Effects of Spatial Heterogeneity of Microenvironment on Plant Biodiversity in the Southeastern Missouri Ozarks

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Abstract

In this paper we examine how the spatial heterogeneity of microclimate, topography, and vegetation influences plant species richness in the Southeastern Missouri Ozarks and how the results from this study related to the species richness-habitat heterogeneity hypothesis. We measured air temperature, soil temperature (5cm in depth), soil surface temperature, and soil moisture every 10 m along a 4250 m transect using mobile and permanent weather stations during the growing season, June to September 1996. We used 1×1 m plot to record ground flora (up to 2 m above ground) information, such as height and coverage, by species every 10 m along the transect. Topographic condition, litter depth, rock coverage, canopy coverage, and landscape patch type were also recorded at each plot. Elevation at each plot was measured using a submeter-resolution global positioning system (GPS). We find that the heterogeneity of topography, vegetation, and microclimate is strongly correlated with plant species richness (R^2=0.99), but the relationships are highly scale dependent. Most variables are highly correlated with plant species richness from 1500 to 2000 m scale. Contrary to the prediction of habitat heterogeneity theory, we find that the heterogeneity of slope and aspect is negatively correlated with plant species richness. The heterogeneity of elevation is weakly correlated with plant species richness. However, the heterogeneity of patch type, canopy coverage, and ground flora coverage is highly and positively correlated with plant species richness at most spatial scales examined. Plant species richness can be accurately predicted by the heterogeneity of microclimate. At 2000 m scale, spatial heterogeneity of microclimate can explain 98% of the total variation in plant species richness.