WHEN DOES BIODIVERSITY MATTER? ASSESSING ECOSYSTEM SERVICES ACROSS BROAD REGIONS USING FOREST INVENTORY AND ANALYSIS DATA

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Abstract—Biodiversity is expected to convey numerous functional benefits to forested ecosystems, including increased productivity and resilience. When assessing biodiversity, however, statistics that account for evolutionary relationships among species may be more ecologically meaningful than traditional measures such as species richness. In three broad-scale studies, we applied evolutionary diversity metrics to assess the relationship between biodiversity and forest function across broad U.S. regions, using Forest Inventory and Analysis (FIA) data. In one study, we assessed trends in live aboveground tree biomass (LAGB) in relation to tree biodiversity on 79,000 FIA plots across the United States, controlling for site productivity and live tree stocking. Biodiversity was more closely associated with greater LAGB on low-productivity sites with low tree stocking. This is consistent with the expectation that the coexistence of functionally different species increases forest productivity in less productive and more stressful environments, while dominant and highly productive species are able to competitively dominate in more productive habitats. In a second study, we assessed the associations between tree diversity metrics and invasive species diversity and cover on 39,000 FIA plots across the Southeast. Region-wide, tree biodiversity was higher on plots that also had invasive plants, and plot-level "invadedness" was positively correlated with evolutionary biodiversity. Among the biodiversity metrics, plot invadedness was most strongly correlated with phylogenetic diversity. The results suggest that forest tree biodiversity in parts of the Southeast may actually indicate the presence of better environmental conditions for invasive plants. In a third study, we tracked regional changes in forest community biodiversity separately for trees and seedlings on FIA plots across broad regions of the eastern United States. We detected broad-scale patterns of forest evolutionary diversity change that are consistent with expected early effects of climate change. Such changes could alter the ecological functions of forest communities.

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