

Phylogenetic relatedness determines the strength of stable coexistence mechanisms in multispecies communities

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Abstract

Evolutionary relatedness may hinder stable coexistence due to similar niches and non-linear responses to competition. The mechanisms driving stability may respond differently to phylogenetic distance. Related species may be synchronic (have similar demographic responses over time), affecting fluctuation-dependent mechanisms: the storage effect should destabilize coexistence, and relative non-linearity (RNL) should be stronger due to increased fluctuations in competition. We tested these hypotheses using invasion analysis based on a model parameterized for 19 plant species from a semiarid grassland. Coexistence stability increased with phylogenetic distance. Stabilization through fluctuation-independent niche differentiation was stronger between distant relatives as a result of weaker competition. Synchronicity was higher between relatives, having the expected effects on SE and RNL. RNL was also strong between distant species probably due to different non-linear responses. Phylogenetic distance became more important as more species interacted, suggesting that evolutionary relatedness may be decisive in species-rich communities.

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