LANDSCAPE VARIATION IN SPECIES DIVERSITY AND SUCCESSION AS RELATED TO TOPOGRAPHY, SOILS AND HUMAN DISTURBANCE[1]

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Abstract: Three hundred and thirty-two plots have been sampled on the Wayne National Forest of southeastern Ohio, for the purpose of developing an ecological classification system (ECS). The ECS will be based on the herbaceous and woody vegetation, soils and topography of mature (80-140 year-old), relatively-undisturbed forests. Species diversity changes little across this landscape. Forty-eight woody tree species were identified among all plots and species richness (R) varied from two to thirteen on individual plots. Although variable within landform type, R varied similarly across landform type, with slightly greater variability on moderately steep slopes (3-13) than on steep slopes (3-10). Ridgetops (4-11) were comparable to sideslopes while ravines generally had fewer species (2-9) than other landforms. Again, although variable, R and species diversity (H) were not highly different across areas with differing soils characteristics. However, higher values of R and H were associated with severe, xeric sites having sandy soils; and mesic to dry-mesic sites that had evidence of nearby disturbance.

Species composition did vary predictably across the landscape. Northerly aspect and lower slope positions had more mesic communities than did southerly aspect and upper slope positions which were typically more xeric. Compositional stability of stands was determined by calculating a composition index (CI, after Fralish et al., 1993) for overstory, sub-canopy, sapling and seedling layers of woody vegetation. CI was based on the sum of the product between each species importance value (IV) and environmental adaptation value (AV). IV was the average of the relative density and the relative dominance of each species, and AV was compiled from several previously published studies (Buell et al., 1965; Curtis and McIntosh, 1951; Fralish et al, 1993; and Wells, 1976). Differences between strata of less than 100 units were considered to be fairly stable. Compositionally stable stands (based on four vegetational layers) were generally restricted to very mesic sites, xeric sites, and sites with unstable soil/slope conditions that prevent successional climax. Compositional stability on dry-mesic sites that are dominated by oak-hickory overstory is related to subcanopy and sapling layers that are predominately *Acer rubrum* (L.) and other non-oak species with AVs similar to oaks.

LITERATURE CITED

Buell, M. F., A. N. Langford, D. W. Davidson, and L. F. Ohmann. 1966. The upland forest continuum in northern New Jersey. Ecology 47:416-432.

Curtis, J. T., and R. P. McIntosh. 1951. An upland forest continuum in the prairie-forest border region of Wisconsin. Ecology 32:476-496.

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Fralish, J. S., S. B. Franklin, P. A. Robertson, S. M. Kettler, and F. B. Crooks. 1993. An ordination of compositionally stable and unstable forest communities at Land Between The Lakes, Kentucky and Tennessee. *In*: [Fralish, J. S., R. P. McIntosh, and O. L. Loucks; eds.] Fifty Years of Wisconsin Plant Ecology. The Wisconsin Academy of Sciences, Arts, and Letters. pp. 247-267.

Well, P. V. 1976. A climax index for broadleaf forest: An n-dimensional, ecomorphological model of succession. *In*: [Fralish, J. S., G. T. Weaver, and R. C. Schlesinger; eds.] Proc: Central Hardwoods Forest Conf., Carbondale, Ill. Oct. 17-19, 1976. pp 131-175. North Central Forest Exp. Sta., 1992 Folwell Ave., St. Paul, MN 55108