Development stage-dependent effects of biodiversity on aboveground biomass of temperate forests

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Biodiversity–ecosystem functioning relationships (BEFs) have been extensively explored across ecosystems. However, these relationships may change as the forest matures, and the underlying mechanisms remain underexplored. Using large temperate forest datasets from 2,392 permanent plots in northeastern China, we examined the relationships between biodiversity and aboveground biomass (AGB) across different developmental stages from young to over-mature stands. We found the positive BEFs using both species richness and functional diversity, but these positive effects decreased with forest development. However, the effects of community-weighted mean on AGB showed two peaks in young and mature stands. Notably, the effects of community-weighted mean on AGB became larger than the effects of functional diversity after the forests developed to near-mature/mature stands, indicating that BEFs are driven by mass-ratio effects (i.e., dominant species) rather than niche complementarity in old stands. Our findings on how the developmental stage influences the effects of biodiversity on ecosystem functioning in natural forests will help identify effective strategies for maintaining or enhancing ecosystem services at different forest successional stages.