

## Functional traits interactions and habitat context control tree demography changes in tropical forests

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Trait-based ecology is largely based on the assumption that species functional traits determine species fitness. Clear trait-demographic relationships, however, have been limited in the literature, possibly due to both overriding environmental effects on fitness and trait interactions causing alternative designs with similar fitness. We analyzed demographic data (relative growth rate, RGR, and mortality rate, MR) of 16,000 individuals from 129 species surveyed in 13 1 ha permanent plots, distributed along an elevational gradient covering four broad habitat types in the Brazilian Atlantic Rainforest. By using both linear mixed effects and mixed-effects random forest models, we evaluated the relationship between population demography, functional traits (maximum height, woody density, seed mass, specific leaf area, nitrogen and phosphorous leaf content), elevation, and their interactions. We found that, as the crowding neighborhood increased with elevation, for several species, RGR decreased and MR increased with elevation. The importance of functional traits and elevation was, however, different on RGR and MR with interactions among traits, and between traits and elevation. For example, the changes in demography were best explained by wood density. Nevertheless, its relative influence was two times greater on RGR than MR and its effect changed across habitats. To sum up, interactions among functional traits shape fitness and life history strategies, but such interactions can be different in different environmental conditions and for different fitness components. We thus suggest the trait-based studies should consider the habitat suitability gradients to understand the changes in tropical tree performance and fully incorporate the concept of multiple trait-fitness optima resulting from trait interactions in different habitats.