INCORPORATING EVOLUTIONARY RELATIONSHIPS INTO REGIONAL ASSESSMENTS OF FOREST BIODIVERSITY ACROSS FOREST INVENTORY AND ANALYSIS PLOTS

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Abstract.—Evolutionary diversity metrics may be more biologically meaningful indicators of forest biodiversity than traditional measures such as species richness, which treat all species as equally important. This is because measures that account for evolutionary relationships among species should be better surrogates of functional diversity within forest communities, given that taxonomically distinct species should contribute more to the diversity present within a community. One measure, phylogenetic diversity, has been linked to a variety of plant ecosystem processes, goods and services, supporting the argument that it is a more useful conservation criterion for management decisions. To investigate patterns of forest functional biodiversity across the United States, we calculated plot-level evolutionary diversity measures on approximately 125,000 Forest Inventory and Analysis plots. Most measures were not well-correlated with species richness, while others were decoupled with it at small and medium scales. Phylogenetic diversity was consistently better correlated than species richness with most plot-level measures of forest productivity, including trees per acre and relative density, although the results varied by region. Using data remeasured over time on a subset of the forest inventory plots, we detected broad-scale patterns of phylogenetic diversity change that were consistent with the expected early effects of climate change. Specifically, phylogenetic diversity change was greater among seedlings than trees, was associated in some locations with latitude and elevation, and was greater among species with high dispersal capacity. These findings demonstrate that demographic indicators of evolutionary diversity can refine our understanding of climate change impacts on forest community biodiversity and function across broad regions. The importance, statistical power, and geographic extent of such indicators will increase as repeated measurements occur on all 125,000 inventory plots across the United States.

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