Seventy Years of Stand Dynamics in Connecticut Hardwood Forests—The Old-Series Plots

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The Old-Series plots chronicle 70 years of natural change in unmanaged central Connecticut forests. The plots were established in 1926-27 in four stands typical of that period: they had originated around 1900, had a prior history of repeated cutting and agricultural use, and were predominately hardwood in composition. One period of disturbance has had a large influence on changes in these plots. During the 1960s the plots were repeatedly defoliated by gypsy moth and canker worm during an extended period of drought. There were shorter periods of defoliation during the 1970s and 1980s. This report covers natural changes between 1927-1997 on the 10.5 acres that have not been disturbed by man. All trees with a diameter of at least 0.5 inch have been mapped and measured at 10-year intervals, except during the 1940s, using 16.5 foot wide strips transversing the forests. There are now records on 43,357 stems distributed on nearly 60 tree and shrub species.

The overall picture shows that density steadily declined from 1,439 to 530 stems/acre between 1927-67, rose to 693 stems/acre over the next 10 years, and slowly declined during the past 20 years to 590 stems/acre. At the same time there were also changes in species composition. Birch, maple, and beech have increased from 37% of stems in 1927 to 75% of stems in 1997. Much of this increase was in response to the increased mortality of oak and hickory caused by the defoliation during the 1960s. The number of new trees (ingrowth) was nearly three times greater between 1967-77 than between 1957-67. Oak decreased from 22% to 8% of stems between 1927-97. Soil moisture affected species composition. In 1997, oak accounted for only 4% of trees on moist sites compared with 15% on dry sites. Moist sites had more birch, tulip poplar, and ash. Dry sites had more maple and beech. Five pioneer species (paper birch, gray birch, aspen, butternut, and eastern red cedar) that grow quickly and die young have been lost from our stands.

The decreasing number of trees was not indicative of a declining forest; rather it resulted from trees growing larger. Large trees need more resources (light, moisture, and nutrients) than small trees; trees that are not as competitive as others decline and die. Basal area is one measure of the bulk of the forest. Except for a slight decline between 1957-67, basal area has steadily increased from 69 ft^2/acre in 1927 to 120 ft^2/acre in 1997. The proportion of maple and birch basal area has been constant over the past 70 years. Oak basal area has increased on all soil moisture classes and accounted for nearly 60% of basal area on dry sites in 1997.

The subcanopy is comprised of those trees that live in the shade of larger upper canopy trees. They form the pool of individuals that will form the future forest. Birch, maple, and beech comprised over three-quarters of subcanopy trees in 1997. Birch predominated on moist and medium sites, maple on dry sites. Beech subcanopy density was highest on dry sites. In 1997, oak was a significant component of the subcanopy only on dry sites.

Seedlings and saplings have also been followed in these forests since 1977 using 1/300 plots. Saplings are defined as trees > 4 feet tall and < 0.5 inch dbh, seedlings are < 4 feet tall. Because all mature trees begin life as seedlings and then become saplings, study of seedlings and saplings provides clues on future changes in our forests. Sapling density decreased for all species groups, except beech, between 1977-87. It is likely that sapling density was higher than normal in 1977 because of high defoliation-induced oak mortality during the 1960s. Birch, maple, and beech were the most numerous species in the sapling size class in 1997. Beech and birch were predominate on moist sites, birch and maple on dry sites. Surprisingly, oak accounted for 7% of saplings from 1977-97.

The last, and smallest, size class examined was seedlings. Seedling density fell from a high of over 12,000/acre in 1977 to 6,900/acre in 1987 and then increased to 8,000/acre in 1997. It is worth noting that seedling composition is distinct from the larger size classes. Birch and beech were minor components and together accounted for less than 10% of seedlings. Oak and maple were the predominant species. Oak accounted for nearly one-half of seedlings in 1977 and one-quarter in 1997. Maple accounted for one-fifth of seedlings in 1977 and nearly one-half in 1997. The dominance of the seedling size class by maple and oak was observed on moist, medium, and dry sites.

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