Disentangling local adaptation and phenotypic plasticity in trees using national forest inventories

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Abstract

Phenotypic traits are fundamental drivers of community assembly and species response to environmental changes. While growing availability in trait data is improving our understanding of interspecific trait variation, how local adaptation of populations and phenotypic plasticity shape species ranges is poorly understood and restrained to few species for which common gardens have been historically set up. We will present a conceptual framework to disentangle the environmental (plasticity), population (genetic) and their interaction components of trait variation across species' niches using forest inventory data and provenance tests. Forest inventory data offers a wide geographic and environmental coverage to address the intraspecific variation *in situ*, compared to commonly-used provenance tests (common garden experiments), but plasticity and local adaptation are confounded. The challenge here is to disentangle the nature of trait variation, and compare our results with those obtained using common gardens. Bioclimatic clustering of provenances and mixed models of intraspecific trait variation with tree size, competition, long-term climate and recent climate changes are used to analyze genotype - environment interactions. We will illustrate our method by using *Abies alba* as a case study to model growth, survival and tree height variation in western Europe. Strong patterns of population differentiation in the environmental optimum, maximum value and environmental plasticity of fitness-related traits from forest inventory data were compared with those from common gardens, suggesting that national forest inventories can be used to understand the nature of trait variation.

Keywords: climate change, intraspecific variability, local adaptation, phenotypic trait, species distribution

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