

ABSTRACT OF THE THESIS

Edge Characteristics
of a Mature Oak-Hickory Forest
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Variation in plant distributions within the north and south edges of a mature oak-hickory forest on the New Jersey Piedmont are investigated by means of a three-factor analysis of variance with replication. Sources of variation describing species distributions along, into, and along and into the edges are evaluated for trees, their reproductive size classes, and principal shrubs and herbs. Comparison of the significant interactions for the various species, each plotted with respect to its center mean and 95% confidence interval, permits the identification of those species which show responses at the edges, where within the edges the responses occur, and at what age or size class (for tree species) they occur.

Quadrats (trees, saplings, seedlings) and line transects (shrubs, herbs) were selected so as to minimize the influence of all site factors except microclimate and land history, the independent variables by which the individual species gradients, the segregation of species within the edges, and the limits of the edges themselves are explained.

Relatively undisturbed and subjected to a narrow microclimatic ecotone dominated by diffuse light (Wales 1967), the north edge is

characterized by a narrow vegetative ecotone. A 5-meter wide low thicket of tree growth mingled with woody vines and herbs is found exterior to the original edge, a second 5-meter zone characterized by increased densities and basal areas (compared to center) for Quercus and Prunus avium. Only an increased density of depauperate P. avium sapling sprouts and a decreased density of Cornus florida trees represent edge influences interior to the original edge.

Reforestation since 1900 of an abandoned strip approximately 15 meters wide in front of the original edge complicates the situation on the south. The first 5 meters of the young forest are characterized by scattered small trees with clumps of woody vines (Lonicera japonica, Rhus radicans and Rubus allegheniensis) between and upon them. The second 5-meter zone is a dense stand of medium-sized trees, characterized by increased densities of Quercus and Prunus avium. The third 5-meter zone is characterized by an open stand in which both P. avium and Viburnum prunifolium have increased densities. The original south edge, which bears many resemblances to the original north edge, is characterized by increased densities and basal areas of Quercus and V. prunifolium. A decreased density of Cornus florida and increased densities of both sapling- and tree-sized V. prunifolium represent edge influences interior to the original edge. These may be remnants associated with the wide microclimatic ecotone dominated by direct light once existent at the original edge, but now most influential at the new edge.

A delicate segregation of species less pronounced than that between north and south slopes exists at the forest edges. Species

characterized by shade intolerance and/or good vegetative reproduction, many associated with secondary succession in forest gaps, are prevalent at the edges, but responses at the edges are stronger than those in gaps for most gap species. These include Fraxinus americana, Prunus avium, P. serotina, Sassafras albidum, and Viburnum prunifolium. Among canopy dominants, Quercus rubra and Q. velutina show stronger edge responses than Q. alba. The edge response of Q. velutina is stronger on the south. Carya ovalis shows no edge response. Neither are there edge responses for Acer rubrum, A. platanoides or A. saccharum, but in the case of the latter two, too few trees are present to establish a reliable trend. For each tree species, the tree distribution is more complex than that of the seedlings. The shrub distributions are more complex than those of most trees.