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Root Trait Variation among Species in Basal Angiosperm and Seed Plant Clades: Studies at the New York and Brooklyn Botanical Gardens and Barnard Greenhouse

To fully understand plants' impacts on ecosystems requires understanding the form and function of below ground traits. Despite this, root traits are traditionally understudied due to a number of complexities and challenges. Particularly, the location of roots within the soil and the complex symbioses they form with soil microbes are not fully understood and pose methodological and ecological challenges.

Plants are known to invest a considerable amount of energy in developing primary root tissue below ground in addition to developing leafy shoots above ground. These fine roots are characterized by their small size and high surface area. The primary roots are thin and highly branched and the function of this non-woody root is to forage and absorb soil resources. In many ways they are analogous to the above ground leaf tissue, yet they are non photosynthetic and they also form symbioses with mycorrhizal fungi. In our studies we are controlling mycorrhizal colonization, and focusing exclusively on very young and non-woody fine roots by confining our tissue sampling to first- and second-order fine roots.

In this initial study we have began to develop a strategy for characterizing sources of variation in root traits among evolutionarily diverse species at the New York Botanical Garden, Brooklyn Botanical Garden and the Barnard College Greenhouse. We are surveying variation in several roots traits, including specific root length, diameter, and root tip count. We are including species from diverse clades including non-angiosperm seed plant clades (e.g., cycads, *Gingko*) and basal angiosperm taxa (e.g., *Austrobaileya, Illicium, Magnolia*). These species can serve as outgroups in future phylogenetic analysies that will include a wider diversity of eudicot angiosperms. Future applications of this research might include refinement of ecosystem models for a variety of forest types, very useful for forecasting how rapidly changing climate might affect future vegetation boundaries, and response of forests to other disturbances.