COMPENSATORY MECHANISMS OF CENTRAL HARDWOOD FOREST COMMUNITIES IN A CHANGING ENVIRONMENT

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Abstract: Although it is known that forest productivity is highly correlated with canopy leaf area, the influence of environmental gradients on leaf area-productivity relationships has not been well-documented, particularly for mixed-species forests. The present study was conducted to define the mechanisms by which Central Hardwood forest communities respond to changes in environment. Ecological Land Type Phases (ELTPs) of the Central Hardwood region, delineated by soils, topography, and indicator vegetation, provided a framework to examine the impacts of environmental gradients on leaf area-productivity relationships at a landscape level. Three ELTPs— (1) *Quercus prinus/Carex picta-Vaccinium*, Dry slope, (2) *Quercus alba-Acer saccharum - Parthenocissus*, Dry-Mesic slope, and (3) *Fagus-Acer saccharum/Arisaema*, Mesic slope—were selected and stratified into three slope positions viz. the upper edge of the community, the middle or center of the community on the slope, and the lower edge of the community. Circular plots of 0.02 ha in size were established for sampling. Density (standing basal area, volume, and biomass), annual production, relative growth rate, leaf area index, and growth efficiency were determined for each slope position and examined for compensating mechanisms for drier, less fertile conditions. Among the three communities studied, dry slopes compensated for drier conditions through both a shift in species composition and reduced annual production and leaf area. Dry-mesic slopes exhibited adaptation only through changing species composition whereas mesic slopes compensated for drier conditions primarily through reduction in annual production and leaf area. These results indicate reduced productivity for Central Hardwood forests under warmer, drier conditions that have been predicted for the Central U.S. by most general circulation models.

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