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Title:
Drought effects on tropical forest performance: neighborhood interactions and functional dissimilarity across habitats

Main Topic :
Spatial and Temporal Patterns, Processes, and Mechanisms of Biodiversity in the Tropics

Abstract:

Modern ecology increasingly emphasizes spatial processes, as current patterns can reflect past ecological dynamics. Spatial segregation may enhance intraspecific competition relative to interspecific interactions, with functionally dissimilar species exerting weaker density-dependent effects on focal individuals. However, the influence of extreme climatic events and habitat context on local neighborhood interactions and tree performance remains unclear. To address this, we analyzed approximately 25,000 trees across 12 permanent 1-ha plots spanning an elevational gradient and four vegetation types in the Atlantic Rainforest of Southeast Brazil. All individuals with DBH > 5 cm were surveyed before (2005–2008) and after (2013–2016) an extreme drought in 2013. We assessed key functional traits (WD, LA, SLA, and diameter) for 153 species with at least 10 individuals per plot and evaluated tree performance through relative growth rate and mortality. Using hierarchical generalized linear neighborhood models, we selected the best-fit models based on the small-sample corrected Akaike Information Criterion. Our results show that larger neighbors

reduce focal individual growth, with this effect amplified by drought. Prior to the drought, SLA dissimilarity positively influenced growth in lowland communities, but had the opposite effect in submontane communities. After the drought, the previously positive effect of SLA dissimilarity in lowland forests became negative. These findings suggest that negative density dependence is weaker among functionally divergent species. However, extreme climatic events reduce the ability of functional dissimilarity to mitigate competition from stronger competitors. In harsher conditions, competition among functionally similar species may intensify, highlighting the complex role of environmental stress in shaping community dynamics.

Keywords:
Climate; neighbors-interactions; performance; tree; tropics

One sentence summary:
Larger neighbors reduce tree growth, with drought amplifying this effect, while functional dissimilarity influences growth differently across habitats, and extreme climate-events can increase competition among similar species, reshaping community dynamics.

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