Fine-scale heterogeneity of forest herbs: the role of past land use and life-history traits

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The spatial organization of plants arises from interactions among biotic and abiotic variables. At fine scales, species life-history traits can govern spatial patterns by mediating plant-environment associations. Past land use may also control plant communities at this scale by altering the local distribution of soil nutrients. Examining patterns of heterogeneity may be useful for determining the relative influence of these factors. We measured herb abundance and soil nutrient availability in southern Appalachian forests to evaluate how past land use and species life-history traits influence the spatial distribution of herbaceous plants at the microsite scale. Twelve focal herbaceous species and mineral soils were intensively sampled during 2001 and 2002 in eight forest stands that differed in land-use history (previously farmed, logged, or undisturbed) in western North Carolina. Geostatistical analysis revealed that herb spatial patterns diverged in previously logged stands relative to undisturbed stands. Patterns varied little however, when variability due to differences in nutrient availability was removed by detrending the plant abundance data, suggesting that previous land use altered herb spatial heterogeneity by inducing changes in soil resources. Residual variability in the spatial patterns of herb abundance was explained by dispersal mechanism and propensity for vegetative expansion. These results suggest that at fine scales past land use exerts primary control on the spatial distribution of herbs by altering nutrient availability. Moreover, species life-history contributes to the spatial structure of plant communities only secondarily.