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Microbial evidences of abrupt shifts in dunes ecosystems after passing an aridity threshold

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Dune ecosystems are among the most vulnerable regions to climate change worldwide. However, studies on how crossing critical aridity thresholds influence the microbiome of these ecosystems remains scarce. These microbes play a pivotal role in shaping terrestrial ecosystem traits and functions.

In this study, we collected 1.4-meter sediment cores at 5 cm intervals from deserts in Xinjiang, China, in two study sites before and after crossing a previously described aridity threshold. We conducted a comprehensive analysis of community diversity and spatial structure, in light of the changes in environmental heterogeneity and autocorrelation, further exploring the community's differential sensitivity to fluctuations and evidence of state transitions under various states.

The results demonstrate that microbial communities in sand dunes before and after crossing aridity thresholds exhibit distinct vertical ecological niche differentiation patterns under spatial effects. This includes variations in their beta diversity, rarity mode, assembly process, topological properties, and the stability of their networks. This offers new insights into the possible evidence of microbial community state transitions and potential mechanisms in deserts crossing aridity thresholds.