Abstract Detail - Ecological Section

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Among-species diversity in fine root traits: Informing studies in mature forests with a survey of glasshouse collections.

A comprehensive understanding of plants' impacts on ecosystems requires studying the form and function of belowground traits, particularly the resources allocated to the ephemeral fine roots of woody plants. Few studies have documented the significance of variation among species, and even fewer have focused on naturally co-existing species. Also, an open question is whether environmental differences among sites are an additional and significant source of variation. We characterized variation in fine root traits in 25 species of mature forest trees in Pennsylvania State Experimental Forest and Black Rock Forest (NY). We measured diameter, tissue density, specific root length (SRL), and branching frequency on first and second order roots. After growing intact roots of mature forest trees for 3 months in pots installed under each tree, we found a statistically significant species effect for all four traits measured. Consistency of species effects is supported by the lack of a significant site effect and by strong between-site correlations for diameter ($r=0.84$, $P<0.001$), density ($r=0.72$, $P<0.01$), and SRL ($r=0.77$, $P<0.01$). In contrast, among-species variation in branching frequency was less consistent as suggested by a lower, non-significant correlation ($r=0.40$, $P=0.14$). A survey of woody plants in glasshouse collections is useful for placing results from forest studies in a broader phylogenetic context. The survey, analyzed using nested ANOVAs, corroborates the statistical significance and large magnitude of among-species trait variation, particularly for root diameter, as well as the idea that variation in diameter is the major contributor to variation in SRL across diverse woody species. An improved organismal and evolutionary understanding of root form and function should aid efforts to model ecosystem-level effects of rapid climate change and shifts in vegetation boundaries.

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