Effects of Fire, Deer Herbivory, Seed Predation, and Canopy Gaps on Forest Regeneration: A Large-scale Experimental Approach

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Oaks have been a dominant group and readily regenerating in eastern deciduous forests for thousands of years. Interestingly, since the 1960s, oaks have failed to regenerate in many areas. This pattern is one of a number of symptoms characteristic of recent changes in forest understories (i.e. the decline in diversity of wildflowers and tree seedlings; and the increase in maple abundance). We are currently investigating the underlying mechanisms that control tree species regeneration in eastern forests using a large-scale experimental approach to test four prevalent hypotheses. We have experimentally manipulated fire, deer, seed predation and canopy gaps in 128, 400m^2 research plots in West Virginia and are monitoring the survival, growth and recruitment of the 28,000 seedling, sapling and canopy trees within these research plots. The fires were intense and topkilled up to 100% of small saplings and up to 60% of large saplings; however canopy tree mortality was only 4% and not different from controls. Fires strongly influenced the species composition of emergent seedlings. Fire by deer, and gap by deer interactions are emerging as important factors affecting growth and survival of seedlings. This study is just beginning to elucidate the underlying mechanisms that drive forest regeneration.

Effects of Shelterwood Harvesting and Prescribed Fire on Regeneration Structure

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In 1993, four, 10 acre Appalachian hardwood stands received a shelterwood seed cut. Preharvest overstory species consisted primarily of yellow poplar (40-50% of basal area) and oaks (30% of basal area); understory composition was dominated by red maple. Post-harvest basal areas averaged 70ft^2/a with oaks comprising the majority of the seed trees. After 6 growing seasons, black cherry, red maple and sassafras seedlings dominated the regeneration. Because regeneration composition did not reflect the pre-harvest overstory, a prescribed fire was conducted in November 1999 primarily to reduce the density of black cherry and red maple and to promote oak species. The effects of fire on herbaceous vegetation and soil nutrients are also being examined.

In the summer of 1999, the 10-acre treatment blocks were divided into two, 5-acre treatments: burned and unburned. In each 5-acre block, nine, milacre sampling plots were established and all woody and herbaceous vegetation <1" dbh was counted and height recorded. An additional milacre was established to measure only tree seedlings. All plots will be remeasured in the spring and summer of 2000 and 2001.

Soil samples were collected at 3 locations, adjacent to six of the vegetation sample plots, immediately prior to and after burning. Soil samples will be collected two additional times in spring and summer 2000. Litter and mineral soil samples will be analyzed for total N. P. K, Mg, Ca, and S. Mineral soil samples will also be analyzed for exchangeable or available N. P. K, Mg, Ca, and S. CEC, % BS, bulk density and pH.