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The Effects of Plant Community Diversity and Drought on Soil Microbial Communities and the Subsequent Effect on the Invasion Success of Common Exotic Species

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Invasive species threaten ecosystems worldwide by outcompeting and eliminating native species, leading to losses in local biodiversity. Ecological theory predicts that ecosystems that are more diverse are less susceptible to invasion, but experimental evidence is ambiguous and the mechanisms underlying this diversity-invasion relationship have not been established. I set up a greenhouse experiment to investigate how soil biota, obtained from plant communities differing in species richness under drought and ambient water conditions, affected the invasion success of three common invasive species. The three invasive species, *Cirsium vulgare*, *Dipsacus fullonum*, and *Lespedeza cuneata*, differ in their phylogenetic relatedness to the resident plant communities. The results showed that soil microbes are largely pathogenic and that drought and phylogenic relatedness play a role in mediating the relationship between diversity and invasion. The change in soil communities due to drought generally decreased the biomass of the three invasive species, caused the biomass of *D. fullonum* grown with inoculum from a drought polyculture to drop significantly compared to plants grown with inoculum from the ambient polyculture, and reversed the effect of changing soil biota due to diversity for *L. cuneata*. Additionally, *Cirsium vulgare*, the most closely related species to the resident plant communities, was suppressed by soil biota originating from *Asteraceae* monocultures whereas *D. fullonum* was facilitated by these soil biota. This suggests that the microbes in these soils were largely family-specific, and that phylogenetic relatedness affects the role that community diversity plays in invasion. The relationship between community diversity and invasion is not universal and is instead mediated by microbial populations and their changes due to diversity, phylogenetic relatedness, and drought.