Accounting for underlying complexities identifies simple hierarchy of trait-environment relationships in Wisconsin forest understory communities

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Abstract

Adaptive relationships between traits and the environment are often inferred from observational data by regressing community-weighted mean (CWM) traits on environmental gradients. However, trait-environment relationships are better understood as the outcome of trait-abundance and environment-abundance relationships, and the interaction between traits and the environment. Accounting for this functional structure and for interrelationships among traits should improve our ability to accurately describe general trait-environment relationships. Using forest understory communities in Wisconsin, we applied a generalized mixed model (GLMM) incorporating this structure. We identified a simple hierarchy of trait-environment relationships dominated by a strong positive effect of mean temperature on plant height. Compared to the traditional CWM approach, the GLMM was more conservative in identifying significant trait-environment relationships, and also detected important relationships that CWM regressions overlooked. This work highlights the need to consider the complexity underlying trait-environment relationships in future analyses

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1