bacterial communities is gradually dominated by deterministic processes dominated of habitat filtration, while fungal communities are dominated by random processes of species dispersal. Structural equation modelling revealed that the differences in temperature and precipitation originating from geographical distances directly modulated the geographical distribution of fungal community diversity, while bacteria were indirectly regulated by influences of local soils and plants. Our findings highlight that different sensitivity of soil bacteria and fungi to climate change and different responses to soil communities in lakeshore wetlands may have profound implications for the stability and functioning of wetland ecosystems.

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