The Connecticut Agricultural Experiment Station, New Haven

Stand Dynamics in Connecticut Hardwood Forests The Old Series Plots (1927-1997)

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SUMMARY

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 Bulletin reports on 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. We now have 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 acre 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 predominant 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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INTRODUCTION

Driving around Connecticut, it is easy to assume that the forests we see covering the hillsides and valleys have always been there. However, if you leave your car and walk along a trail you can find evidence of the previous history of the land. Stonewalls, now overgrown, outline old pastures and grain fields. Occasionally a sunken cellar of a farmhouse can be found. It may be hard to believe, but around 1810 75% of the state was either under plow or in pasture (Harper 1918). The remaining quarter of the state that was forested was not the forest of today. The forest, not the local lumberyard, provided wood for homes, furniture, wagons, and tools. An even larger part was cut for firewood to heat houses, cook meals, and smoke meats.

From 1810 to 1920 the amount of land covered with forests gradually increased from 25 to 40% as farmers either moved into newly industrializing cities or to the more fertile Midwest. The last great cut of the forest came in the late 1800s and early 1900s. Entire hillsides were cut to produce charcoal not only for home use, but also for the local brick, iron, and brass industries. Immense fires, covering up to 20,000 acres, regularly roared over the countryside. Some of these fires were accidental, caused by escaping sparks from railroads, homes, and industry. Many fires were deliberately set to clear the underbrush in the forest to provide better pasture for livestock.

There was another sharp increase in forested areas associated with land abandonment in the 1920s, 30s, and 40s. In the early 1950s the amount of forested land rose to a peak of about 63%. Since then there has been a slight reduction of forest cover, so that approximately 57%, or 1,768 million acres, of the state is covered with forest today (Powell et al. 1993).

Our knowledge of how a forest changes over time has been deduced from examining forests in different stages of succession. No single person lives long enough to record the changes that occur during the development of a mature forest, perhaps two or three centuries. Our knowledge of how a forest changes "naturally" over time is further complicated by repeated disturbances from fire and cutting. Ideally, forest change would be studied by long-term observation on tracts protected from non-natural disturbance. This report presents the observations on four forests over a 70 year period: from relatively young forests to those approaching maturity.

In 1926-27, scientists at The Connecticut Agricultural Experiment Station began a study that has evolved into the oldest, continually monitored study of forest dynamics in North America. The present database includes information on 43,357 stems distributed over 55 species. The research has been expanded to include forest seedlings, tree volume, and more recently, tree diseases. At least twenty-four technical papers, articles, and abstracts have been based on data from this study (listed following References). For the convenience of the reader we repeat some of the data from earlier inventories and add the 1997 totals. Totals may differ slightly from earlier reports because the area affected by non-natural disturbance has been resurveyed. Additionally, some earlier errors have been detected and corrected. The data are generally reported as number of stems or square feet of basal area per acre. This will allow interested readers to make direct comparisons with previous studies. This report does not use metric units, as we wanted the study to remain accessible to field foresters and the general public.

The original goal of the study was "investigating the influence of soil type…on the distribution and growth of forest vegetation" (Hicock et al. 1931). However, at the end of the study, the authors concluded that "Correlation of a given tree species with a specific soil type was largely unsuccessful." Unbeknownst to the scientists, composition of these young stands was mostly a function of a history of repeated, heavy disturbance. However, their efforts established the basis of one of the oldest and largest sets of permanent plots in the eastern deciduous forest. The plots were measured in 1937 and every decade afterward except during the 1940s. The subsequent 70 years of forest

development has seen a sorting of species by soil moisture conditions. Thus, we are now able to achieve the original objective of the study—describing the influence of soil characteristics (specifically soil moisture) on species composition and stand dynamics.

TRACT LOCATIONS AND HISTORY

The Turkey Hill tract (80 acre) is in Cockaponset State Forest in Haddam, Connecticut (41°25'N, 72°31'W). The Cox (50 acre), Reeves (40 acre), and Cabin tracts (40 acre) are in Meshomasic State Forest in Portland, Connecticut (41°37'N, 72°34'W). Cox plot was named after the owners of the property, George and Jennie Cox, before purchase by the state in 1907. Reeves plot was named after Del Reeves, the first forester of Meshomasic (then Portland) State Forest. Cabin plot was named for a chestnut log cabin that sat on the northwest corner of the plot until the late 1960s. Turkey Hill was named for a local geographic feature.

At the time of plot establishment, 1926 for Turkey Hill and 1927 for the remainder, the forest was estimated to be 20 to 40-years-old (Hicock et al. 1931). Guinane (1985) cored upper canopy northern red oaks on the tracts and found a median age of 80 years in 1983, i.e., the forests were approximately 25-years-old at plot establishment.

These tracts were selected in the mid 1920s as representative, second-growth forests in Connecticut. Most of the land was cleared for pasture or cultivation by the mid-1800s. Remnants of stone walls, barbed wire, and the presence of pioneer species in 1927, such as gray birch and eastern red cedar, indicated old field reverting to forest. Rugged terrain, rock outcrops, abundance of boulders, and the presence of chestnut sprouts suggest that the tracts were never completely cleared. Farm woodlots in the 1800s were repeatedly cut for fuelwood and wood products. In addition, it is likely that the woodlots had been burned by accident or on purpose to improve pasture for livestock prior to farm abandonment around 1900. These tracts were typical of most forests, not only in central Connecticut, but also in all of southern New England.

INSECTS AND DISEASE

There have been other disturbances to the forests. The tracts were subjected to three episodes of defoliation between 1961-82 (Fig. 1). Between 1961-64 gypsy moth *(Lymantria dispar* L.), canker worm (*Paleacrita vernata* Peck.), and other defoliating insects attacked the canopies of all four tracts. Aerial surveys indicated partial defoliation of Cox, Cabin, and Reeves during 1961-63 and of Turkey Hill in 1964. The tracts were partially defoliated by gypsy moth and elm spanworm (*Ennomos subsignarius* Hbn.) during 1971-72. Cox was defoliated most and Turkey Hill least. All tracts were heavily defoliated by gypsy moth in 1981. Only Cabin was lightly defoliated in 1982. The duration of each defoliation episode decreased over time, but defoliation

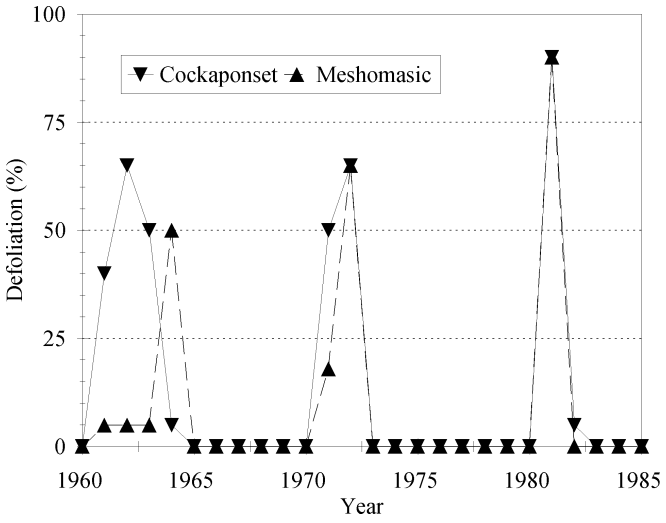

Figure 1. Estimated canopy defoliation (%) on Old-Series plots between 1960-1990. There were no other defoliation episodes.

intensity was greatest in 1981. A fourth gypsy moth infestation began in 1989, but was controlled by the gypsy moth fungus (*Entomophaga maimaiga*). This appearance of the fungus in Connecticut was the first in the United States. The fungus has continued to control gypsy moth populations in Connecticut (Weseloh et al. 1993) and may have relegated this pest to minor status.

The arrival of the chestnut blight fungus (*Cryphonectria parasitica*) before 1907 reduced American chestnut to an understory species by the time of the first survey in 1927. The interaction of chestnuts with chestnut blight is discussed in depth in the section CHESTNUT BLIGHT. Dutch elm disease (*Ceratocystis ulmi*) reached the tracts between 1937-57. Because elms were never abundant in these forests, the disease had less impact than in the towns of Connecticut where elms had been common street trees. Most of the flowering dogwoods died between 1977-87. Although the disease agent was never identified, it was probably the same agent that devastated ornamental dogwoods during the same period. Nectria canker (*Nectria galligena*) is the most common stem canker in the forest. Although it rarely kills trees, Nectria canker causes considerable loss of commercial wood production and can weaken trees. More detailed information on Nectria canker in the tracts can be found in the section NECTRIA CANKER.

WEATHER

Climatic data used here are from Hartford, Connecticut approximately 15 miles northwest of the Meshomasic plots (NOAA 1991). The area is in the northern temperate climate zone. Mean monthly temperature ranges from 25F in January to 73F in July. There are an average of 176 frost

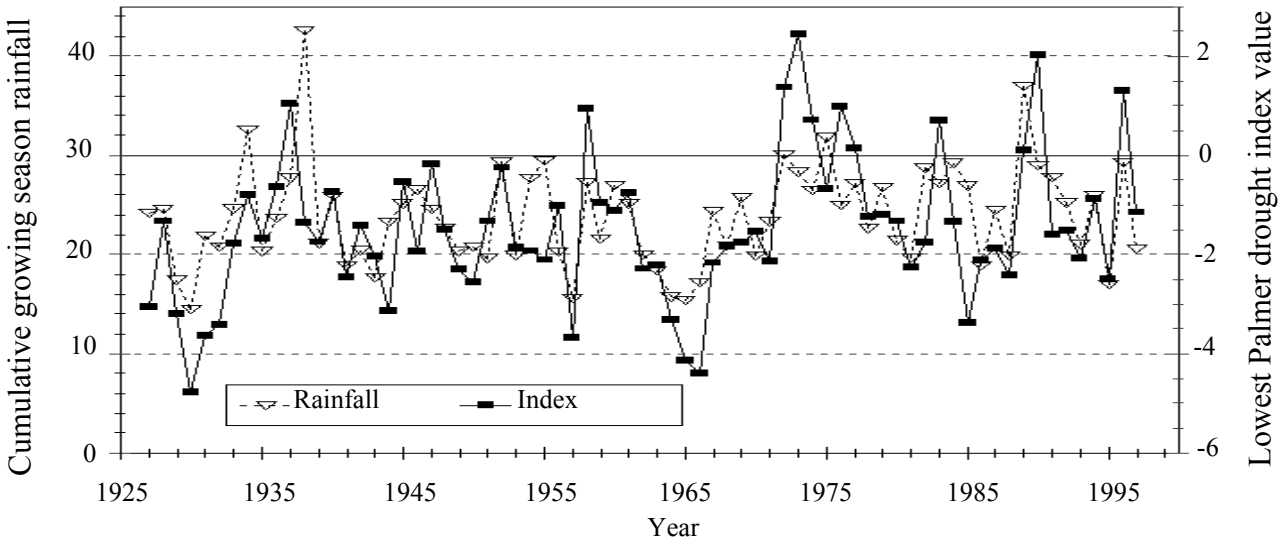

Figure 2. Growing season rainfall and lowest Palmer drought severity index values between 1927 and 1990.

free days per year. Average annual precipitation is 44.4 inches per year, evenly distributed over all months. The Turkey Hill tract is more exposed to strong easterly storm winds, while the Meshomasic plots are sheltered to the east by Meshomasic Mountain.

Soil moisture is replenished during winter months because trees do not remove water via transpiration. Adequate rainfall during the growing season is crucial if trees are to maximize growth. Therefore, we present only Palmer drought severity index values and precipitation amounts for the April-September growing season (NOAA 1999). Since a wet August or September can mask the presence of a drought during the early summer, we determined the lowest (most severe) Palmer drought index value for a given year. These are presented, along with annual growing season precipitation, in Figure 2. The average growing season precipitation during the past 70 years was 23.9 inches and the lowest average Palmer drought severity index value was -1.5.

The climate in central Connecticut has oscillated between wet and dry during the past 70 years (Fig. 2). The first decade (1927-37) was dry and the next two decades had average rainfall (1937-57). The very dry 1957-67 decade was followed by the wettest decade (1967-77). The next decade (1977-87) was average and the last decade (1987-97) was moist. It should be noted that there were years within each 10-year period when rainfall differed significantly from the average for the decade.

SITE CHARACTERISTICS

The plots are on the western edge of the Eastern Highlands of Connecticut, a region of metamorphic rocks and glaciated soils. The topography of the plots is gently rolling with elevations ranging from 300 to 550 ft above mean sea level. Soils are very stony to extremely stony, fine sandy loams derived from granite, gneiss, and schist glacial tills, and are acidic to strongly acidic (pH 4.5-6.0). Although soil type, depth of soil, internal soil drainage, stoniness, humus type, and aspect were determined along each transect (Hicock et al. 1931), only internal soil drainage has been found useful for relating vegetation to site characteristics. Soil drainage classes were classified according to the Soil Survey Manual (Anon. 1951). In addition to the seven classes described in the manual, an eighth class, muck, was added to describe the swamps on the Turkey Hill and Cox plots.

Because the sampled area on some moisture classes was small, the eight classes were condensed to four: Wet (swamp or muck), Moist (very poorly drained, poorly drained), Medium (imperfectly drained, somewhat poorly drained, well drained), and Dry (somewhat excessively drained, excessively drained) soils. The areas of the combined moisture classes are shown in Table 1. (All tables are in numerical order following the text). Soils on Moist sites are predominately of the Leicester series (Aeric Haplaquepts). Soils on Medium sites are of the Charlton (Typic Dystrochrepts), and Woodbridge series (Typic Fragiochrepts). Some soils of the Paxton series (Typic Fragiochrepts) are found on Medium sites on the Turkey Hill Tract. Soils on Dry sites are of the Hollis series (Lithic Dystrochrepts) with rock outcropping.

FIELD METHODS

All four tracts were laid out as rectangles with the long axis running east-west. The dimensions were: Turkey Hill (1,320 x 2,640 ft), Cox (924 x 2,376 ft), Reeves (660 x

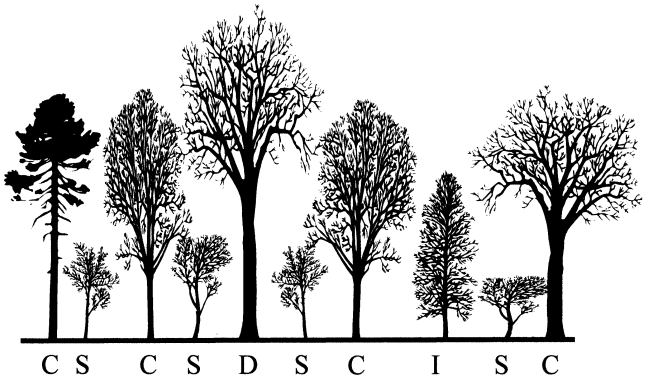

Figure 3. Schematic drawing of crown classes. D-Dominant, C-codominant, I-intermediate, S-suppressed.

2,640 ft), and Cabin (1,320 x 1,320 ft). North-south transects were 330 feet apart on the Turkey Hill tract and 264 feet apart on the other tracts. The centerline of each transect was permanently located by a chestnut stake and rock cairn at 132-ft (2 chain) intervals. The chestnut stakes were replaced with red pine stakes in 1957 and then iron t-bars in 1977.

Along a strip 16.5 feet wide and centered on the transect line, each stem equal to or greater than the minimum stem diameter at breast height (dbh), 4.5 feet above ground, was plotted on a map, identified, and described. The 1926-27 tree descriptions included species, dbh, crown class (except on Turkey Hill), and whether the stem was part of a sprout clump. Diameters were measured to the nearest inch with a minimum diameter of 0.6 inches.

Crown class is a qualitative measure of a tree's position in the canopy relative to its neighbors (Smith 1962). The upper canopy of a forest is comprised of dominant and codominant trees (Fig. 3). Upper canopy trees have well-developed crowns that receive direct sunlight from above and partly on the side. Intermediate and suppressed trees form the lower canopy. Intermediate trees only receive direct sunlight from above and not on the sides. Suppressed trees are found under the other crown classes and receive no direct sunlight, except for occasional sunflecks. Crown class designations in 1927 were based on Fernow (1917), which are nearly identical to those used in later surveys (Smith 1962).

The surveys of 1937 and 1957 recorded the same information as in 1926-27. Individual trees were relocated using maps from the previous survey. Crown class has been recorded on all tracts, including Turkey Hill, since 1937. These surveys also recorded mortality of previously counted stems and ingrowth (stems that had grown to at least the minimum dbh since previous survey). The minimum dbh was decreased to 0.5 inches in 1957. In 1957 the total height of all dominant trees and every tenth other tree was measured with an Abney level. Trees measured for height were also examined for stem and crown defects. The defects were of form and symmetry and external injury to crown and stem. Internal defects such as heartrot were not included.

In 1967, 1977, 1987, all stems with a minimum diameter of at least 0.5 inches dbh were located and described as above, except that diameters were measured to the nearest 0.1 inch. In 1997, stems were measured using the metric system. Diameters were measured to the nearest 0.1 cm and the minimum diameter was decreased to 1.2 cm. Since 1977, the sawlog and pulpwood height of all trees and every tenth other tree has been measured to the nearest foot. In 1987 and 1997 the perpendicular distance of each stem from the centerline of the transect was measured and recorded.

Regeneration (stems < 0.5 inches dbh) has been monitored since 1977 using 1/300 acre circular plots. The center of each regeneration plot was located halfway, or 66 feet, between the cairns with stakes. Stems were tallied by species in 1-foot height classes (<1, 1-1.9, 2-2.9,…, > 9 ft tall). For this Bulletin, regeneration was categorized as either seedlings (< 4 feet tall) or saplings (> 4 ft tall and < 0.5 inches dbh). Only regeneration plots in undisturbed areas were included in the analysis.

A summer wildfire burned approximately 40% of the Turkey Hill tract in 1932. The burned area was inventoried in 1934. Mortality, ingrowth, and crown class were recorded along with the intersection of the fire boundary with the transect. Trees alive in 1926, but dead in 1934, were arbitrarily assigned to the suppressed crown class. Trees in the section that was burned were not included in the present analysis. Summaries of the effect of this wildfire on stand dynamics can be found in Ward and Stephens (1989) and Stephens and Ward (1992).

Beginning in 1957, human disturbance along each transect was recorded. Disturbances ranged from road construction during the 1930s to trail establishment. The location of the disturbances varied slightly from survey-to-survey, so the disturbances were mapped using consistent methodology in 1999. About 76% of the original 13.75 acres in the transects remained undisturbed through 1997. Areas disturbed at any time during the past 70 years were omitted from the analysis.

SPECIES GROUPS

Species are categorized into similar groups to simplify the discussion. As before, extensive tables with summaries by individual species are provided. These are found at the end of the Bulletin. Preceding these tables is a species list with their common and scientific names.

The Oak group included northern red, black, scarlet, white, and chestnut oak. The Birch group includes black, yellow, and paper birch. The Maple group includes red and sugar maple. As in much of the Connecticut forest, the

number of American beech trees is rapidly increasing in the plots. It is the sole species in the Beech group. The "Other" group includes those species that can form part of the upper canopy in a mature forest, but were found at low densities on these tracts. To fit the individual species tables on a page the following species were combined: green and white ash, slippery and American elm, and bigtooth and quaking aspen.

Minor species are those species that do not grow large at maturity and generally do not appear in the canopy except in very young stands. This group includes intolerant pioneer species (e.g., eastern red cedar and gray birch) and species that can grow and develop in the understory (e.g., flowering dogwood, blue-beech, shadbush, and hophornbeam). American chestnut is also included in the Minor species category because chestnut blight kills stems before they grow large enough to enter the upper canopy.

DENSITY

Total. Total density is the mean density of the combined species over all moisture classes. For the reader's convenience, all tables are at the end of this Bulletin. Total tree density decreased steadily between 1927-67 (Table 2, Fig. 4). Density of all species groups decreased, except Beech, which slightly increased over the period. Total density, and density of all species groups, then increased between 1967-77. This was a lag response to the period of drought and defoliation during the early 1960s that killed many of the upper canopy trees (see next section). Total density fell between 1977-87, although density of some species groups (Oak, Birch, and Beech) continued to increase during this period. Total density continued to decrease through 1997 as density fell for all species groups except Beech.

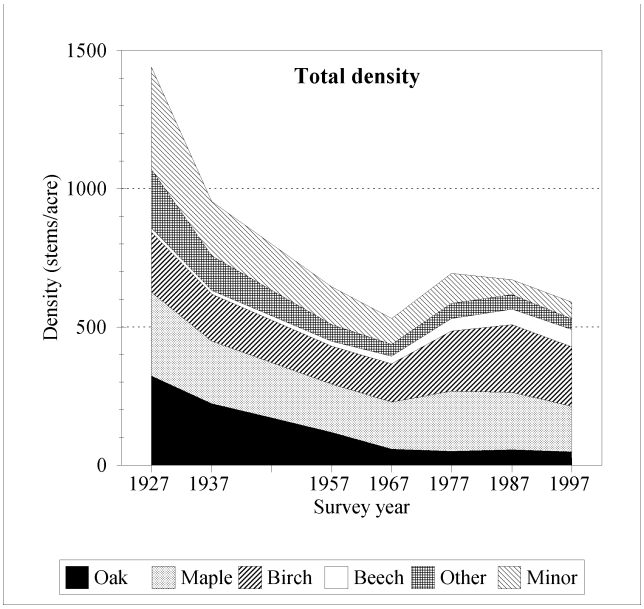

Figure 4. Total stand density (stems/acre) by species group and survey year for Old-Series plots in central Connecticut. Average over all moisture classes and plots (muck soils excluded).

Minor species exhibited a slightly different pattern during the past 70 years. As with the other species there was a gradual decrease through 1967, followed by an increase in 1977, and then a decrease through 1987. However, Minor species density increased between 1987-97. This increase can be attributed to deer browse resistant species such as blue-beech and hophornbeam.

The pattern of decreasing density, followed by a short period of increasing density, and then a gradual decrease through 1997 occurred on all moisture classes (Table 2). Maple, Birch, and Oak were predominant on all moisture classes, accounting for roughly three-quarters of the stems in 1997. Their relative importance in the plots differed by moisture class. In 1997, Oak accounted for only 4% of stems on moist sites compared with 15% on dry sites. Surprisingly, Beech also accounted for a higher percentage of stems on dry compared with moist sites, 16% vs. 9%, respectively. In contrast, Birch relative density was highest on moist sites, 42%, compared with only 31% of stems on dry sites. Other species relative density was also higher on moist than dry sites, 13% and 2% respectively. This is not surprising considering that ash, tulip poplar, and tupelo account for three-quarters of the stems in this species group and all are considered moist site species.

Within the Birch, Maple, and Oak species groups there were shifts in individual species dominance among moisture classes in 1997. Yellow birch accounted for 73%, 51%, and 7% of Birch on moist, medium, and dry sites, respectively. Sugar maple accounted for 44%, 18%, and 4% of Maple on moist, medium, and dry sites, respectively. Along the same gradient, northern red oak (as a percent of all oak) decreased from 61% to 43% to 34%. Moving from moist to dry sites, yellow birch and sugar maple were replaced by red maple and black birch. Northern red oak was still a significant component on the Oak species group on dry sites, but was found as a mixture with the other oaks.

In the preceding section we examined the net changes in stem density from decade to decade. In order to better understand the dynamics affecting net change in our forests, we can separate decade-to-decade change into three components: persistence, mortality, and ingrowth.

Persistence. Persistence is the number of stems that survive, mortality is the number of stems that die, and ingrowth is the number of new stems during a given period. Persistence is important because it conveys a sense of the population stability. Stand density will remain relatively

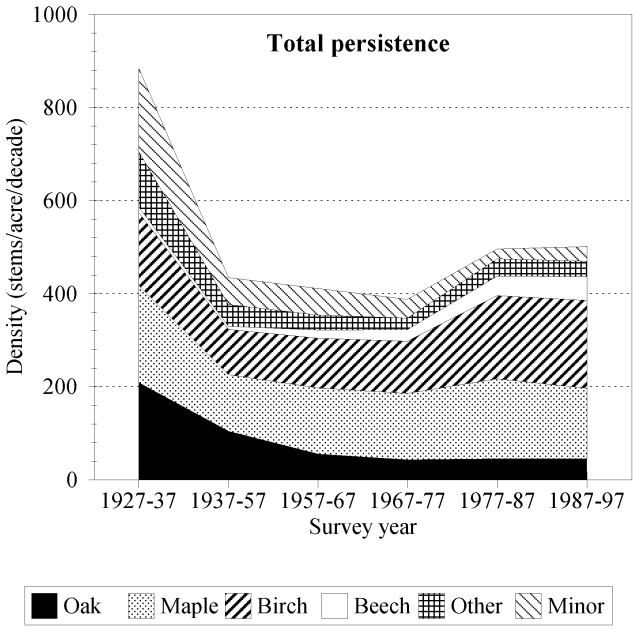

Figure 5. Persistence (stems/acre/decade) by species group and survey years for Old-Series plots in central Connecticut. Persistence includes stems that survived from one survey to the next. Average over all moisture classes and plots (muck soils excluded).

stable as long as mortality and ingrowth are nearly balanced; i.e., the population will be stable under scenarios where both mortality and ingrowth are high, or where both mortality and ingrowth are low. The first example would be a population with high turnover, the second a stable population.

To facilitate understanding, all three components of change (persistence, mortality, and ingrowth) are presented as stems/acre/decade. To do this we have converted the values of the longer 20-year period between 1937-57 to the 10-year intervals between other periods. As with total density, persistence decreased between 1927-67 (Fig. 5). However, the decrease between 1937-67 was negligible. Persistence between 1957-67 was only 11% lower than between 1957-67 (Table 3). Persistence of Maple, Birch, and Beech actually increased between 1957-67, with persistence of Birch and Beech continuing to increase through 1997. Only Maple and Other exhibited a decrease in persistence between 1987-97.

Moist and medium sites, but not dry sites, had temporal patterns similar to the overall pattern. On dry sites persistence increased steadily between 1937-87, but decreased after 1987. Oak persistence has increased on dry sites from 73 stems/acre/decade between 1967-77 to 80 stems/acre/decade between 1987-97, while remaining nearly stable on moist (19 stems/acre/decade) and medium sites (43 stems/acre/decade). Birch persistence has increased steadily on medium and dry sites since 1937, and on moist sites since 1967. In contrast, Maple persistence has declined on all moisture classes between 1987-97.

Mortality. 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, nutrients) than small trees. As individual trees grow and utilize more and more resources, one or more resources becomes limiting. Smaller trees that are not as competitive as others decline and die. Mortality is especially high for smaller trees overtopped by their larger neighbors. Large trees usually die as a result of storm damage, disease, or declining vigor. As trees become larger and larger, more of the sugars produced by the tree are needed to keep alive the massive support structures (trunk and branches) that lift the leaves above competing trees. This allows less energy for defense against insect and disease attacks. Therefore, older, larger trees are more likely to succumb to an infestation.

Total mortality declined steadily from 555 stems/acre/decade between 1927-37 to 142 stems/acre/decade between 1967-77 (Table 4). Some species, such as paper birch and bigtooth aspen, have declined in number because they are pioneer species that colonize recently disturbed areas, grow quickly, and die at a relatively young age (for trees). Mortality increased to 197 stems/acre/decade between 1977-87 before declining again. A similar temporal pattern was observed on medium and dry sites, but not on moist

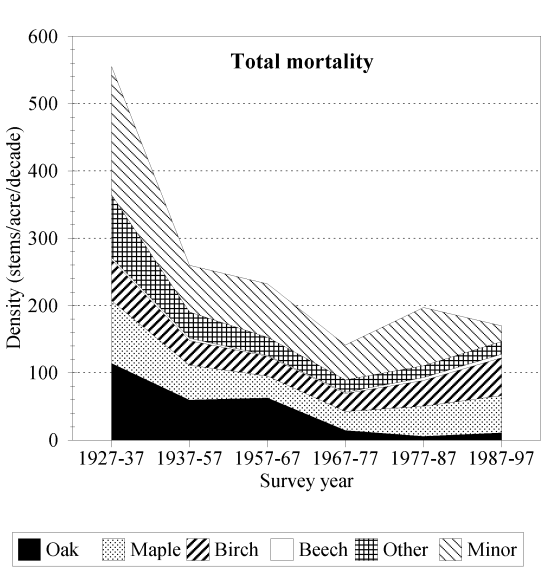

Figure 6. Mortality (stems/acre/decade) by species group and survey years for Old-Series plots in central Connecticut. Mortality includes stems that died between surveys. Average over all moisture classes and plots (muck soils excluded).

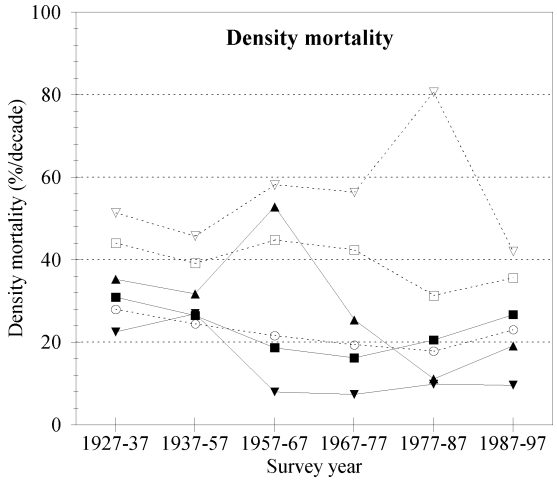

Figure 7. Mortality rate (%/decade) by species group and survey years for Old-Series plots in central Connecticut. Mortality rate is percent of stems that grew to threshold diameter between surveys. Average over all moisture classes and plots (muck soils excluded).

sites where there was no increased mortality between 1977-87.

Each species group had a unique pattern of mortality after decreasing between 1927-37 (Fig. 6). Oak mortality rose slightly between 1957-67 and then declined through 1987. Maple and Birch mortality declined through 1977 and have been steadily increasing since then. Beech mortality has been increasing steadily since 1967.

Gross mortality numbers only tell how many stems have died, not how fast the stems are dying. For example, let us imagine that the mortality of two species groups, A and B, was both 50 stems/acre/decade. If at the beginning of the period species group A had 100 stems and species group B had 1000 stems, then species group A would have a higher mortality rate (50%) than species group B (5%). These mortality rates (%/decade) are presented in Figure 7. Oak mortality rates peaked between 1957-67 at over 50% and have then declined to 11% between 1977-87. Minor species mortality rates rose steadily between 1927-87, when they peaked at over 80%. Maple and Birch mortality rates have been much more stable since 1937 and have only ranged between 16-27%.

Ingrowth. When trees die, the growing space they occupied is released. Some of the growing space is captured by neighboring trees. Leftover growing space is colonized by new seedlings that may then grow large enough (0.5 inches dbh) to be included in our surveys. These new trees are ingrowth and they form the pool of individuals that will form the future forest. With the passage of time, some of the ingrowth will survive and grow into the upper canopy. Examining the composition of the ingrowth provides us with clues as to the makeup of our future forests.

There was a striking increase in ingrowth between 1967-77 (Fig. 8). Ingrowth increased from approximately 100 stems/acre/decade before 1967 to over 300 stems/acre/decade between 1967-77, and has since declined to less than 100 stems/acre/decade (Table 5). The increase in mortality, especially oak, between 1957-67 was probably the cause of the increased ingrowth between 1967-77.

Over time there has been a gradual sorting of ingrowth by moisture class. Between 1927-37, Maple and Birch ingrowth were similar on all moisture classes. By the 1987-98 period, for every one Maple there were three Birches on moist sites, two Birches on medium sites, and slightly more than one Birch on dry sites. This suggests that future forests on moist sites will be increasingly dominated by Birch. It is also interesting to note that Oak accounts for nearly 10% of ingrowth on dry sites compared with approximately 1% on moist sites.

BASAL AREA

Total. If you were to cut a tree at 4.5 feet and calculate the area of the cut surface, you would have determined the value that foresters refer to as the basal area of that tree. Summing the basal area values of all trees provides the basal area of the forest. Basal area is closely correlated with the bulk, or volume, of the forest and gives more importance to the larger trees. For example, 196 1-inch diameter trees have the same basal area as one 14-inch diameter tree. Basal area,

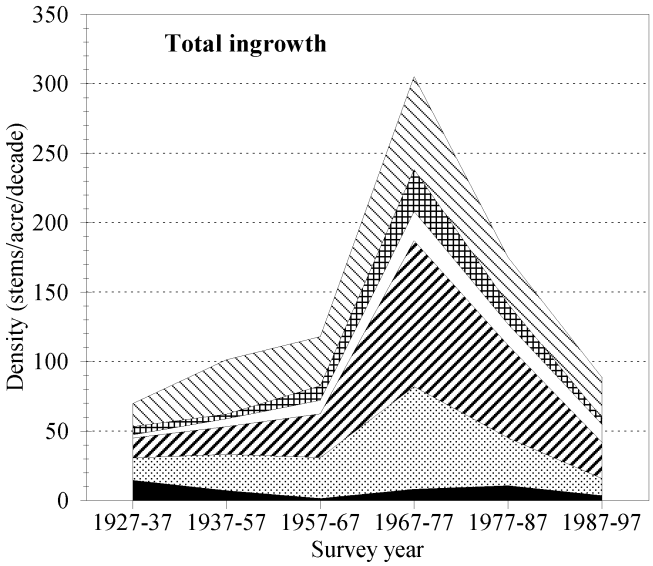

Figure 8. Ingrowth (stems/acre/decade) by species group and survey years for Old-Series plots in Central Connecticut. Ingrowth includes stems that grew to threshold diameter between surveys. Average over all moisture classes and plots (muck soils excluded).

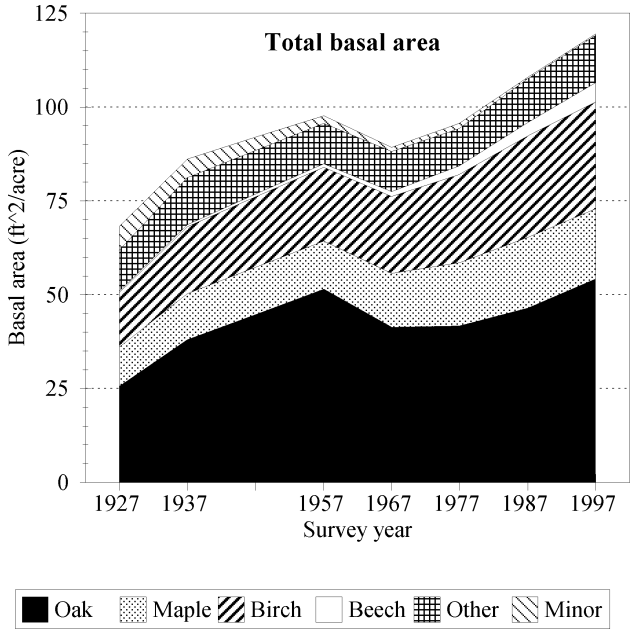

Figure 9. Total stand basal area (ft^2/acre) by species group and survey year for Old-Series plots in central Connecticut. Average over all moisture classes and plots (muck soils excluded).

because it represents the forest volume, provides a clearer picture of how the forest is being altered by processes such as mortality and persistence.

Unlike density, basal area has steadily increased since 1927, except between 1957-67, (Table 6). This indicates that, although density has been generally declining, the forest is healthy and increasingly comprised of larger trees. The proportion of Oak, Birch, and Maple basal area for the combined moisture classes has been remarkably constant over the past 70 years (Fig. 9). Although Oak only accounted for 8% of trees in 1997 (Table 2), Oak contributed over 45% of the basal area.

Moist sites not only have higher levels of soil moisture, but are generally more fertile than medium and dry sites. Therefore, it is not surprising that basal area has been higher on moist than medium sites, and on medium than dry sites, from 1927-1997. Unexpectedly, basal area increases from inventory-to-inventory were similar among soil moisture classes. For example, basal area increased by 12 ft^2/acre between 1987-97 on moist and dry sites, and 11 ft^2/acre on medium sites.

There was a marked contrast in species composition among sites, as measured by basal area (Table 6). Oak accounted for only 24% of basal area on moist sites in 1997, compared with 48% and 59% on medium and dry sites, respectively. In 1997, beech also accounted for a larger proportion of basal area on dry (9%) than moist sites (3%). Maple, Birch, and Other were predominant on moist sites, 73% of basal area, compared with dry sites, 32%.

Persistence. Basal area persistence has steadily increased from 58 ft^2/acre/decade between 1927-37 to over 100 ft^2/acre/decade between 1987-98 (Fig. 10). As with total basal area (Table 6), persistence has been higher on moist than medium, and higher on medium than dry sites (Table 7). Oak accounted for nearly half of persistence from 1927 through 1997. However, distribution of persistence among species groups has differed among soil moisture classes. Oak persistence was higher, and increased more over time, on dry than moist and medium sites. Maple and Birch persistence was twice as high on moist compared with dry sites. In contrast, basal area persistence of Beech was highest on dry and lowest on moist sites.

Mortality. There was a marked increase in basal area mortality between 1957-67, especially on medium and dry species dominated by oaks (Table 8). Oak basal area mortality increased from 4 ft^2/acre/decade between 1937-57 to nearly 17 ft^2/acre/decade for the 1957-67 period (Fig. 11). This more than offset the decreased mortality of the Maple, Other, and Minor species groups. As noted above, the increased mortality can be attributed to the period of defoliation between 1961-64. Oak basal area mortality decreased after 1967 and was less than 1 ft^2/acre/decade

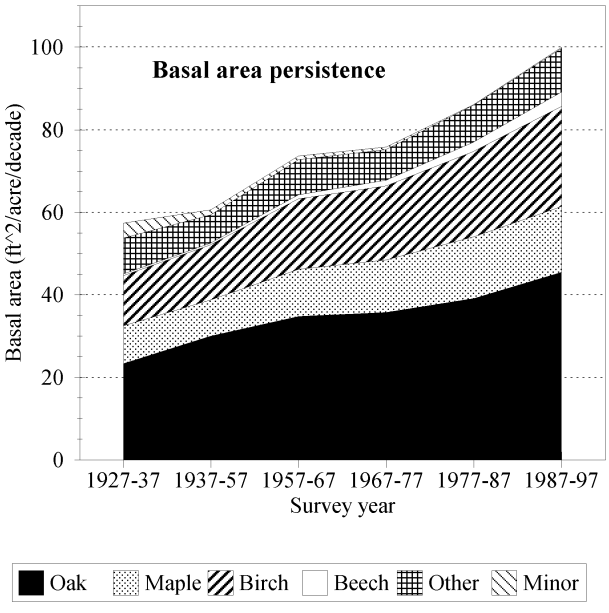

Figure 10. Basal area persistence (ft^2/acre/decade) by species group and survey years for Old-Series plots in central Connecticut. Average over all moisture classes and plots (muck soils excluded).

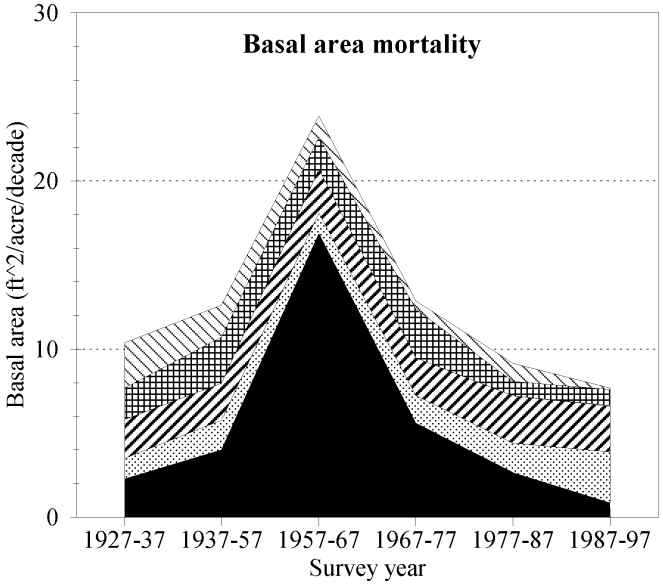

Figure 11. Basal area mortality (ft²/acre/decade) by species group and survey years for Old-Series plots in central Connecticut. Average over all moisture classes and plots (muck soils excluded).

between 1987-97. Maple and Birch mortality increased during the 1967-97 period, albeit slightly, to less than 6 ft²/acre/decade.

Accretion. Accretion is the amount of basal area added to trees that survived between surveys (e.g., between 1967 and 1977). Ingrowth trees are small by definition and contribute little to basal area. Therefore, any increase in total basal area is due to growth of the surviving trees. If accretion is greater than mortality, total basal area increases. Because basal area accretion is closely correlated with the amount of wood produced by surviving trees, it conveys a sense of forest vigor. Basal area accretion was very high between 1927-37, averaging over 28 ft²/acre/decade (Table 9). Accretion declined from 1937-67 for two reasons (Fig. 12). First, as forest stands become older, growth generally decreases to a constant level before beginning to decline. Second, the combination of defoliation and drought between 1957-67 reduced the surviving trees' vigor and the amount of energy that could be invested in new wood formation.

The period of drought and defoliation was beneficial for most of the surviving trees. As noted above, limiting resources (light, moisture, and nutrients) are released by dying trees. This allowed the surviving trees to expand their crowns and root systems. The recovery of surviving trees is illustrated in the increased accretion rates from 1967-87 (Fig. 12). Indeed, Oak and Beech accretion increased through 1997. Decreased accretion of Birch, Maple, and Other between 1987-97 was sufficient to cause a slight decline in total accretion for that period. Surprisingly, there has been little difference in accretion rates between moisture classes in these plots.

DIAMETER DISTRIBUTION

Density and basal area only tell part of the story of forest dynamics. All trees have small diameters in young, even-aged forests. Some trees grow faster than others, and a range of tree diameters develop as a stand matures. Our plots had diameter distributions typical of young stands in 1927 (Table 10). At that time, nearly 90% of stems were in the sapling size class (< 4.5 inches dbh). The few scattered poles (4.5-10.4 inches dbh) and sawtimber (> 10.5 inches dbh) were probably along old fence lines and along streams. As trees grew larger, a larger proportion moved into the pole size class. Nearly one-fourth of stems were in the pole size class by 1957. The percent of stems in the sawtimber size class has increased from less than 1% in 1927 to over 10% in 1997. Stems have continued to grow into the larger diameter classes. In 1997 there were nearly 21 stems/acre that had a diameter of >16.5 inches compared with only 4 stems/acre in 1967. Additionally, there were several stems with diameters >24 inches in 1997.

The Oak species group has dominated the larger size

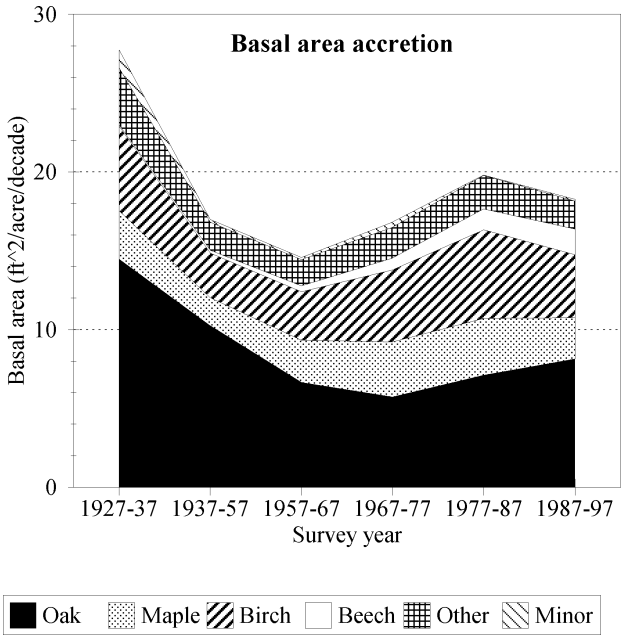

Figure 12. Basal area accretion (ft²/acre/decade) by species group and survey years for Old-Series plots in central Connecticut. Accretion is growth of trees that survived between surveys. Average over all moisture classes and plots (muck soils excluded).

classes since 1927 (Table 11), accounting for nearly half of the sawtimber in 1927 and 76% of trees with a diameter of >16.5 inches in 1997. The pole size class has become increasingly dominated by Maple and Birch. In 1997 these species accounted for fully 80% of the poles, compared with only 33% in 1927. Although Maple and Birch accounted for 65% of sapling stems in 1997, this size class was far more diverse than the larger size classes. Nearly one-third of saplings were from the Other (American beech, tupelo, sassafras) or Minor species groups (American chestnut, blue-beech, hophornbeam).

UPPER CANOPY TREES

Another way to categorize trees is by crown class (Fig. 3). As mentioned in the Methods section, upper canopy (or overstory) trees are those trees that have well developed crowns and receive direct sunlight from above and partly on the side. They are the trees you see when standing on a hill and looking out over the landscape below. Forests are often typed, especially by the casual observer, by the composition of the upper canopy. Ridgetop forests with a chestnut oak overstory, red maple subcanopy, and a lowbush blueberry shrub layer are most commonly categorized as chestnut oak forest.

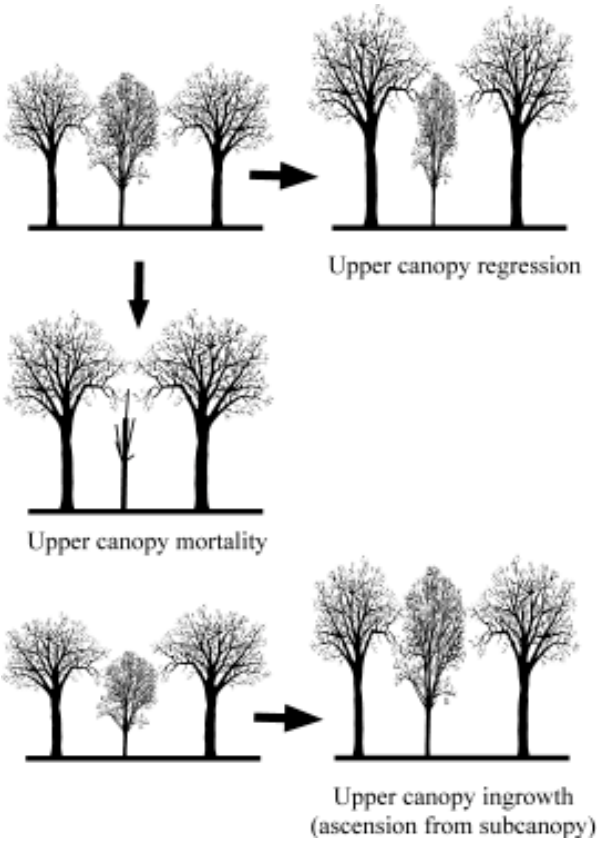

Figure 13. Schematic drawing showing upper canopy regression and ingrowth (ascension). Regression includes those trees that failed to grow fast enough to stay in the upper canopy (i.e., the tree had slower height growth than its neighbors). Upper canopy ingrowth (ascension) includes trees in the intermediate crown class that grew tall enough to form part of the upper canopy.

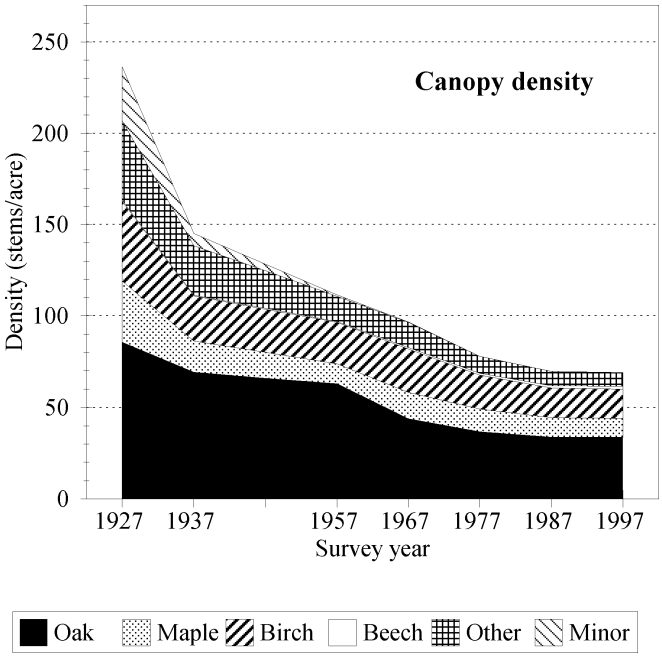

Figure 14. Upper canopy density (stems/acre) by species group and survey year for Old-Series plots in central Connecticut. Upper canopy includes trees in dominant and codominant crown classes. Average over all moisture classes and plots (muck soils excluded).

Upper canopy composition is important for several reasons. There is a direct correlation between the amount of direct sunlight a tree receives and the amount of seed produced. Therefore, the composition of the upper canopy has a direct impact on seed production. This not only affects the makeup of the seedling strata, but also the wildlife species that live in the forest. Eastern white-tailed deer and turkey consume large amounts of acorns.

Composition of the upper canopy impacts the esthetic appeal of a forest. In the fall, a forest dominated by chestnut oak will be brown, birch or hickory forests will be yellow, maple forests will be a kaleidoscope of yellow, orange, and red. The brilliant reds and oranges are mostly seen in leaves that are in direct sunlight.

Density. Upper canopy density in the Old-Series plots has steadily declined from a high of 237 stems/acre in 1927 to fewer than 69 stems/acre in 1997 (Table 12). There were

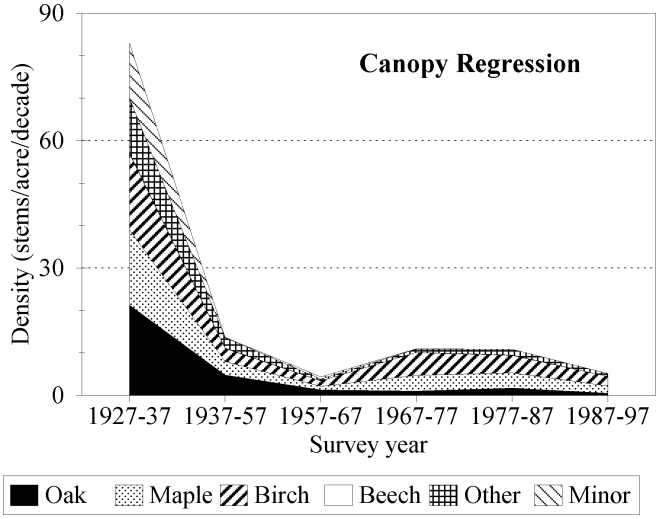

Figure 15. Upper canopy regression (stems/acre/decade) by species group and survey year for Old-Series plots in central Connecticut. Regression includes stems that moved from the upper canopy to the subcanopy. Average over all moisture classes and plots (muck soils excluded).

fewer upper canopy trees in 1997 than in 1927 because surviving trees now have larger diameters and crowns. Minor species have fallen out of the upper canopy because they are unable to grow as tall as competing oaks, birches, and other species (Figs. 13 and 14). Oak has been the predominant species group in the upper canopy since 1927. The proportion of the upper canopy that was Oak rose from 36% in 1927 to 56% in 1957. During the period of defoliation (1956-67), the proportion of Oak fell to 45%, but has since slowly risen to nearly 50%. In 1997, Maple and Birch comprised another 38% of the upper canopy.

The proportion of Oak in the upper canopy has varied among the moisture classes since 1927. The differences among moisture classes have been accentuated by 70 years of forest dynamics. Oak upper canopy density on moist sites has increased slightly from 15% in 1927 to 20% in 1997. A larger increase, from 51% to 64%, was noted on the medium sites for the same time periods. Oaks have truly come to dominate the upper canopies on dry sites, increasing from 47% in 1927 to over 75% in 1997. Maple was the dominant upper canopy species on moist sites in 1997. Birch was the second most common upper canopy species on all moisture classes.

Regression. In previous bulletins, upper canopy mortality has included true mortality (trees that died) and regression (Fig. 13). Regression includes those trees that failed to grow fast enough to stay in the upper canopy and became part of the lower canopy (i.e., the tree had slower height growth than its neighbors). For example, a 40-year-old birch in the upper canopy is 50 feet tall and surrounded by oaks that are also 50 feet tall. Over the next 20 years the birch only grows 2 feet, while the surrounding oaks grow 20 feet. Although the birch has increased its height, it has regressed into a lower canopy position because it was overtopped by the faster growing neighboring oaks. Indeed, most of the larger maples and birch that are found under the upper canopy oaks are not younger than the oaks, just slower growing.

Most upper canopy regression occurred early in stand development (Table 13). An average of 83 trees/acre regressed from the upper between 1927-37, compared with only 14 trees between 1937-57. The temporary decrease in regression between 1957-67 is probably related to the increased mortality during the same period. Regression has slowly decreased since 1967.

Oak was the major component of upper canopy regression between 1927-67 (Fig. 15). Maple and Birch, although fewer in number than Oak, have been the major component of regression since 1967. This is reflected in the percent of upper canopy trees that regressed into the lower canopy. Between 1967-77 regression rates for Oak, Maple, and Birch were 2%, 25%, and 23%, respectively. Although overall regression rates had fallen by 1987-97, regression was still lower for Oak (1%) than for Maple (16%) and Birch (13%).

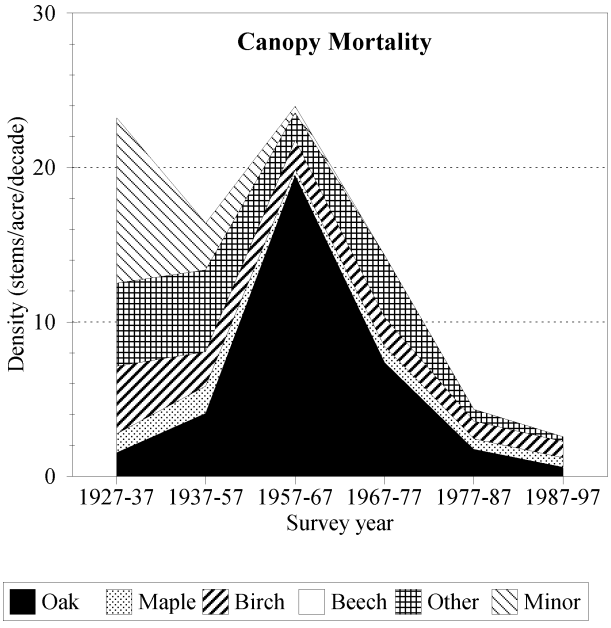

Figure 16. Upper canopy mortality (stems/acre/decade) by species group and survey year for Old-Series plots in central Connecticut. Average over all moisture classes and plots (muck soils excluded).

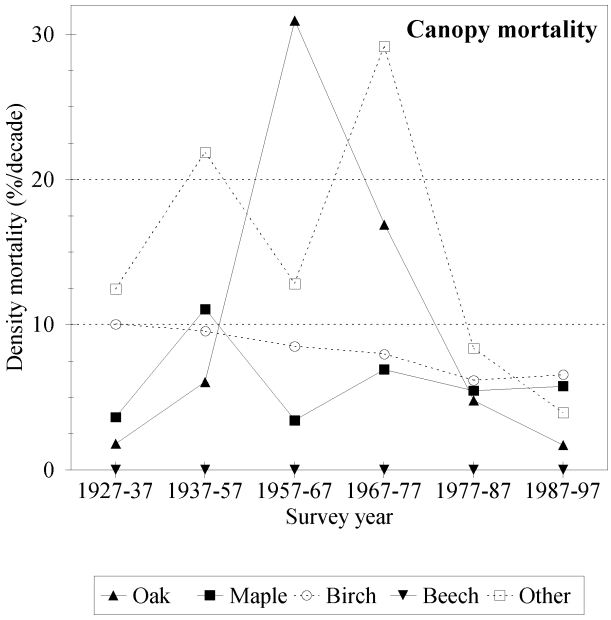

Figure 17. Upper canopy mortality rate (%/decade) by species group and survey years for Old-Series plots in central Connecticut. Ascension includes stems that moved from subcanopy to upper canopy positions between surveys. Average over all moisture classes and plots (muck soils excluded).

Mortality. Prior to the 1957-67 period, regression accounted for a larger share of trees leaving the upper canopy than did mortality. For example, between 1927-37 an average of 83 trees/acre regressed into the lower canopy and only 19 trees/acre died (Table 14). This ratio had reversed by the 1957-67 period when 24 trees/acre died compared with only 4 trees/acre that regressed. Mortality has remained higher than regression through 1997. The shift from a regression to a mortality dominated process was probably related to increasing crown size of upper canopy trees. Height growth slows as trees age, making it less likely for a tree to be overtopped by a neighbor.

Because Oak accounted for a majority of upper canopy stems on medium and dry sites, it was not surprising that upper canopy mortality greatly increased between 1957-67 (Fig. 16). Gypsy moth was the primary defoliator during this period, and it preferentially feeds on oak. Except for the 1957-67 period (31%/decade), and to a lesser extent the 1967-77 period (17%/decade), upper canopy oak mortality has been less than 7%/decade and was less than 2% between 1987-97 (Fig. 17). The intermediate level of mortality between 1967-77 probably was the loss of trees that were severely weakened during the earlier defoliations. These weakened trees did not die immediately, but began a decline spiral and became susceptible to other insects and diseases such as two-lined chestnut borer (*Agrilus bilineatus*) and shoe-string root rot (*Armillariela mellea*).

Upper canopy mortality differed among soil moisture classes (Table 14), and much of the difference could be related to oak density (Table 12). On moist sites where upper canopy Oak density was low, mortality gradually decreased from 1927-97, although there was a spike in Oak mortality between 1956-67. This was offset by decreases in Maple and Other mortality. On both medium and dry sites, Oak mortality between 1957-67 was four times greater than between 1937-57. With the decreased frequency of defoliation events after 1964, there was a subsequent decrease in Oak mortality.

Ingrowth (Ascension). Occasionally, canopy gaps are large enough to allow a tree in the intermediate crown class to move into the upper canopy (Fig. 13). This is called ingrowth into the upper canopy, or ascension from the lower canopy. Total upper canopy ingrowth was stable between 1927-1967, about 13.5 stems/acre/decade (Fig. 18). Ingrowth fell sharply to about 7 stems/acre/decade between 1967-77 and has remained stable at that level through 1997. Ironically, the sharp decrease between 1967-77 is probably linked to higher than expected levels between 1957-67. High upper canopy mortality during 1957-67 (Fig. 16)

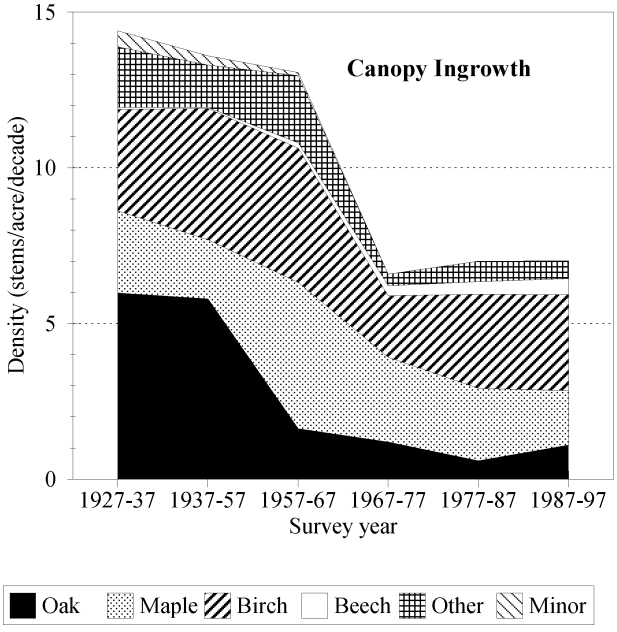

Figure 18. Upper canopy ascension or ingrowth (stems/acre/decade) by species group and survey years for Old-Series plots in central Connecticut. Ascension includes stems that moved from subcanopy to upper canopy positions between surveys. Average over all moisture classes and plots (muck soils excluded).

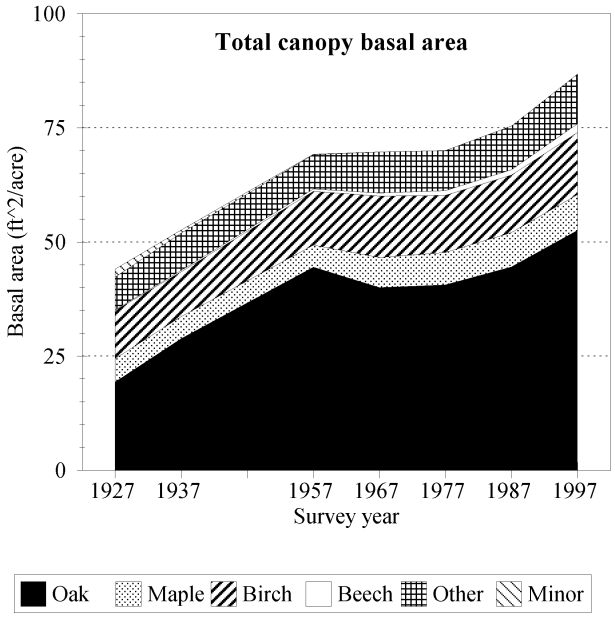

Figure 19. Upper canopy basal area (ft²/acre by species group and survey year for Old-Series plots in central Connecticut. Average over all moisture classes and plots (muck soils excluded).

provided additional growing space (light, nutrients, and moisture) for lower canopy trees and allowed some of them to move into the upper canopy. This influx of new upper canopy trees precluded other lower canopy trees from ascending to a higher position.

As with mortality and regression, upper canopy ingrowth differed among moisture classes (Table 15). Ingrowth was higher on moist than medium, and higher on medium than dry sites. Maple ingrowth was more common than Birch on moist than medium and dry sites. Oak ingrowth increased from moist to medium to dry sites. Between 1987-97, Oak only accounted for 5% of canopy ingrowth on moist sites compared with 31% on dry sites. More than 35% of upper canopy ingrowth on dry sites since 1967 has been Oak. Except for 1967-77 period, Birch has been the predominant upper canopy ingrowth species on medium sites.

Basal area. Because upper canopy trees are generally the largest trees in a forest, it is not surprising that total basal area values (Table 6) are largely a function of upper canopy basal area (Table 16). Upper canopy basal area has steadily increased for most of the past 70 years. The exception was between 1957-77 when basal area increased only slightly (Fig. 19). Upper canopy basal area actually decreased between 1957-67 on medium sites and between 1967-77 on moist sites (Table 16).

Upper canopy basal area has been increasing on all soil moisture classes for the past 20-30 years. In 1997, basal area was highest on moist (95 ft²/acre) and lowest on dry sites (79 ft²/acre). Several trends have been noted: increasing dominance by Oak on all sites, loss of Birch and Other on dry sites, and Beech increasing on the dry sites. From 1927-97, Oak has increased from 17% to 32% of the upper canopy basal area on moist sites and from 54% to 80% on dry sites. Over the same period, Birch and Other has decreased from 32% to 8% on dry sites. Concurrently, Beech increased from 4% to 7% on dry sites. Remarkably, Maple has remained relatively constant over the past 70 years on all sites.

As mentioned above, the decreased growth between 1957-67 was driven by the episodes of defoliation (Fig. 1) and extended drought (Fig. 2) during the 1960s. Upper canopy basal area loss (combined mortality and regression) increased from less than 8 ft²/acre/decade between 1937-57 to nearly 14 ft²/acre/decade between 1957-67 (Fig. 20). Basal area loss remained high through 1967-77 (13 ft²/acre/decade) before beginning to fall. For the 1987-97 period, basal area loss was only 5 ft²/acre/decade). For all individual soil moisture classes, the increased basal area loss between 1957-67 was caused by a large increase in Oak mortality (Table 17). The continued loss of upper canopy basal area on moist sites between 1967-77 can largely be attributed to Maple and Birch that regressed back into the subcanopy.

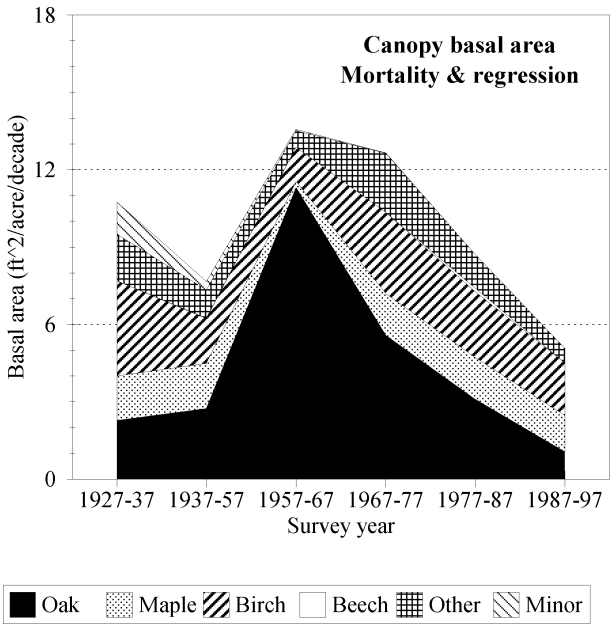

Figure 20. Upper canopy basal area mortality and regression (ft²/acre/decade) by species group and survey year for Old-Series plots in central Connecticut. Average over all moisture classes and plots (muck soils excluded).

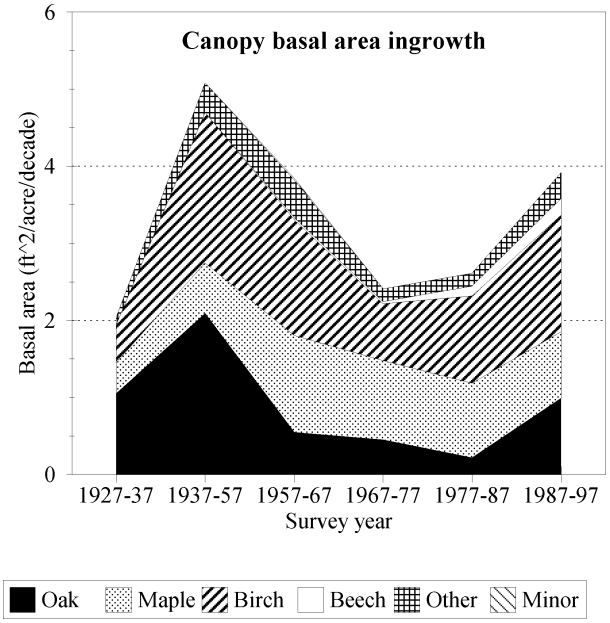

Figure 21. Combined upper canopy basal area ascension (ft²/acre/decade) by species group and survey year for Old-Series plots in central Connecticut. Average over all moisture classes and plots (muck soils excluded).

Until the 1987-97 period, upper canopy basal area ingrowth (from subcanopy trees that ascended into the upper canopy) had been a minor component of basal area change (Table 18). Ingrowth peaked at 4.3 ft²/acre/decade between 1937-57, fell to ~ 2.7 ft²/acre/decade between 1967-87, and then increased to 4.0 ft²/acre/decade between 1987-97. Since 1957, Birch and Maple have accounted for most of the upper canopy basal area ingrowth since 1957 (Fig. 21). Indeed, there has been negligible Oak ingrowth on moist sites since 1937, and Oak has been a minor component of basal area ingrowth on medium and dry sites.

SUBCANOPY TREES

Under the upper canopy are the subcanopy, or understory, trees (Fig. 3). These are trees in the intermediate and suppressed crown classes. While intermediate trees receive sunlight on the top of their crowns, the more numerous suppressed trees live completely in the shade of lower trees.

This environment is quite distinct from that experienced by upper canopy trees. Light levels can be reduced by 90% or more, and the light that does get through is of a lower quality. Humidity is generally higher, but obtaining soil moisture is constrained by the root systems of larger trees. Nutrient availability is low. Browse damage can be high, especially for the smaller saplings. Lastly, small trees can be crushed or damaged by falling branches and storm damaged trees.

In a mature forest, such as the Old-Series plots in 1997, the subcanopy forms the pool of trees from which future upper canopy trees will emerge. Most subcanopy trees grow and die before an adjacent upper canopy tree dies, creating an opening for them to ascend into the upper canopy. Surviving and growing in this environment requires a different set of attributes from those best suited for growing in an open field, a recent clearcut, or a hurricane blowdown. Understory trees need to be able to photosynthesize at low light levels and survive while growing very little. They also have to be efficient scavengers of mineral nutrients such as nitrogen, phosphorus, and iron.

Subcanopy trees have important ecological functions. The fruit of many species is utilized by small mammals and birds. The low branches of subcanopy trees are the preferred nesting site for some birds and provide cover for other animals. By filling the root gaps of larger trees, and by being efficient scavengers of nutrients, subcanopy trees recover nutrients that otherwise would be lost to natural leaching. This helps maintain site productivity.

Density. As with total density (Fig. 4), subcanopy density has had a pattern of gradual decrease, punctuated with an single period of increase (Fig. 22). Subcanopy density fell steadily from 1927 through 1967. During this 40-year period, density decreased by nearly two-thirds, from over 1202 to 433 stems/acre (Table 19). Oak, Other, and Minor species decreased by 94%, 82%, and 73%,

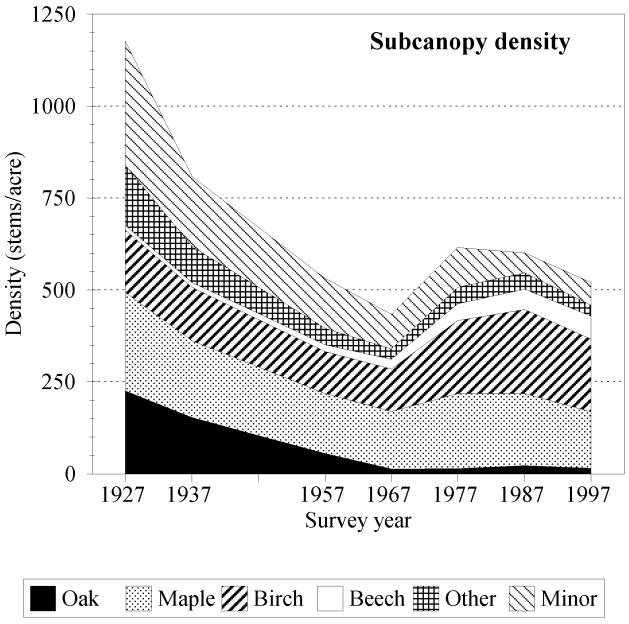

Figure 22. Subcanopy density (stems/acre) by species group and survey years for Old-Series plots in central Connecticut. Subcanopy includes trees in intermediate and suppressed crown classes. Average over all moisture classes and plots (muck soils excluded).

respectively. More modest decreases were noted by Maple (41%) and Birch (32%). Subcanopy Beech density actually increased from 14 to 26 stems/acre. Subcanopy density increased dramatically following the defoliation episodes of the early 1960s.

Between 1967-77, density increased by 42%. However, after 1977, total subcanopy density began to decrease and has continued to decrease through 1997. Maple, Other, and Minor mirrored the overall subcanopy trend and began to decline after 1997. In contrast, Oak and Birch densities continued to increase through 1987 before beginning to decline. Only Beech has continued to increase, albeit more slowly, through 1997.

The past 70 years of stand dynamics have accentuated the differences in subcanopy composition among the soil moisture classes (Table 19). Oak had virtually disappeared from the subcanopy on moist sites by 1997 (3.5 stems/acre) where it comprised less than 1% of all subcanopy density. Density of subcanopy Oak was low on dry sites, but was 10 times more numerous (37 stems/acre) and accounted for nearly 7% of stems. Absolute and relative Beech densities were higher on dry than moist sites in 1997. Beech comprised 18% of the subcanopy on dry sites (95 stems/acre), compared with only 10% on moist sites (47 stems/acre).

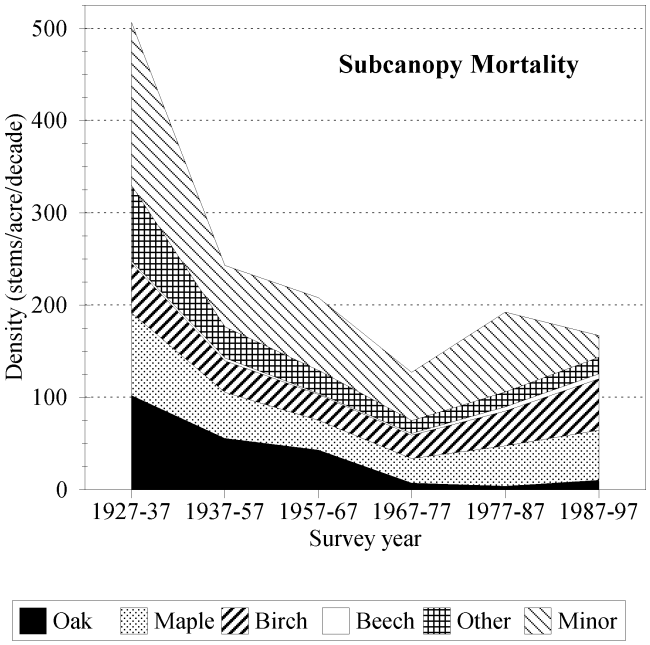

Figure 23. Subcanopy mortality (stems/acre/decade) by species group and survey year for Old-Series plots in central Connecticut. Average over all moisture classes and plots (muck soils excluded).

Mortality. Subcanopy mortality (Table 20) was higher than mortality for upper canopy trees (Table 14). As noted previously, trees in the subcanopy grow in an environment of restricted resources: low light levels, low nutrient availability, limited available root space, etc. These suboptimal conditions do not allow small trees to store the starch reserves needed to replace leaves or other parts destroyed by insects, disease, or browsing. If the damage is severe, then the tree may be unable to recover from subsequent attacks and die. Subcanopy trees that developed in canopy gaps often decline and die when the gap is closed by lateral branch extension of surviving upper canopy trees. These scenarios and others (e.g., competition) contribute to the high levels of subcanopy mortality.

Subcanopy mortality, expressed as stems/acre/decade, declined from 1927-77, then rose between 1977-87 before beginning to decline again (Fig. 23). Minor species accounted for the largest share of mortality for all periods, except between 1987-97 (Table 20). Subcanopy mortality was similar among soil moisture classes through the 1967-77 period. Since 1977, mortality has been highest on dry sites and lowest on moist sites.

An examination of mortality rates (i.e., the percent of stems that died on a per decade basis) reveals temporal patterns that were obscured by differences in initial densities. Subcanopy mortality rates of Oak, Other, and Minor species groups have been much higher than for Maple and Birch (Fig. 24). Beech mortality rates have been at least half that of other species groups since 1957.

Concurrent with the period of defoliation during the early 1960s, the mortality rate of subcanopy Oak increased to nearly 80% for the 1957-67 period. Undoubtedly, defoliation hastened the death of many subcanopy oaks. The mortality rate of the Other species group also peaked between 1957-67. This was due in part to the high mortality of hickory (63%) and ash (56%) (Table 20). The high mortality of hickory was not unexpected because it is a preferred species for gypsy moth. Ash has low palatability for gypsy moth and the cause of its high mortality is unknown. Maple and Birch are not preferred species for gypsy moth. Their mortality rates declined slightly during the period of defoliation, then increased, and by 1987-97 were at levels comparable with the predefoliation rates of 1937-57.

SEEDLINGS AND SAPLINGS

For this Bulletin, saplings are defined as trees > 4 feet tall and < 0.5 inches dbh, seedlings are < 4 feet tall. All trees begin as seedlings. The ability to produce seed that can successfully germinate, survive, and grow is essential if a species is to continue in a mature stand. Some species, such as aspen and juniper, require a high intensity disturbance (i.e., hurricane, clearcut) to remove the upper canopy before they can successfully regenerate. These species have been largely lost from our stands. Other

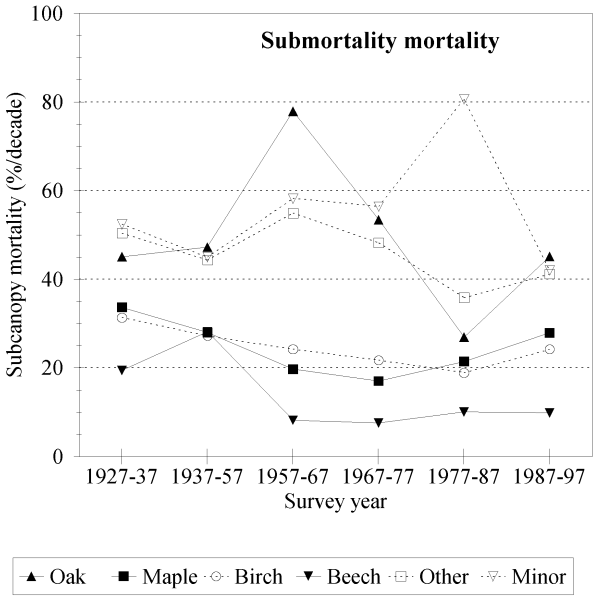

Figure 24. Subcanopy mortality rate (%/decade) by species group and survey years for Old-Series plots in central Connecticut. Mortality rate is percent of stems that died between surveys. Average over all moisture classes and plots (muck soils excluded).

species, such as Oak, require disturbances (i.e., fire, grazing, or drought) that regularly reduce the number of subcanopy trees. These species are slowly declining in our forests. Species that can successfully establish in the small gaps created by intermediate disturbances, such as Maple, Birch, and Beech, are flourishing in the Old-Series stands. Unless there is a change in the disturbance type or climate, they will likely continue to increase and will eventually dominate these stands.

Saplings. Sapling density decreased by two-thirds between 1977-97 (Fig. 25). The decrease was greater than 70% for Oak, Maple, Birch, and Other species groups (Table 21). Only for Beech was an increase in sapling density noted between 1977-97. It is likely that the high sapling densities noted in 1977 were a consequence of the defoliation during the early 1960s, and the subsequent spike in upper canopy and subcanopy mortality (Fig. 6). Similarly, subcanopy tree density has been declining since 1977 after increasing between 1967-77 (Fig. 22).

There have been notable differences in sapling densities among the soil moisture classes (Table 21). Dry sites had nearly twice as many stems as moist sites in 1977. Oak and Maple saplings were more numerous, and accounted for a larger proportion, on dry sites compared with moist sites. Other and Beech sapling densities were highest on moist sites. As with the upper canopy and subcanopy strata, composition of Birch and Maple differed among moisture classes. All of the Maple saplings on moist sites in 1997 were sugar maple, while the maples on dry sites were red maple. Medium sites had a mixture of the two species. Two-thirds of the birch on moist sites were yellow birch. Black birch was the largest component on dry sites. American chestnut and hophornbeam saplings were not found on the moist sites, but were 81% of Minor species saplings on the dry sites.

Sapling densities were similar among moisture classes in 1997 because density decreased faster on dry than moist sites. Concurrently, there were changes in species composition among moisture classes. In 1997, Maple accounted for 24% of saplings on dry sites compared with only 8% on moist sites. Oak was not found on moist sites, but accounted for approximately 7% of saplings on medium and dry sites. Beech sapling density was almost eight times higher on moist than dry sites. Thus, Beech accounted for one-third of saplings on moist sites in 1997, compared with only 3% on dry sites.

Seedlings. Seedlings (< 4 feet tall) populations are highly variable and can change rapidly from year-to-year. Oaks flower early in the spring and produce mast (large) crops of

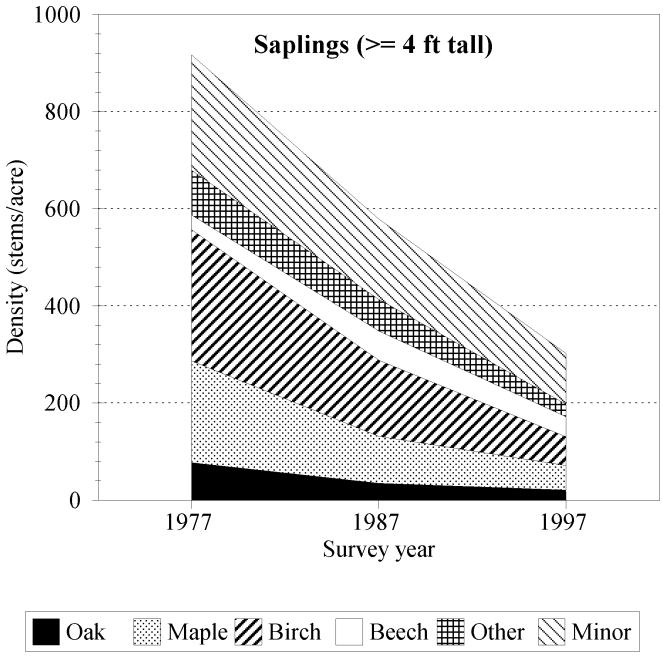

Figure 25. Sapling density (stems/acre) by species group and survey year for Old-Series plots in central Connecticut. Saplings include trees > 4-feet tall and with a diameter < 0.5 inches. Average over all moisture classes and plots (muck soils excluded).

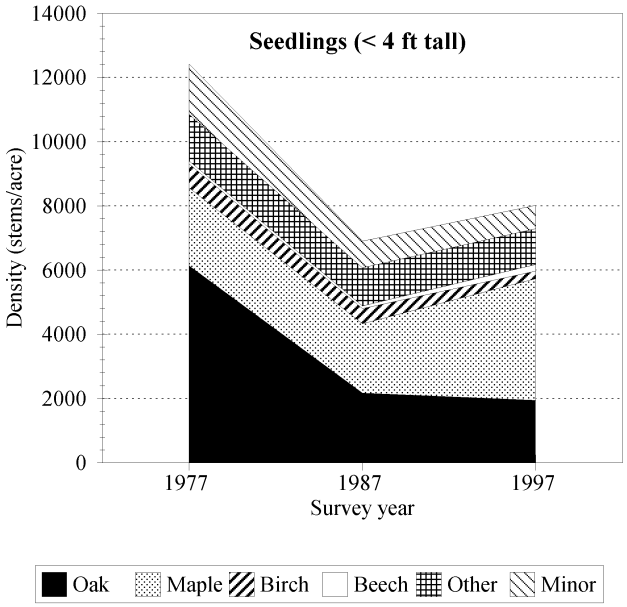

Figure 26. Seedling density (stems/acre) by species group and survey year for Old-Series plots in central Connecticut. Seedlings include trees <4-feet tall. Average over all moisture classes and plots (muck soils excluded).

acorns at 2-10 year intervals. Acorn production is often limited by late spring frosts that kill the flowers. Maples and birches produce abundant seed every year, with heavy production every several years. Seed production of different species is not synchronized. Thus, in some years many species have high seed production, while in other years many species have low seed production. More commonly, in a given year, some species have high seed production, some species have intermediate production, and the remaining species have very low seed production.

High seed production does not ensure high seedling densities. High populations of seed predators (weevils, mice, deer, etc.) can consume many, if not most, seeds before they germinate. Intact upper canopies or dense subcanopies can starve seedlings by intercepting most of the life-giving light. Because seedlings have small root systems, they are vulnerable to desiccation during drought years. Likewise, seedlings are susceptible to fungus disease during wetter than normal years. Loss of several leaves is unlikely to kill a sapling, but may well doom a seedling. Thus, seedlings have to overcome a myriad of difficulties to survive and grow into the sapling size class. Most do not.

Seedling densities were much higher than sapling, subcanopy, or upper canopy densities (Fig. 26). In 1977 there were more than 12,000 seedlings/acre. This fell to slightly less than 7000/acre in 1987 and then rose to over 8000 in 1997. Surprisingly, Oak accounted for nearly one-half of all seedlings in 1977 (Table 22). The high density of Oak seedlings was probably due to a combination of a northern red oak mast crop one or two years before the survey and the defoliations of the early 1960s. The defoliations increased light to the forest floor, increasing survival of Oak seedlings, and permitting a buildup of the Oak seedling population. Oak seedling densities declined quickly after 1977 as the crowns of upper canopy trees expanded and filled in canopy gaps. Oak seedling density in 1977 was one-third that of 1977, and only accounted for 24% of the seedling population. Birch, Other, and Minor seedling densities also decreased by over 50% between 1977-97. In contrast, seedling densities of Maple and Beech increased over the same interval by 56% and 121%, respectively.

Total seedling densities among soil moisture classes have been relatively similar. Composition of the seedling stratum has varied among moisture classes, but to a lesser extent than for the larger size classes (sapling, subcanopy, and upper canopy). Birch seedling densities differed the most among moisture classes in 1997. Density on dry sites (40 stems/acre) was 16 times lower than on moist sites (658 stems/acre). Therefore, Birch accounted for 8% of seedlings on moist sites compared with less than 1% on dry sites. Seedling density of the Other species group also declined from moist to dry sites. In contrast, Oak accounted for only 13% of seedlings on moist sites, compared with over 20% on medium and dry sites in 1997.

THE FUTURE FOREST

Seventy years of research has provided solid documentation of the dynamics of Connecticut's forests. We hope you have gained an appreciation that our forests are not static dioramas, but are constantly changing. Change will continue to be a characteristic of our forests. In the next 70 years these forests will shift from even-aged stands that arose on abandoned fields and cutover forests to uneven-aged stands as many of the trees comprising the upper canopy die and are replaced by new recruits. More specifically, the oak-dominated upper canopy will gradually be replaced by "late-successional" species such as maple, birch, and beech.

Similar to other Connecticut forests, this is the second major change in forest composition since the early 1900s. As with the shift from American chestnut to oak forests at the beginning of the century, the emergence of a forest dominated by mesic species will alter economic, ecological, and aesthetic values. The consequences of these changes will last well into the 21st Century. Oak is more economically desirable for its value (subject to the whims of furniture and cabinetry fashions), lower cull rates, and

higher per acre volume growth. The shift from oak to late-successional species will also affect many wildlife and insect populations—discriminating against species dependent on oak and favoring those species associated with maple, birch, or beech. Aesthetic effects are important because of increased public utilization of the forested landscape for both home sites and recreation. The leaves and flowers of maple and birch are more colorful than oak. However, faster growing oaks are more likely to have the "big tree" characteristics that the public associates with old growth.

Continual monitoring of these forests will enable us to more completely understand the processes that shape our forests. It will also allow us to assess any future impact to the forest caused by hurricanes or exotic pests such as beech bark disease (*Sirococcus clavigignenti-juglandacearum*/ *Nectria coccinea* var. *faginata* or *N. galligena*). The following two sections examine the impact of an exotic (chestnut blight) and a native disease (Nectria canker) on forest dynamics.

AMERICAN CHESTNUT (*Castanea dentata*)

Connecticut's American chestnut trees (*Castanea dentata*) were once abundant in our forests. At first, about half of our hardwoods were chestnut, but repeated cutting allowed these fast growing trees to dominate, shading out oaks and maples, and making the forest look like pure stands of chestnut. Most of the railroad ties and telephone poles in the state were made of chestnut, because the wood was rich in tannins and did not rot. Chestnut was used for timbers in construction, planks in wooden bridges, and as rough siding (Stoddard and Moss 1913). The annual sawmill output of chestnut lumber in Connecticut was larger than the combined cut of all other hardwoods at the turn of the century. Most of the finished chestnut lumber (49%) went into making musical instruments, such as pianos in Ivoryton and pipe organs along Long Island Sound (Pierson 1913).

The demise of Connecticut's chestnut forests. Most of our American chestnuts died of chestnut blight disease between 1907 and about 1915 (Clinton 1912). The fungus came into the United States on imported Japanese chestnut trees in the late 1800s, and was shipped all over the country by the mail-order nursery industry. The American chestnuts sprouted from the base (root collar) where the blight fungus cannot penetrate, and began a cycle of sprouting, becoming infected, dying, and sprouting again. The larger the original tree, the less likely it was to sprout; and browsing pressure from herbivores often completely killed the trees.

The first specimens of the blight fungus isolated in Connecticut came from bark sent to The Connecticut Agricultural Experiment Station in November 1907 by F.V. Stevens, Jr., of Stamford, and Stevens thought he had also seen it in "one or two other towns in the state" as well. G.H. Hollister of Keney Park, Hartford remembered seeing something similar on an estate in Greenwich in 1905, and State Forester S.N. Spring thought the disease was in Easton in 1905. By early 1912 the disease was throughout the state (Clinton 1912, Stoddard and Moss 1913).

Chestnuts in the Old-Series Plots. The first survey of the Old-Series plots in 1927 revealed many chestnut sprouts from stumps still surviving in spite of chestnut blight. The Meshomasic State Forest plots (Cabin, Cox, and Reeves) were similar to each other, with at least 100 stems measured in each at maximum. The Cockaponset State Forest plot (Turkey Hill) was distinct from the other plots and only had about 40 chestnut stems at maximum. In the Meshomasic plots, most chestnut sprouts in 1927 were in the 1-inch dbh class (135 sprouts), but in Turkey Hill there were two trees 4 and 2 inches dbh, and only six others, all in the 1-inch dbh class. Thus, the two areas will be discussed separately.

In both the undisturbed and the burned sections of Cockaponset, chestnut density peaked and stems were largest, in 1977. In the unburned section, chestnut was only found on medium sites. On the burned section, there were only a few stems on medium sites. The other chestnuts (14 stems in 1977) were on moist sites. Numbers of stems are so low that no patterns can be assumed from this data.

The median diameter of chestnut sprouts measured in the Meshomasic over the decades has remained in the 1-inch class. Maximum dbh increased to a peak of 3 to 4 inches in the 1977 measurement and then declined to about 1½ inches by the 1997 measurement. When the data for number of sprouts per acre are sorted by site class, an interesting pattern emerges. On medium sites, the number of sprouts increased to a broad peak between 1957-77 and then sharply decreased in 1987 and declined further in 1997. However, on dry sites density was higher in 1977, followed by a sharp decline. If the blight fungus kills chestnut stems more slowly on dry sites, perhaps their slower growth rate is the important factor.

On the medium sites in Cabin and Cox, numbers were slightly higher in 1997 than in 1987, suggesting an upturn in the cycle, but declined progressively in Reeves from 1977-97. This pattern was repeated on the dry sites in Cox and Reeves (there are no chestnuts on dry sites in Cabin).

These data suggest that the cycle of chestnut sprouts growing, becoming infected, and dying is about 50 years in the understory of the Old-Series plots. In a clearcut, where unlimited light allows the trees to sprout and grow rapidly, the cycle is about 10 years. If there is a significant increase in numbers and dbh in the next measurement, we may have evidence for a strong effect of tree growth rate on the infection and mortality caused by the blight fungus.

NECTRIA CANKER ON BLACK BIRCH

Black birch (*Betula lenta*) highly prized for use as a veneer, is becoming an increasingly important component of

the hardwood forests of Connecticut (Figs. 4 and 22). However, defects along the trunk caused by Nectria cankers (*Nectria galligena*) can effectively render the lumber valueless. The fungus is thought to initially infect a tree when spores are washed into open wounds in the bark during or immediately following rain. These wounds may be caused by burrowing insects, frost cracks, damage due to abrasion from crossed branches or climbing vines, cracking in the crotch of a dual-stemmed tree and/or improperly healed wounds after the death of side branches. Preliminary work has shown that once the outer bark is breached, the fungus spreads, killing the living tissue underneath. The outer covering of bark remains intact for several years. During this period, the only outward sign of infection is the flattening of the tree on the canker side where little or no new wood or bark is produced. Eventually, the dead bark sloughs off, leaving an open-faced canker. The tree produces profuse amounts of callus tissue during the summer months in an attempt to wall off the fungus. This strategy meets with variable success depending on the overall health and resistance of the tree, weather conditions, and the virulence of the attacking fungal strain. When the fungus has the advantage, the tree is quickly girdled and dies. In contrast, healthy and fast growing trees can wall off the invader with callus tissue and close over the canker.

More often there is an annual battle between tree and fungus, the advantage alternating by season. Portions of the canker are walled off during periods of rapid tree growth in late spring and early summer and parts of the callus tissue are infected anew to yield satellite cankers during fall and early spring. This process can continue for many years without resulting in the death of the host tree. We have examined a number of trees that have survived over 40 years with open-faced cankers. Because cankered trees compete with their neighbors for limiting resources (light, water, and nutrients), the long-term survival of these relatively valueless trees may be the major economic impact of this disease.

Arthur H. Graves (1919) was the first to describe Nectria canker on black birch in the United States. He reported that G.P. Clinton, from The Connecticut Agricultural Experiment Station, had found cankered birch trees in New Haven in 1906. A 1934 survey of tree diseases in Connecticut forests reported Nectria canker on 314 out of 813 plots where black birch was found (Kienholz and Bidwell 1938). Within these infected plots, the percentage of cankered trees ranged from 2% to 53% with an average of 15%.

Nectria canker on the Old-Series plots. During the 1997 survey of the Old-Series plots, the incidence and severity of Nectria canker on black birch were recorded (Table 23). There were 407 cankers on 126 infected black birch trees out of a sample of 1,560 (8%). This is considerably lower than the 21% canker incidence observed in Meshomasic State Forest on black birch in 1934 (Kienholz and Bidwell 1938). Canker incidence varied by tree age in the Old-Series plots in 1997. Only 2% of trees 50-years-old or younger were cankered compared with 22% for trees at least 95-years-old. The immediate question to answer is: why have so few cankers developed in these unmanaged plots in the last 40 years?

One might hypothesize a reduction in inoculum or some long-term climatic change to explain the low levels of canker in the last few decades. In order to test this hypothesis, Nectria canker was sampled in four clearcuts (22-29 years-old) near the Old-Series plots. Within these clearcuts, Nectria cankers were found on 22 of 374 black birch trees (6%). Two additional clearcuts (21 and 32-years-old) in Naugatuck State Forest were also assayed for Nectria canker. In these plots, cankers were found on 20 of the 130 (15%) black birch trees examined. Thus, infection rates were much higher in the clearcuts (8%) than for the same age trees growing in uncut stands (3%). This indicates that inoculum was present and climate was favorable for infection. It may be that the larger trees in the unmanaged Old-Series plots reduced Nectria canker incidence on the mostly suppressed black birch by providing shade and protection from the wind. This might be due to reduced side branching under low light conditions, as well as a reduction in bark damage due to sunscald and frost cracking.

From the epidemiological standpoint the black birch/ Nectria canker system provides some unique and exciting possibilities. Due to the long-term survival of infected trees, canker assays made at one point in time can provide considerable temporal information by determining the age of cankers. Thus, it is possible to obtain decades of epidemiological data over a relatively short period of time. Detailed examination of callus growth over the life of the tree can be used to relate infection rate to general climatic events (droughts, minimum winter temperatures, degree of snow-cover, etc.). Due to the ubiquitous presence of black birch and Nectria canker throughout Connecticut, it may be possible to examine and mathematically predict the role this disease will play in the long-term survival of black birch in our forests.

ACKNOWLEDGEMENTS

As with all long-term studies, we are indebted to the two generations of scientists and field technicians who preceded us. We thank H.W. Hicock, M.F. Morgan, J.J. Lutz, H. Bull, and H.A. Lunt for the foresight in establishing these permanent forest research plots; the Division of Forestry, Connecticut Department of Environmental Protection for preserving the study areas; J.P. Barsky, O.W. Horning, G.J. Kuhr, M.R. Short, and J. Yanzo for assisting in the 1997 field survey. A special thanks to G.R. Stephens who assisted in the 1957 survey and was the lead scientist responsible for these plots through 1995. This research was partly funded by McIntire-Stennis Project CONH-553.

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COMMON AND SCIENTIFIC NAMES OF TREES MENTIONED

Oak	
White oak	*Quercus alba*
Scarlet oak	*Quercus coccinea*
Chestnut oak	*Quercus prinus*
Northern red oak	*Quercus rubra*
Black oak	*Quercus velutina*
Maple	
Red maple	*Acer rubrum*
Sugar maple	*Acer saccharum*
Birch	
Yellow birch	*Betula alleghaniensis*
Black birch	*Betula lenta*
Paper birch	*Betula papyrifera*
Beech	
American beech	*Fagus grandifolia*
Minor	
Shadbush	*Amelanchier arborea*
Gray birch	*Betula populifolia*
Bluebeech	*Carpinus caroliniana*
American chestnut	*Castanea dentata*
Flowering dogwood	*Cornus florida*
Eastern red cedar	*Juniperus virginiana*
Hophornbeam	*Ostrya virginiana*
Other	
Bitternut hickory	*Carya cordiformis*
Pignut hickory	*Carya glabra*
Shagbark hickory	*Carya ovata*
Mockernut hickory	*Carya tomentosa*
White ash	*Fraxinus americana*
Black ash	*Fraxinus nigra*
Green ash	*Fraxinus pennsylvanica*
Butternut	*Juglans cinerea*
Tulip poplar	*Liriodendron tulipifera*
Tupelo	*Nyssa sylvatica*
Eastern white pine	*Pinus strobus*
Bigtooth aspen	*Populus grandidentata*
Quaking aspen	*Populus tremuloides*
Black cherry	*Prunus serotina*
Black locust	*Robinia pseudoacacia*
Sassafras	*Sassafras albidum*
Basswood	*Tilia americana*
Eastern hemlock	*Tsuga canadensis*
American elm	*Ulmus americana*
Slippery elm	*Ulmus rubra*
Shrub	
Mountain laurel	*Kalmia latifolia*
Witchhazel	*Hamamelis virginiana*
Winterberry	*Ilex verticillata*
Spicebush	*Lindera benzoin*
Highbush blueberry	*Vaccinium corymbosum*
Sweet pepperbush	*Clethra alnifolia*
Pink azalea	*Rhododendron nudiflorum*
Mapleleaf viburnum	*Viburnum acerifolium*
Beaked hazelnut	*Corylus cornuta*

LIST OF TABLES

Table 1. Distribution of area (acres) by tract, soil moisture class, and disturbance of Old-Series research plots after February, 1999 field recheck.

	Soil moisture class				
Tract name	Muck	Moist	Medium	Dry	Total
Turkey Hill (unburned)	0.237	0.498	1.617	0.095	2.447
Cox plots	0.000	0.535	2.049	0.649	3.233
Reeves plots	0.000	0.336	1.441	0.726	2.502
Cabin plots	0.000	0.335	1.931	0.000	2.266
Total undisturbed	0.237	1.704	7.039	1.469	10.449
Turkey hill (burned)	0.000	0.203	1.090	0.285	1.577
Other disturbance types[a]	0.060	0.206	1.154	0.303	1.723
Total area	0.297	2.112	9.283	2.057	13.750

[a]Near road, existing trail, or unauthorized cutting (firewood, horse trail, campsite).

Table 2a. Stand density (stems/acre) during 1927-1997. Average over all tracts (does not include muck). T represents < 0.1 stem/acre.

	Combined moisture classes							Moist sites						
Species	1927	1937	1957	1967	1977	1987	1997	1927	1937	1957	1967	1977	1987	1997
Eastern white pine	T	.2	.9	T	.4	.5	.5	-	.6	-	-	-	-	-
Eastern hemlock	.3	.3	.3	.3	.4	.3	.3	.6	.6	.6	.6	.6	.6	.6
Sugar maple	37.3	34.1	34.0	31.5	33.1	34.0	31.2	76.9	75.1	73.4	67.5	63.4	62.8	58.1
Red maple	265.7	191.7	140.5	139.7	184.1	172.8	132.7	262.3	187.2	125.6	103.9	103.9	100.4	72.8
Bitternut hickory	2.2	1.1	.2	T	.3	.3	.2	2.3	1.2	-	-	1.2	1.2	.6
Mockernut hickory	13.7	9.8	5.8	2.3	.7	.8	.4	4.1	1.8	.6	.6	.6	.6	.6
Pignut hickory	48.5	26.8	11.0	6.1	3.6	4.7	4.8	12.3	9.4	5.3	3.5	7.0	10.0	10.0
Shagbark hickory	10.2	7.1	4.8	2.7	1.1	1.0	.8	6.5	4.7	3.5	1.2	1.2	1.2	.6
Northern red oak	99.8	70.5	42.7	24.8	19.4	20.8	20.5	71.0	56.9	38.1	18.2	12.3	12.9	12.3
Black oak	37.6	28.7	16.7	9.2	9.3	10.7	9.0	10.6	7.0	4.1	1.8	2.3	2.3	1.8
Scarlet oak	22.3	17.0	11.9	7.2	6.0	5.5	5.2	9.4	8.8	4.7	2.3	2.3	2.3	2.3
White oak	131.5	81.9	27.3	8.6	7.1	8.8	6.8	41.1	20.0	10.6	2.3	2.3	2.9	2.3
Chestnut oak	31.3	25.2	19.6	7.3	9.0	10.3	7.3	17.0	19.4	8.2	2.9	3.5	1.2	1.2
Yellow birch	88.8	70.2	60.1	55.7	99.8	118.3	106.6	154.9	129.7	103.3	92.1	162.6	196.6	164.9
Black birch	126.6	99.2	76.1	82.6	116.9	126.8	107.9	46.4	37.6	34.6	38.1	66.3	71.6	61.0
Paper birch	.7	.6	.7	.5	.2	-	-	-	-	-	-	-	-	-
American beech	14.4	13.4	18.3	26.6	45.6	56.2	63.7	1.8	1.8	16.4	20.0	31.7	46.4	48.1
White ash	66.3	41.7	18.1	10.8	7.3	5.8	3.9	65.7	44.6	28.2	18.8	16.4	12.9	10.0
Black ash	.7	.3	-	T	-	-	-	1.8	1.2	-	-	-	-	-
Basswood	3.1	2.0	.7	.2	T	T	-	3.5	3.5	1.2	-	-	-	-
Tulip poplar	12.1	9.2	5.3	4.9	10.0	13.9	12.2	11.7	10.6	5.9	5.3	22.9	30.5	27.0
American elm	4.3	3.0	1.4	.5	T	T	T	18.2	13.5	6.5	1.8	-	-	-
Bigtooth aspen	14.3	8.4	.4	T	-	-	-	37.0	21.7	-	-	-	-	-
Tupelo	7.9	5.6	4.0	4.3	8.0	8.5	6.1	20.0	14.1	11.2	12.3	28.8	28.2	18.2
Black locust	.3	T	T	T	T	T	T	-	-	-	-	-	-	-
Butternut	4.2	1.0	-	-	T	-	-	3.5	.6	-	-	-	-	-
Black cherry	11.0	1.7	T	-	T	.6	.9	33.5	5.3	.6	-	-	-	.6
Sassafras	13.7	6.7	6.3	10.7	22.9	15.8	8.3	11.2	4.7	9.4	8.2	11.2	6.5	2.9
MAJOR SPECIES	1068.9	757.4	507.2	437.1	585.8	616.5	529.5	923.1	681.3	491.8	401.4	540.5	591.0	495.9
Eastern red cedar	3.3	.2	T	-	-	-	-	-	-	-	-	-	-	-
American chestnut	11.8	1.6	37.2	40.4	49.7	14.5	12.5	2.9	.6	11.7	8.8	14.7	4.1	1.8
Flowering dogwood	39.9	33.9	28.9	31.2	42.1	6.8	2.7	15.8	10.6	15.3	21.1	27.0	5.3	2.3
Bluebeech	187.2	99.6	51.3	17.2	11.0	18.9	23.0	275.8	156.7	96.2	38.7	25.2	37.0	31.7
Shadbush	18.1	13.6	2.7	1.2	1.2	.7	.5	25.8	20.0	3.5	1.2	2.9	.6	.6
Hophornbeam	35.0	19.5	15.5	2.4	3.2	13.7	21.7	31.1	18.8	30.5	4.1	4.1	8.8	7.0
Gray birch	74.9	28.4	.8	T	T	-	-	110.3	34.6	1.2	-	-	-	-
MINOR SPECIES	370.2	196.7	136.5	92.5	107.3	54.5	60.5	461.9	241.2	158.5	73.9	73.9	55.8	43.4
ALL SPECIES	1439.1	954.2	643.8	529.7	693.1	671.1	590.0	1385.0	922.5	650.2	475.4	614.4	646.7	539.3

Table 2b. Stand density (stems/acre) during 1927-1997. Average over all tracts (does not include muck). T represents < 0.1 stem/acre.

	Medium sites							Dry sites						
Species	1927	1937	1957	1967	1977	1987	1997	1927	1937	1957	1967	1977	1987	1997
Eastern white pine	.1	.1	1.3	.1	.6	.6	.6	-	-	-	-	-	.7	.7
Eastern hemlock	.3	.3	.3	.3	.4	.3	.3	-	-	-	-	-	-	-
Sugar maple	33.2	29.4	29.4	27.7	30.1	31.7	29.7	10.9	8.8	10.2	8.2	12.3	11.6	7.5
Red maple	262.4	192.4	140.5	140.6	190.7	176.6	135.5	285.2	194.0	157.9	177.0	245.7	238.9	188.6
Bitternut hickory	2.6	1.3	.3	.1	.1	.1	.1	-	-	-	-	-	-	-
Mockernut hickory	14.2	10.1	6.4	2.3	.7	.7	.4	22.5	17.7	8.8	4.1	.7	1.4	-
Pignut hickory	46.3	23.0	10.7	6.1	3.3	3.6	3.8	100.7	65.4	19.1	8.8	1.4	4.1	3.4
Shagbark hickory	11.6	8.0	5.7	3.7	1.3	1.1	1.0	7.5	6.1	2.0	-	-	-	-
Northern red oak	108.4	74.3	44.0	25.6	19.7	20.7	20.3	91.9	68.1	41.5	28.6	25.9	30.0	30.6
Black oak	31.8	23.9	15.1	8.5	9.1	9.5	8.4	96.7	76.9	39.5	21.1	18.4	25.9	20.4
Scarlet oak	21.5	15.5	11.6	7.1	5.4	4.5	4.7	41.5	34.0	21.8	13.6	12.9	13.6	10.9
White oak	139.8	83.4	27.3	9.0	7.1	8.2	6.4	196.7	146.4	47.0	14.3	12.9	18.4	13.6
Chestnut oak	36.4	28.0	23.6	7.5	9.2	10.7	7.5	23.8	18.4	13.6	11.6	14.3	19.1	13.6
Yellow birch	88.9	68.6	61.1	57.0	102.3	120.2	112.1	11.6	8.8	5.4	7.5	15.0	18.4	12.9
Black birch	138.9	107.1	79.1	85.0	114.6	123.7	105.6	160.7	132.7	109.6	123.2	186.5	205.6	173.6
Paper birch	1.0	.9	1.0	.7	.3	-	-	-	-	-	-	-	-	-
American beech	15.2	13.5	16.5	23.0	40.8	50.9	60.0	25.2	26.5	29.3	51.7	85.1	93.3	99.4
White ash	75.0	45.2	18.3	10.9	6.5	5.3	3.3	25.2	21.8	5.4	.7	.7	-	-
Black ash	.6	.1	-	-	-	-	-	-	-	-	.7	-	-	-
Basswood	3.7	2.0	.7	.3	.1	.1	-	-	-	-	-	-	-	-
Tulip poplar	14.5	10.7	6.1	5.7	8.7	12.4	10.9	1.4	.7	.7	.7	1.4	2.0	1.4
American elm	1.7	1.1	.4	.3	.1	.1	.1	.7	-	-	-	-	-	-
Bigtooth aspen	7.8	5.5	.6	.1	-	-	-	19.1	6.8	-	-	-	-	-
Tupelo	6.0	4.4	2.8	3.1	4.5	5.4	4.4	3.4	1.4	1.4	.7	.7	.7	-
Black locust	-	-	-	-	-	-	-	2.0	.7	.7	.7	.7	.7	.7
Butternut	3.8	.9	-	-	.1	-	-	6.8	2.0	-	-	-	-	-
Black cherry	5.7	.9	-	-	.1	.9	1.1	10.2	1.4	-	-	-	-	-
Sassafras	13.5	7.2	5.7	10.7	25.4	18.0	10.1	17.7	6.1	5.4	13.6	24.5	15.7	6.1
MAJOR SPECIES	1085.0	757.6	508.5	435.4	581.5	605.3	526.4	1161.3	844.8	519.4	486.7	659.0	699.8	583.4
Eastern red cedar	4.3	.3	.1	-	-	-	-	2.7	-	-	-	-	-	-
American chestnut	11.1	1.4	41.9	46.3	50.7	16.1	14.1	25.2	3.4	44.2	49.0	85.8	19.1	17.7
Flowering dogwood	49.6	43.5	36.4	37.9	51.9	8.4	3.3	21.1	15.0	8.8	10.9	12.9	.7	.7
Bluebeech	195.1	100.7	48.3	15.3	9.4	17.5	25.0	47.0	27.9	13.6	1.4	2.0	4.8	3.4
Shadbush	15.3	12.2	2.6	.9	.7	.9	.6	22.5	12.9	2.7	2.7	1.4	-	-
Hophornbeam	40.2	20.7	12.5	2.3	3.3	17.3	28.8	14.3	14.3	12.3	.7	2.0	2.0	4.8
Gray birch	68.3	27.1	.9	.1	-	-	-	65.4	27.2	-	-	.7	-	-
MINOR SPECIES	383.9	206.0	142.6	102.9	115.9	60.1	71.7	198.1	100.7	81.7	64.7	104.8	26.5	26.5
ALL SPECIES	1468.8	963.6	651.1	538.3	697.4	665.4	598.1	1359.4	945.5	601.1	551.4	763.8	726.3	609.9

Table 3a. Persistence (stems/acre/decade) during 1927-1997 of stems present at the beginning of each interval. Average over all tracts (does not include muck). T represents less than 0.1 stem/acre.

	Combined moisture classes						Moist sites					
SPECIES	1927 -1937	1937 -1957	1957 -1967	1967 -1977	1977 -1987	1987 -1997	1927 -1937	1937 -1957	1957 -1967	1967 -1977	1977 -1987	1987 -1997
Eastern white pine	T	-	-	T	.3	.5	-	-	-	-	-	-
Eastern hemlock	.3	.3	.3	.3	.3	.3	.6	.6	.6	.6	.6	.6
Sugar maple	30.7	22.8	28.8	27.4	29.6	29.5	67.5	49.3	62.8	57.5	57.5	55.2
Red maple	178.6	99.1	113.0	116.1	143.1	122.0	174.3	103.3	93.9	78.6	83.3	69.2
Bitternut hickory	1.1	.2	T	T	.3	T	1.2	-	-	-	1.2	-
Mockernut hickory	9.6	5.3	2.1	.5	.7	.4	1.8	.6	.6	.6	.6	.6
Pignut hickory	25.0	9.1	5.6	2.7	3.2	3.9	8.8	4.7	2.9	3.5	7.0	8.8
Shagbark hickory	7.1	4.7	2.6	1.0	.9	.7	4.7	3.5	1.2	.6	1.2	.6
Northern red oak	65.7	38.5	24.1	18.2	18.3	19.3	49.3	34.6	17.6	10.6	11.7	11.7
Black oak	27.0	15.9	9.1	8.2	8.8	8.7	7.0	3.5	1.8	1.8	2.3	1.8
Scarlet oak	16.9	11.5	7.2	5.7	5.1	4.8	8.8	4.7	2.3	2.3	2.3	2.3
White oak	77.2	24.1	8.4	5.7	5.9	6.5	20.0	7.6	2.3	1.8	2.3	2.3
Chestnut oak	22.0	14.2	6.9	4.8	7.1	6.1	15.3	7.6	2.9	1.2	1.2	1.2
Yellow birch	63.1	40.2	43.1	44.3	83.4	92.7	112.7	81.6	78.1	65.1	138.5	150.2
Black birch	92.1	56.3	63.7	67.5	94.8	95.9	36.4	23.5	29.9	32.3	57.5	56.3
Paper birch	.5	.5	.5	.2	-	-	-	-	-	-	-	-
American beech	11.2	7.1	16.8	24.7	41.1	50.8	.6	1.2	16.4	18.2	28.2	41.7
White ash	39.7	13.9	9.8	5.7	4.7	3.5	42.3	20.0	17.0	13.5	10.0	9.4
Black ash	.3	-	-	-	-	-	1.2	-	-	-	-	-
Basswood	1.9	.7	.2	T	T	-	2.9	1.2	-	-	-	-
Tulip poplar	9.1	4.7	4.7	4.8	8.4	11.0	10.0	5.3	4.7	5.3	20.0	24.6
American elm	2.7	1.4	.5	-	T	T	12.3	6.5	1.8	-	-	-
Bigtooth aspen	8.3	.3	T	-	-	-	21.7	-	-	-	-	-
Tupelo	5.0	3.3	3.2	3.8	6.9	6.1	12.9	10.0	9.4	11.7	22.9	18.2
Black locust	T	T	T	T	T	T	-	-	-	-	-	-
Butternut	.8	-	-	-	-	-	.6	-	-	-	-	-
American chestnut	.9	.4	16.9	8.0	4.3	3.5	-	-	7.0	1.8	2.3	1.2
Black cherry	1.6	T	-	-	T	.3	5.3	.6	-	-	-	-
Sassafras	6.4	2.3	3.4	5.7	11.8	6.8	4.7	1.2	4.1	2.3	5.3	2.3
MAJOR SPECIES	704.1	376.5	354.4	347.6	475.1	469.9	622.7	370.9	350.4	307.5	453.6	457.2
Eastern red cedar	.2	T	-	-	-	-	-	-	-	-	-	-
Flowering dogwood	27.9	16.9	23.3	24.8	5.5	2.6	10.6	8.8	13.5	17.6	5.3	2.3
Bluebeech	93.2	28.7	14.1	5.6	7.7	13.1	144.4	54.6	31.1	11.2	18.8	27.6
Shadbush	12.1	1.3	.8	.6	.4	.4	17.0	1.8	1.2	.6	.6	.6
Hophornbeam	17.7	9.8	1.9	1.4	2.8	11.8	15.3	12.3	4.1	2.9	4.1	5.3
Gray birch	27.9	.7	T	-	-	-	34.6	1.2	-	-	-	-
MINOR SPECIES	180.0	57.9	57.1	40.3	20.8	31.5	221.8	78.6	56.9	34.0	31.1	37.0
ALL SPECIES	884.1	434.4	411.5	388.0	495.9	501.5	844.5	449.5	407.3	341.5	484.7	494.1

Table 3b. Persistence (stems/acre/decade) during 1927-1997 of stems present at the beginning of each interval. Average over all tracts (does not include muck). T represents less than 0.1 stem/acre.

	Combined moisture classes						Moist sites					
SPECIES	1927 -1937	1937 -1957	1957 -1967	1967 -1977	1977 -1987	1987 -1997	1927 -1937	1937 -1957	1957 -1967	1967 -1977	1977 -1987	1987 -1997
Eastern white pine	.1	-	-	.1	.4	.6	-	-	-	-	-	.7
Eastern hemlock	.3	.3	.3	.3	.3	.3	-	-	-	-	-	-
Sugar maple	26.4	19.9	24.9	24.3	26.9	27.8	8.8	6.1	8.2	7.5	10.2	7.5
Red maple	178.7	99.0	114.4	117.8	146.0	124.6	183.1	94.6	128.7	151.8	198.1	170.9
Bitternut hickory	1.3	.3	.1	.1	.1	.1	-	-	-	-	-	-
Mockernut hickory	9.8	5.7	2.0	.4	.7	.4	17.7	8.8	4.1	.7	.7	-
Pignut hickory	21.6	8.2	5.7	2.8	2.8	3.1	59.9	18.4	8.2	1.4	.7	2.0
Shagbark hickory	8.0	5.7	3.6	1.3	1.0	.9	6.1	1.4	-	-	-	-
Northern red oak	70.2	39.9	24.7	18.9	18.5	19.6	63.3	36.1	28.6	23.8	25.2	26.5
Black oak	22.6	14.3	8.5	8.1	8.4	8.2	71.5	37.4	20.4	16.3	18.4	19.1
Scarlet oak	15.3	11.1	7.1	5.0	4.4	4.3	34.0	21.1	13.6	12.9	11.6	10.2
White oak	78.1	23.7	8.8	5.5	5.8	6.0	138.9	44.9	13.6	10.9	10.2	13.6
Chestnut oak	25.1	16.5	7.2	4.7	7.2	6.3	15.0	10.9	9.5	9.5	13.6	10.9
Yellow birch	62.5	38.1	42.6	47.0	85.0	95.8	8.2	2.7	4.8	6.8	12.3	11.6
Black birch	99.9	60.2	65.1	68.3	93.3	93.9	119.8	75.6	96.7	104.2	145.0	151.1
Paper birch	.7	.7	.7	.3	-	-	-	-	-	-	-	-
American beech	11.5	6.7	14.8	21.3	37.4	47.6	21.8	16.3	27.2	48.3	74.2	76.9
White ash	43.3	14.5	9.9	5.0	4.4	2.8	19.1	4.1	.7	-	-	-
Black ash	.1	-	-	-	-	-	-	-	-	-	-	-
Basswood	2.0	.7	.3	.1	.1	-	-	-	-	-	-	-
Tulip poplar	10.7	5.4	5.5	5.5	7.1	9.7	.7	.7	.7	.7	1.4	1.4
American elm	1.0	.4	.3	-	.1	.1	-	-	-	-	-	-
Bigtooth aspen	5.4	.4	.1	-	-	-	6.8	-	-	-	-	-
Tupelo	3.8	2.1	2.3	2.6	4.3	4.4	1.4	1.4	.7	.7	.7	-
Black locust	-	-	-	-	-	-	.7	.7	.7	.7	.7	.7
Butternut	.7	-	-	-	-	-	1.4	-	-	-	-	-
American chestnut	1.0	.4	19.0	9.1	4.7	4.3	1.4	.7	18.4	10.2	4.8	2.7
Black cherry	.9	-	-	-	.1	.4	.7	-	-	-	-	-
Sassafras	7.0	2.3	3.1	5.3	12.9	8.2	5.4	3.4	4.1	11.6	14.3	4.8
MAJOR SPECIES	707.1	376.2	352.0	344.8	467.4	465.1	784.2	384.6	370.3	407.8	537.1	507.8
Eastern red cedar	.3	.1	-	-	-	-	-	-	-	-	-	-
Flowering dogwood	35.1	21.3	29.0	30.0	6.5	3.1	13.6	5.4	7.5	8.2	.7	.7
Bluebeech	95.0	27.3	12.8	5.4	6.3	11.9	25.2	5.4	.7	-	2.0	2.0
Shadbush	11.1	1.0	.4	.4	.4	.4	11.6	2.0	2.0	1.4	-	-
Hophornbeam	19.7	9.8	1.7	1.1	3.0	15.5	10.9	6.8	-	.7	.7	2.0
Gray birch	26.7	.7	.1	-	-	-	25.9	-	-	-	-	-
MINOR SPECIES	188.9	60.7	63.1	46.0	20.9	35.2	88.5	20.4	28.6	20.4	8.2	7.5
ALL SPECIES	896.0	436.9	415.1	390.8	488.3	500.4	872.7	405.0	398.9	428.2	545.3	515.3

Table 4a. Periodic mortality (stems/acre/decade) during 1927-1997. Average over all tracts (does not include muck). T represents less than 0.1 stem/acre.

	Combined moisture classes						Moist sites					
SPECIES	1927 -1937	1937 -1957	1957 -1967	1967 -1977	1977 -1987	1987 -1997	1927 -1937	1937 -1957	1957 -1967	1967 -1977	1977 -1987	1987 -1997
Eastern white pine	-	T	.9	-	T	-	-	.3	-	-	-	-
Eastern hemlock	-	-	-	-	T	-	-	-	-	-	-	-
Sugar maple	6.6	5.6	5.2	4.1	3.5	4.5	9.4	12.9	10.6	10.0	5.9	7.6
Red maple	87.1	46.3	27.5	23.6	41.0	50.8	88.0	42.0	31.7	25.2	20.5	31.1
Bitternut hickory	1.1	.4	T	-	-	.2	1.2	.6	-	-	-	1.2
Mockernut hickory	4.1	2.3	3.7	1.8	-	.4	2.3	.6	-	-	-	-
Pignut hickory	23.5	8.9	5.4	3.3	.4	.8	3.5	2.3	2.3	-	-	1.2
Shagbark hickory	3.0	1.2	2.2	1.8	.2	.3	1.8	.6	2.3	.6	-	.6
Northern red oak	34.1	16.0	18.6	6.6	1.1	1.5	21.7	11.2	20.5	7.6	.6	1.2
Black oak	10.6	6.4	7.6	1.0	.5	2.0	3.5	1.8	2.3	-	-	.6
Scarlet oak	5.4	2.8	4.7	1.6	.9	.7	.6	2.1	2.3	-	-	-
White oak	54.3	28.9	18.9	2.9	1.3	2.4	21.1	6.2	8.2	.6	-	.6
Chestnut oak	9.3	5.5	12.7	2.5	1.9	4.2	1.8	5.9	5.3	1.8	2.3	-
Yellow birch	25.8	15.0	17.0	11.5	16.4	25.6	42.3	24.1	25.2	27.0	24.1	46.4
Black birch	34.5	21.4	12.3	15.2	22.1	30.9	10.0	7.0	4.7	5.9	8.8	15.3
Paper birch	.2	T	.2	.3	.2	-	-	-	-	-	-	-
American beech	3.2	3.1	1.5	2.0	4.5	5.4	1.2	.3	-	1.8	3.5	4.7
White ash	26.6	13.9	8.3	5.1	2.6	2.3	23.5	12.3	11.2	5.3	6.5	3.5
Black ash	.4	.1	-	T	-	-	.6	.6	-	-	-	-
Basswood	1.3	.6	.5	T	-	T	.6	1.2	1.2	-	-	-
Tulip poplar	3.0	2.3	.6	T	1.6	2.9	1.8	2.6	1.2	-	2.9	5.9
American elm	1.6	.8	.9	.5	-	-	5.9	3.5	4.7	1.8	-	-
Bigtooth aspen	6.0	4.1	.3	T	-	-	15.3	10.9	-	-	-	-
Tupelo	2.9	1.1	.8	.5	1.2	2.4	7.0	2.1	1.8	.6	5.9	10.0
Black locust	.2	-	-	-	-	-	-	-	-	-	-	-
Butternut	3.4	.5	-	-	T	-	2.9	.3	-	-	-	-
Black cherry	9.4	.8	T	-	-	.3	28.2	2.3	.6	-	-	-
Sassafras	7.3	2.2	2.8	5.0	11.1	9.0	6.5	1.8	5.3	5.9	5.9	4.1
MAJOR SPECIES	364.9	190.5	152.9	89.5	110.7	146.6	300.5	155.2	141.4	93.9	86.9	133.8
Eastern red cedar	3.1	T	T	-	-	-	-	-	-	-	-	-
American chestnut	10.9	.6	20.3	32.4	45.4	11.0	2.9	.3	4.7	7.0	12.3	2.9
Flowering dogwood	11.9	8.5	5.6	6.5	36.6	4.1	5.3	.9	1.8	3.5	21.7	2.9
Bluebeech	94.0	35.4	37.2	11.7	3.2	5.8	131.5	51.1	65.1	27.6	6.5	9.4
Shadbush	6.0	6.2	2.0	.6	.8	.3	8.8	9.1	2.3	.6	2.3	-
Hophornbeam	17.2	4.8	13.6	1.0	.4	1.9	15.8	3.2	26.4	1.2	-	3.5
Gray birch	47.0	13.9	.7	T	T	-	75.7	16.7	1.2	-	-	-
MINOR SPECIES	190.2	69.4	79.4	52.2	86.6	23.0	240.0	81.3	101.5	39.9	42.8	18.8
ALL SPECIES	555.0	259.9	232.3	141.7	197.2	169.6	540.5	236.5	243.0	133.8	129.7	152.6

Table 4b. Periodic mortality (stems/acre/decade) during 1927-1997. Average over all tracts (does not include muck). T represents less than 0.1 stem/acre.

	Medium sites						Dry sites					
SPECIES	1927 -1937	1937 -1957	1957 -1967	1967 -1977	1977 -1987	1987 -1997	1927 -1937	1937 -1957	1957 -1967	1967 -1977	1977 -1987	1987 -1997
Eastern white pine	-	T	1.3	-	.1	-	-	-	-	-	-	-
Eastern hemlock	-	-	-	-	.1	-	-	-	-	-	-	-
Sugar maple	6.8	4.8	4.5	3.4	3.3	3.8	2.0	1.4	2.0	.7	2.0	4.1
Red maple	83.7	46.7	26.1	22.9	44.6	52.0	102.1	49.7	29.3	25.2	47.7	68.1
Bitternut hickory	1.3	.5	.1	-	-	-	-	-	-	-	-	-
Mockernut hickory	4.4	2.2	4.4	1.8	-	.3	4.8	4.4	4.8	3.4	-	1.4
Pignut hickory	24.7	7.4	5.0	3.3	.4	.4	40.8	23.5	10.9	7.5	.7	2.0
Shagbark hickory	3.7	1.1	2.1	2.4	.3	.3	1.4	2.4	2.0	-	-	-
Northern red oak	38.2	17.2	19.3	6.7	1.3	1.1	28.6	16.0	12.9	4.8	.7	3.4
Black oak	9.2	4.8	6.5	.4	.7	1.3	25.2	19.7	19.1	4.8	-	6.8
Scarlet oak	6.1	2.2	4.5	2.1	1.0	.3	7.5	6.5	8.2	.7	1.4	3.4
White oak	61.7	29.8	18.5	3.4	1.3	2.3	57.9	50.7	33.4	3.4	2.7	4.8
Chestnut oak	11.2	5.8	16.3	2.8	2.0	4.4	8.8	3.7	4.1	2.0	.7	8.2
Yellow birch	26.4	15.3	18.5	9.9	17.3	24.4	3.4	3.1	.7	.7	2.7	6.8
Black birch	39.1	23.4	14.1	16.6	21.3	29.8	40.8	28.6	12.9	19.1	41.5	54.5
Paper birch	.3	T	.3	.4	.3	-	-	-	-	-	-	-
American beech	3.7	3.4	1.7	1.7	3.4	3.3	3.4	5.1	2.0	3.4	10.9	16.3
White ash	31.7	15.3	8.4	6.0	2.1	2.4	6.1	8.8	4.8	.7	.7	-
Black ash	.4	T	-	-	-	-	-	-	-	.7	-	-
Basswood	1.7	.6	.4	.1	-	.1	-	-	-	-	-	-
Tulip poplar	3.8	2.6	.6	.1	1.6	2.7	.7	-	-	-	-	.7
American elm	.7	.4	.1	.3	-	-	.7	-	-	-	-	-
Bigtooth aspen	2.4	2.6	.4	.1	-	-	12.3	3.4	-	-	-	-
Tupelo	2.1	1.1	.6	.6	.3	1.0	2.0	-	.7	-	-	.7
Black locust	-	-	-	-	-	-	1.4	-	-	-	-	-
Butternut	3.1	.4	-	-	.1	-	5.4	1.0	-	-	-	-
Black cherry	4.8	.4	-	-	-	.4	9.5	.7	-	-	-	-
Sassafras	6.5	2.5	2.6	5.4	12.5	9.8	12.3	1.4	1.4	2.0	10.2	10.9
MAJOR SPECIES	377.9	190.7	156.4	90.6	114.1	140.2	377.1	230.1	149.1	79.0	121.9	192.0
Eastern red cedar	4.0	T	.1	-	-	-	2.7	-	-	-	-	-
American chestnut	10.1	.5	22.9	37.2	46.0	11.8	23.8	1.4	25.9	38.8	81.0	16.3
Flowering dogwood	14.5	11.1	7.4	8.0	45.3	5.3	7.5	4.8	1.4	2.7	12.3	-
Bluebeech	100.0	36.7	35.5	9.9	3.1	5.5	21.8	11.2	12.9	1.4	-	2.7
Shadbush	4.3	5.6	2.1	.4	.3	.4	10.9	5.4	.7	1.4	1.4	-
Hophornbeam	20.5	5.5	10.8	1.1	.3	1.8	3.4	3.7	12.3	-	1.4	-
Gray birch	41.6	13.2	.7	.1	-	-	39.5	13.6	-	-	.7	-
MINOR SPECIES	194.9	72.7	79.6	56.8	95.0	24.9	109.6	40.2	53.1	44.2	96.7	19.1
ALL SPECIES	572.8	263.4	236.0	147.5	209.1	165.1	486.7	270.3	202.2	123.2	218.5	211.0

Table 5a. Periodic ingrowth (stems/acre/decade) during 1927-1997. Average over all tracts (does not include muck). T represents less than 0.1 stem/acre.

	Combined moisture classes						Moist sites					
SPECIES	1927 -1937	1937 -1957	1957 -1967	1967 -1977	1977 -1987	1987 -1997	1927 -1937	1937 -1957	1957 -1967	1967 -1977	1977 -1987	1987 -1997
Eastern white pine	T	.4	T	.3	.2	-	.6	-	-	-	-	-
Eastern hemlock	-	-	-	T	-	-	-	-	-	-	-	-
Sugar maple	3.3	5.6	2.7	5.7	4.4	1.8	7.6	12.0	4.7	5.9	5.3	2.9
Red maple	13.1	20.7	26.7	68.0	29.8	10.7	12.9	11.2	10.0	25.2	17.0	3.5
Bitternut hickory	-	-	-	.2	-	T	-	-	-	1.2	-	.6
Mockernut hickory	.2	.2	.2	.2	T	-	-	-	-	-	-	-
Pignut hickory	1.9	.9	.5	.9	1.5	.9	.6	.3	.6	3.5	2.9	1.2
Shagbark hickory	-	T	T	T	T	T	-	-	-	.6	-	-
Northern red oak	4.8	2.1	.7	1.2	2.4	1.2	7.6	1.8	.6	1.8	1.2	.6
Black oak	1.7	.4	T	1.1	1.9	.3	-	.3	-	.6	-	-
Scarlet oak	T	.2	-	.3	.4	.4	-	-	-	-	-	-
White oak	4.7	1.6	.2	1.5	2.9	.3	-	1.5	-	.6	.6	-
Chestnut oak	3.1	2.7	.5	4.2	3.1	1.3	4.1	.3	-	2.3	-	-
Yellow birch	7.1	9.9	12.6	55.5	34.9	13.9	17.0	10.9	14.1	97.4	58.1	14.7
Black birch	7.1	9.9	18.9	49.5	32.0	12.0	1.2	5.6	8.2	34.0	14.1	4.7
Paper birch	T	T	-	-	-	-	-	-	-	-	-	-
American beech	2.3	5.6	9.8	21.0	15.1	12.8	1.2	7.6	3.5	13.5	18.2	6.5
White ash	2.1	2.1	1.0	1.7	1.1	.4	2.3	4.1	1.8	2.9	2.9	.6
Black ash	-	-	T	-	-	-	-	-	-	-	-	-
Basswood	T	-	-	-	-	-	.6	-	-	-	-	-
Tulip poplar	T	.3	.2	5.2	5.5	1.3	.6	.3	.6	17.6	10.6	2.3
American elm	.3	-	-	T	-	-	1.2	-	-	-	-	-
Bigtooth aspen	T	T	-	-	-	-	-	-	-	-	-	-
Tupelo	.6	.3	1.1	4.2	1.7	-	1.2	.6	2.9	17.0	5.3	-
Butternut	.2	-	-	T	-	-	-	-	-	-	-	-
Black cherry	T	-	-	T	.5	.6	-	-	-	-	-	.6
Sassafras	.3	2.0	7.2	17.2	3.9	1.6	-	4.1	4.1	8.8	1.2	.6
MAJOR SPECIES	53.4	65.4	82.7	238.2	141.4	59.5	58.7	60.4	51.1	233.0	137.3	38.7
American chestnut	.7	18.4	23.5	41.7	10.2	9.0	.6	5.9	1.8	12.9	1.8	.6
Flowering dogwood	6.0	6.0	7.9	17.3	1.3	T	-	3.2	7.6	9.4	-	-
Bluebeech	6.4	11.3	3.1	5.4	11.2	9.9	12.3	20.8	7.6	14.1	18.2	4.1
Shadbush	1.5	.7	.4	.6	.3	T	2.9	.9	-	2.3	-	-
Hophornbeam	1.8	2.8	.5	1.9	10.9	9.9	3.5	9.1	-	1.2	4.7	1.8
Gray birch	.5	T	-	T	-	-	-	-	-	-	-	-
MINOR SPECIES	16.7	39.3	35.4	67.0	33.8	29.0	19.4	39.9	17.0	39.9	24.6	6.5
ALL SPECIES	70.1	104.7	118.2	305.1	175.2	88.5	78.1	100.4	68.1	272.9	162.0	45.2

Table 5b. Periodic ingrowth (stems/acre/decade) during 1927-1997. Average over all tracts (does not include muck). T represents less than 0.1 stem/acre.

	Medium sites						Dry sites					
SPECIES	1927 -1937	1937 -1957	1957 -1967	1967 -1977	1977 -1987	1987 -1997	1927 -1937	1937 -1957	1957 -1967	1967 -1977	1977 -1987	1987 -1997
Eastern white pine	-	.6	.1	.4	.1	-	-	-	-	-	.7	-
Eastern hemlock	-	-	-	.1	-	-	-	-	-	-	-	-
Sugar maple	3.0	4.8	2.8	5.8	4.8	1.8	-	2.0	-	4.8	1.4	-
Red maple	13.6	20.7	26.3	72.9	30.5	10.9	10.9	31.7	48.3	93.9	40.8	17.7
Bitternut hickory	-	-	-	-	-	-	-	-	-	-	-	-
Mockernut hickory	.3	.4	.3	.3	-	-	-	-	-	-	.7	-
Pignut hickory	1.4	1.2	.4	.4	.7	.7	5.4	.3	.7	-	3.4	1.4
Shagbark hickory	-	-	.1	-	.1	.1	-	.3	-	-	-	-
Northern red oak	4.1	2.1	.9	.9	2.3	.7	4.8	2.7	-	2.0	4.8	4.1
Black oak	1.3	.4	-	1.0	1.1	.1	5.4	1.0	.7	2.0	7.5	1.4
Scarlet oak	.1	.3	-	.4	.1	.4	-	.3	-	-	2.0	.7
White oak	5.3	1.8	.1	1.6	2.4	.4	7.5	1.0	.7	2.0	8.2	-
Chestnut oak	2.8	3.6	.3	4.5	3.4	1.3	3.4	1.4	2.0	4.8	5.4	2.7
Yellow birch	6.1	11.5	14.3	55.3	35.2	16.3	.7	1.4	2.7	8.2	6.1	1.4
Black birch	7.2	9.4	19.9	46.3	30.4	11.6	12.9	17.0	26.5	82.4	60.6	22.5
Paper birch	.1	.1	-	-	-	-	-	-	-	-	-	-
American beech	2.0	4.9	8.2	19.5	13.5	12.4	4.8	6.5	24.5	36.8	19.1	22.5
White ash	1.8	1.9	1.0	1.6	.9	.4	2.7	.7	-	.7	-	-
Black ash	-	-	-	-	-	-	-	-	.7	-	-	-
Basswood	-	-	-	-	-	-	-	-	-	-	-	-
Tulip poplar	-	.4	.1	3.1	5.3	1.3	-	-	-	.7	.7	-
American elm	.1	-	-	.1	-	-	-	-	-	-	-	-
Bigtooth aspen	.1	T	-	-	-	-	-	-	-	-	-	-
Tupelo	.6	.4	.9	2.0	1.1	-	-	-	-	-	-	-
Butternut	.1	-	-	.1	-	-	.7	-	-	-	-	-
Black cherry	-	-	-	.1	.7	.7	.7	-	-	-	-	-
Sassafras	.3	1.7	7.5	20.2	5.1	1.8	.7	1.0	9.5	12.9	1.4	1.4
MAJOR SPECIES	50.6	66.1	83.4	236.7	137.9	61.2	60.6	67.4	116.4	251.2	162.7	75.6
American chestnut	.4	20.7	27.3	41.6	11.4	9.8	2.0	21.8	30.6	75.6	14.3	15.0
Flowering dogwood	8.4	7.5	9.0	21.9	1.8	.1	1.4	1.7	3.4	4.8	-	-
Bluebeech	5.7	10.5	2.6	4.0	11.2	13.1	2.7	4.1	.7	2.0	2.7	1.4
Shadbush	1.1	.8	.4	.3	.4	.1	1.4	.3	.7	-	-	-
Hophornbeam	1.0	1.3	.6	2.1	14.3	13.4	3.4	2.7	.7	1.4	1.4	2.7
Gray birch	.4	T	-	-	-	-	1.4	-	-	.7	-	-
MINOR SPECIES	17.0	41.0	39.8	69.9	39.2	36.5	12.3	30.6	36.1	84.4	18.4	19.1
ALL SPECIES	67.6	107.1	123.2	306.6	177.2	97.7	72.8	98.0	152.5	335.6	181.1	94.6

Table 6a. Stand basal area (feet^2/acre) during 1927-1997. Average over all tracts (does not include muck). T represents less than 0.1 feet^2/acre.

	Combined moisture classes							Moist sites						
Species	1927	1937	1957	1967	1977	1987	1997	1927	1937	1957	1967	1977	1987	1997
Eastern white pine	T	T	T	T	T	T	T	-	T	-	-	-	-	-
Eastern hemlock	T	T	T	T	.1	.1	.2	T	T	T	.1	.2	.3	.4
Sugar maple	1.2	1.5	1.9	2.2	2.8	3.4	3.9	3.9	4.5	5.4	6.2	7.7	9.2	10.5
Red maple	9.1	10.8	10.9	12.2	14.0	15.5	14.8	18.3	21.0	19.6	20.5	20.0	23.4	23.4
Bitternut hickory	T	T	T	T	T	T	T	T	T	-	-	T	T	T
Mockernut hickory	.6	.7	.8	.5	T	T	T	T	T	T	T	T	.1	.1
Pignut hickory	1.6	1.9	1.9	1.8	.7	.8	.9	.6	.7	1.2	.9	1.1	1.3	1.5
Shagbark hickory	.6	.7	.8	.6	.2	.3	.3	.4	.5	.7	.4	.2	.3	.3
Northern red oak	8.1	12.7	19.5	19.3	19.7	22.8	27.7	5.2	9.2	16.2	14.6	13.6	16.1	19.4
Black oak	3.4	5.7	9.0	8.4	9.3	10.2	11.6	1.5	2.1	3.3	3.4	4.0	4.4	5.1
Scarlet oak	3.3	5.0	7.0	5.8	5.5	5.4	6.0	1.5	2.7	3.3	1.8	2.1	2.5	3.0
White oak	6.4	8.2	8.1	4.4	4.5	4.9	5.4	1.6	2.1	2.3	1.4	1.5	1.9	2.2
Chestnut oak	4.6	6.5	7.9	3.5	2.9	3.1	3.4	2.8	4.5	6.0	2.8	1.0	.4	.5
Yellow birch	5.3	6.6	6.8	6.4	7.5	9.6	10.1	12.6	15.1	17.0	16.4	17.0	20.0	21.1
Black birch	9.2	11.2	12.7	13.8	16.0	17.4	18.4	9.1	7.9	11.2	12.7	14.1	15.7	17.2
Paper birch	T	.1	.1	.1	T	-	-	-	-	-	-	-	-	-
American beech	.4	.5	.9	1.4	2.3	3.6	5.2	.1	.3	.7	1.1	1.6	2.5	3.4
White ash	2.8	3.3	2.7	2.6	2.3	2.1	1.9	4.1	5.1	5.4	5.6	5.3	4.3	4.0
Black ash	T	T	-	T	-	-	-	.3	.3	-	-	-	-	-
Basswood	.2	.3	.2	.1	.1	.1	-	.5	.7	.2	-	-	-	-
Tulip poplar	1.9	2.9	3.5	4.4	6.1	7.5	8.6	2.5	3.9	5.5	6.9	9.2	10.3	12.3
American elm	.2	.3	.3	T	T	T	T	1.2	1.4	1.5	.5	-	-	-
Bigtooth aspen	1.9	1.8	T	T	-	-	-	5.1	4.5	-	-	-	-	-
Tupelo	.1	.2	.2	.2	.3	.4	.4	.3	.3	.3	.5	.8	1.2	1.3
Black locust	T	T	T	T	T	T	T	-	-	-	-	-	-	-
Butternut	.3	.1	-	-	T	-	-	.3	T	-	-	-	-	-
Black cherry	.3	T	T	-	T	T	T	.9	.2	T	-	-	-	T
Sassafras	.3	.4	.3	.2	.2	.3	.3	.4	.2	.2	.1	T	.1	T
MAJOR SPECIES	62.0	81.4	95.7	88.3	94.5	107.6	119.3	73.3	87.3	100.2	95.8	99.6	113.9	125.8
Eastern red cedar	.2	T	T	-	-	-	-	-	-	-	-	-	-	-
American chestnut	T	T	.2	.3	.4	T	T	T	T	T	T	.1	T	T
Flowering dogwood	.6	.7	.7	.7	.8	.2	T	.2	.2	.3	.4	.6	.3	.2
Bluebeech	1.7	1.3	.8	.2	.1	.1	.2	2.9	2.5	2.0	.6	.2	.3	.4
Shadbush	.2	.2	T	T	T	T	T	.3	.4	T	T	T	T	T
Hophornbeam	.6	.6	.4	T	T	T	.2	1.0	1.0	.8	T	T	.1	.5
Gray birch	3.1	2.2	T	T	T	-	-	4.4	2.6	.2	-	-	-	-
MINOR SPECIES	6.6	5.1	2.2	1.3	1.4	.5	.5	8.8	6.7	3.4	1.2	1.0	.8	1.1
ALL SPECIES	68.6	86.5	97.9	89.5	95.9	108.1	119.8	82.1	94.0	103.6	97.1	100.6	114.7	126.9

Table 6b. Stand basal area (feet^2/acre) during 1927-1997. Average over all tracts (does not include muck). T represents less than 0.1 feet^2/acre.

	Medium sites							Dry sites						
Species	1927	1937	1957	1967	1977	1987	1997	1927	1937	1957	1967	1977	1987	1997
Eastern white pine	.1	.1	T	T	T	T	T	-	-	-	-	-	T	T
Eastern hemlock	T	T	T	T	.1	.1	.1	-	-	-	-	-	-	-
Sugar maple	.8	1.0	1.4	1.6	2.1	2.6	3.0	.1	.1	.2	.2	.5	.6	.7
Red maple	7.7	9.2	9.7	11.1	13.3	14.3	13.1	5.6	6.5	6.6	8.2	10.1	12.0	12.7
Bitternut hickory	T	T	T	T	T	T	T	-	-	-	-	-	-	-
Mockernut hickory	.7	.8	1.0	.6	T	.1	.1	.7	.9	.9	.7	T	T	-
Pignut hickory	1.5	1.7	1.9	1.9	.6	.7	.8	3.3	4.2	2.7	2.3	.8	.6	.6
Shagbark hickory	.7	.9	1.0	.8	.3	.3	.3	.2	.2	.1	-	-	-	-
Northern red oak	9.5	14.5	21.6	21.2	21.8	25.1	30.5	4.6	8.4	13.6	15.4	16.4	19.9	24.1
Black oak	3.3	5.5	8.8	8.4	9.6	10.3	11.5	5.9	10.7	16.7	14.2	13.9	16.5	19.7
Scarlet oak	3.6	5.2	7.2	6.0	5.2	4.9	5.6	3.7	6.6	10.1	9.5	10.5	10.9	11.4
White oak	7.1	8.8	8.6	4.8	4.8	5.3	5.9	8.3	12.4	12.2	6.0	6.3	6.5	6.9
Chestnut oak	5.5	7.7	9.2	3.5	3.1	3.3	3.8	2.2	2.6	3.9	3.9	4.1	5.0	5.0
Yellow birch	4.5	5.8	5.6	5.2	6.6	8.9	9.3	.5	.6	.6	.6	.7	.9	.8
Black birch	9.4	11.9	13.1	14.0	16.0	17.5	18.6	8.4	11.3	12.4	14.4	18.2	18.8	19.0
Paper birch	.1	.2	.2	.2	.1	-	-	-	-	-	-	-	-	-
American beech	.2	.3	.5	.8	1.6	2.8	4.4	1.6	1.9	3.3	4.3	6.1	8.5	10.7
White ash	2.8	3.2	2.5	2.4	2.0	2.0	1.8	1.2	1.4	.4	.1	T	-	-
Black ash	T	T	-	-	-	-	-	-	-	-	T	-	-	-
Basswood	.2	.2	.3	.2	.2	.2	-	-	-	-	-	-	-	-
Tulip poplar	2.1	3.2	3.7	4.7	6.4	8.1	9.2	T	.2	.4	.5	.9	1.3	1.6
American elm	T	T	T	T	T	T	T	T	-	-	-	-	-	-
Bigtooth aspen	1.2	1.3	.1	T	-	-	-	1.4	1.0	-	-	-	-	-
Tupelo	.1	.2	.1	.2	.2	.3	.3	T	T	T	T	T	T	-
Black locust	-	-	-	-	-	-	-	T	T	.2	.2	.3	.5	.6
Butternut	.3	.1	-	-	T	-	-	.2	T	-	-	-	-	-
Black cherry	.1	T	-	-	T	T	T	.2	T	-	-	-	-	-
Sassafras	.3	.5	.4	.2	.2	.3	.3	.2	.1	.1	.2	.3	.4	.2
MAJOR SPECIES	62.1	82.5	97.0	88.0	94.4	107.2	118.9	48.6	69.5	84.5	80.7	89.4	102.3	114.0
Eastern red cedar	.3	T	T	-	-	-	-	.2	-	-	-	-	-	-
American chestnut	T	T	.2	.3	.5	.1	T	.1	T	.2	.2	.5	T	T
Flowering dogwood	.8	.9	.9	.8	1.0	.2	T	.2	.3	.2	.2	.3	T	T
Bluebeech	1.7	1.3	.7	.2	T	.1	.1	.7	.3	.1	T	T	T	T
Shadbush	.2	.2	T	T	T	T	T	.2	.3	.1	.2	T	-	-
Hophornbeam	.6	.5	.3	T	T	T	.1	.3	.3	.2	T	T	T	T
Gray birch	2.9	2.2	T	T	-	-	-	2.2	1.5	-	-	T	-	-
MINOR SPECIES	6.6	5.2	2.2	1.4	1.6	.5	.4	3.9	2.7	.8	.6	.9	T	.1
ALL SPECIES	68.7	87.7	99.2	89.4	95.9	107.7	119.3	52.6	72.1	85.3	81.4	90.3	102.4	114.1

Table 7a. Basal area (ft^2/acre/decade) at the beginning of an interval persisting throughout the interval. Average over all tracts (does not include muck). T represents less than 0.1 stem/acre.

	Combined moisture classes						Moist sites					
SPECIES	1927 -1937	1937 -1957	1957 -1967	1967 -1977	1977 -1987	1987 -1997	1927 -1937	1937 -1957	1957 -1967	1967 -1977	1977 -1987	1987 -1997
Eastern white pine	T	-	-	T	T	T	-	-	-	-	-	-
Eastern hemlock	T	T	T	T	T	.1	T	T	T	.1	.2	.3
Sugar maple	1.1	1.2	1.8	2.1	2.7	3.4	3.4	3.5	5.2	6.1	7.6	9.1
Red maple	8.0	7.5	9.7	10.6	12.2	12.6	16.2	13.5	17.0	16.4	18.7	19.2
Bitternut hickory	T	T	T	T	T	T	T	-	-	-	T	-
Mockernut hickory	.5	.6	.4	T	T	T	T	T	T	T	T	.1
Pignut hickory	1.3	1.3	1.5	.6	.7	.8	.5	.6	.8	.9	1.1	1.3
Shagbark hickory	.6	.6	.5	.2	.2	.2	.4	.4	.3	.2	.2	.3
Northern red oak	7.4	10.3	16.0	16.7	19.0	22.8	4.8	7.8	12.0	11.3	13.2	16.1
Black oak	3.1	4.9	7.0	7.9	8.8	9.9	1.4	1.8	2.8	3.4	4.0	4.4
Scarlet oak	3.0	4.2	5.0	4.7	4.6	5.1	1.5	1.8	1.5	1.8	2.1	2.5
White oak	5.6	5.5	3.8	3.9	4.2	4.7	1.3	1.7	1.2	1.3	1.5	1.9
Chestnut oak	4.3	5.1	2.9	2.5	2.6	3.0	2.8	3.8	2.4	.9	.3	.4
Yellow birch	4.7	4.9	5.5	5.6	6.9	8.8	11.1	12.7	14.2	13.6	16.0	18.1
Black birch	7.5	8.4	11.4	12.4	13.8	15.4	5.7	7.5	10.6	11.8	13.0	14.6
Paper birch	T	T	.1	T	-	-	-	-	-	-	-	-
American beech	.4	.4	.9	1.3	2.2	3.5	.1	.3	.7	1.0	1.6	2.4
White ash	2.4	1.9	2.3	1.9	1.8	1.7	3.6	3.8	4.8	4.6	3.7	3.6
Black ash	T	-	-	-	-	-	.3	-	-	-	-	-
Basswood	.2	.1	.1	.1	.1	-	.5	.2	-	-	-	-
Tulip poplar	1.8	1.8	3.5	4.4	5.7	7.2	2.4	2.7	5.4	6.9	7.9	10.3
American elm	.2	.2	T	-	T	T	1.2	1.1	.4	-	-	-
Bigtooth aspen	1.3	T	T	-	-	-	3.4	-	-	-	-	-
Tupelo	.1	.1	.2	.2	.3	.3	.2	.2	.3	.5	.8	1.0
Black locust	T	T	T	T	T	T	-	-	-	-	-	-
Butternut	T	-	-	-	-	-	T	-	-	-	-	-
Black cherry	T	T	-	-	T	T	.1	T	-	-	-	-
Sassafras	.2	.2	.1	T	.2	.2	.1	T	T	T	T	T
MAJOR SPECIES	54.0	59.6	72.9	75.5	86.2	99.9	61.1	63.6	79.8	80.9	92.1	105.5
Eastern red cedar	T	T	-	-	-	-	-	-	-	-	-	-
Flowering dogwood	.5	.4	.5	.6	.1	T	.2	.2	.2	.4	.3	.2
American chestnut	T	T	T	T	T	T	-	-	T	T	T	T
Bluebeech	1.0	.5	.2	T	T	.1	1.7	1.1	.5	.1	.2	.3
Shadbush	.1	T	T	T	T	T	.2	T	T	T	T	T
Hophornbeam	.4	.3	T	T	T	T	.7	.6	T	T	T	.1
Gray birch	1.6	T	T	-	-	-	1.9	T	-	-	-	-
MINOR SPECIES	3.7	1.3	.9	.7	.3	.3	4.7	2.1	.9	.5	.5	.6
ALL SPECIES	57.7	60.9	73.8	76.3	86.5	100.1	65.8	65.6	80.7	81.5	92.6	106.1

Table 7b. Basal area (ft^2/acre/decade) at the beginning of an interval persisting throughout the interval. Average over all tracts (does not include muck). T represents less than 0.1 stem/acre.

	Combined moisture classes						Moist sites					
SPECIES	1927 -1937	1937 -1957	1957 -1967	1967 -1977	1977 -1987	1987 -1997	1927 -1937	1937 -1957	1957 -1967	1967 -1977	1977 -1987	1987 -1997
Eastern white pine	.1	-	-	T	T	T	-	-	-	-	-	T
Eastern hemlock	T	T	T	T	T	.1	-	-	-	-	-	-
Sugar maple	.8	.9	1.3	1.5	2.0	2.6	T	.1	.2	.2	.4	.6
Red maple	6.7	6.7	8.8	9.9	11.3	11.5	4.5	4.5	5.9	7.4	9.2	10.0
Bitternut hickory	T	T	T	T	T	T	-	-	-	-	-	-
Mockernut hickory	.5	.7	.5	T	T	T	.6	.7	.7	T	T	-
Pignut hickory	1.2	1.4	1.5	.5	.6	.7	2.7	1.9	2.1	.8	.5	.5
Shagbark hickory	.7	.7	.7	.3	.3	.3	.2	.1	-	-	-	-
Northern red oak	8.6	11.7	17.7	18.6	21.0	25.1	4.3	6.5	12.5	13.8	16.3	19.9
Black oak	3.0	4.8	7.0	8.2	8.9	9.8	5.5	9.0	12.0	11.9	13.9	16.5
Scarlet oak	3.3	4.4	5.1	4.5	4.2	4.7	3.6	6.0	8.2	9.3	9.3	9.8
White oak	6.2	5.7	4.2	4.2	4.5	5.1	7.7	9.1	5.3	5.4	5.7	6.0
Chestnut oak	5.2	6.0	3.0	2.7	2.8	3.3	1.8	2.4	2.9	3.0	4.1	4.4
Yellow birch	4.0	4.0	4.4	4.8	5.9	8.2	.5	.4	.6	.6	.7	.7
Black birch	8.0	8.6	11.5	12.3	14.0	15.6	7.2	8.3	11.7	13.2	13.8	15.6
Paper birch	T	.1	.2	T	-	-	-	-	-	-	-	-
American beech	.2	.2	.5	.8	1.6	2.8	1.5	1.8	3.2	4.3	6.0	8.1
White ash	2.3	1.8	2.1	1.7	1.7	1.6	1.0	.3	T	-	-	-
Black ash	T	-	-	-	-	-	-	-	-	-	-	-
Basswood	.2	.2	.2	.1	.2	-	-	-	-	-	-	-
Tulip poplar	2.0	1.9	3.7	4.6	6.1	7.7	T	.2	.4	.5	.9	1.3
American elm	T	T	T	-	T	T	-	-	-	-	-	-
Bigtooth aspen	1.0	T	T	-	-	-	.8	-	-	-	-	-
Tupelo	.1	.1	.1	.1	.2	.3	T	T	T	T	T	-
Black locust	-	-	-	-	-	-	T	T	.2	.2	.3	.5
Butternut	.1	-	-	-	-	-	T	-	-	-	-	-
Black cherry	T	-	-	-	T	T	T	-	-	-	-	-
Sassafras	.3	.2	.1	T	.2	.2	T	T	T	.1	.2	.1
MAJOR SPECIES	54.7	60.3	72.7	75.3	85.7	99.7	42.3	51.5	65.9	70.7	81.7	94.0
Eastern red cedar	T	T	-	-	-	-	-	-	-	-	-	-
American chestnut	T	T	T	T	T	T	T	T	T	T	T	T
Flowering dogwood	.7	.5	.7	.7	.2	T	.2	.1	.2	.2	T	T
Bluebeech	.9	.4	.2	T	T	T	.2	T	T	-	T	T
Shadbush	.1	T	T	T	T	T	.1	T	.1	T	-	-
Hophornbeam	.4	.3	T	T	T	T	.2	.1	-	T	T	T
Gray birch	1.6	T	T	-	-	-	1.2	-	-	-	-	-
MINOR SPECIES	3.8	1.3	1.0	.8	.3	.2	2.0	.4	.4	.3	T	T
ALL SPECIES	58.5	61.6	73.7	76.1	86.0	100.0	44.3	51.9	66.3	71.0	81.7	94.0

Table 8a. Periodic basal area mortality (ft^2/acre/decade) during 1927-1997. Average over all tracts (does not include muck). T represents less than 0.1 ft^2/acre.

	Combined moisture classes						Moist sites					
SPECIES	1927 -1937	1937 -1957	1957 -1967	1967 -1977	1977 -1987	1987 -1997	1927 -1937	1937 -1957	1957 -1967	1967 -1977	1977 -1987	1987 -1997
Eastern white pine	-	T	T	-	T	-	-	T	-	-	-	-
Eastern hemlock	-	-	-	-	T	-	-	-	-	-	-	-
Sugar maple	.1	.1	T	T	T	T	.4	.5	.2	.1	.2	.1
Red maple	1.2	1.6	1.2	1.6	1.7	3.0	2.2	3.8	2.6	4.1	1.3	4.3
Bitternut hickory	T	T	T	-	-	T	T	T	-	-	-	T
Mockernut hickory	.1	T	.4	.5	-	T	T	T	-	-	-	-
Pignut hickory	.3	.3	.4	1.2	T	T	T	T	.4	-	-	T
Shagbark hickory	T	T	.3	.4	T	T	T	T	.4	.2	-	T
Northern red oak	.7	1.2	3.5	2.6	.7	T	.4	.7	4.3	3.4	.4	T
Black oak	.3	.4	2.0	.5	.5	.3	.1	.2	.4	-	-	T
Scarlet oak	.3	.4	2.0	1.1	.9	.3	T	.5	1.8	-	-	-
White oak	.8	1.3	4.3	.5	.3	.2	.2	.2	1.1	T	-	T
Chestnut oak	.3	.7	5.0	1.0	.3	.1	T	.4	3.6	1.9	.7	-
Yellow birch	.6	.8	1.3	.8	.6	.8	1.5	1.2	2.8	2.8	1.0	1.9
Black birch	1.7	1.4	1.3	1.5	2.2	1.9	3.4	.2	.6	.8	1.0	1.1
Paper birch	T	T	T	T	T	-	-	-	-	-	-	-
American beech	T	T	T	T	T	T	T	T	-	T	T	T
White ash	.4	.7	.4	.6	.4	.3	.4	.7	.6	1.0	1.5	.6
Black ash	T	T	-	T	-	-	T	.1	-	-	-	-
Basswood	T	T	T	T	-	.1	T	.3	.2	-	-	-
Tulip poplar	T	.6	T	T	.4	.3	T	.6	.1	-	1.3	T
American elm	T	T	.2	T	-	-	T	.1	1.1	.5	-	-
Bigtooth aspen	.6	.9	T	T	-	-	1.8	2.3	-	-	-	-
Tupelo	T	T	T	T	T	T	T	T	T	T	T	.2
Black locust	T	-	-	-	-	-	-	-	-	-	-	-
Butternut	.2	T	-	-	T	-	.3	T	-	-	-	-
Black cherry	.2	T	T	-	-	T	.7	T	T	-	-	-
Sassafras	.1	T	.2	T	T	.1	.3	T	.1	T	T	T
MAJOR SPECIES	8.1	10.9	22.8	12.7	8.3	7.7	12.2	11.9	20.4	14.9	7.6	8.4
Eastern red cedar	.2	T	T	-	-	-	-	-	-	-	-	-
American chestnut	T	T	.1	.2	.4	T	T	T	T	T	.1	T
Flowering dogwood	.1	.2	.1	.1	.7	.1	T	T	T	T	.3	.2
Bluebeech	.8	.4	.6	.2	T	T	1.2	.7	1.6	.5	T	T
Shadbush	T	T	T	T	T	T	T	.2	T	T	T	-
Hophornbeam	.2	.1	.4	T	T	T	.3	.2	.7	T	-	T
Gray birch	1.4	1.1	T	T	T	-	2.5	1.3	.2	-	-	-
MINOR SPECIES	2.9	1.9	1.3	.6	1.1	.2	4.1	2.3	2.6	.7	.5	.2
ALL SPECIES	10.9	12.8	24.2	13.3	9.4	8.0	16.3	14.2	22.9	15.6	8.1	8.6

Table 8b. Periodic basal area mortality (ft^2/acre/decade) during 1927-1997. Average over all tracts (does not include muck). T represents less than 0.1 ft^2/acre.

	Medium sites						Dry sites					
SPECIES	1927 -1937	1937 -1957	1957 -1967	1967 -1977	1977 -1987	1987 -1997	1927 -1937	1937 -1957	1957 -1967	1967 -1977	1977 -1987	1987 -1997
Eastern white pine	-	T	T	-	T	-	-	-	-	-	-	-
Eastern hemlock	-	-	-	-	T	-	-	-	-	-	-	-
Sugar maple	T	T	T	T	T	T	T	T	T	T	T	T
Red maple	.9	1.3	.9	1.2	2.0	2.9	1.2	1.0	.8	.8	.9	2.0
Bitternut hickory	T	T	T	-	-	-	-	-	-	-	-	-
Mockernut hickory	.2	T	.5	.6	-	T	T	.1	.3	.7	-	T
Pignut hickory	.3	.2	.3	1.4	T	T	.6	1.1	.6	1.6	.3	T
Shagbark hickory	T	T	.3	.5	T	T	T	T	.1	-	-	-
Northern red oak	.9	1.4	3.9	2.6	.8	T	.3	.9	1.0	1.6	T	T
Black oak	.3	.3	1.8	.2	.7	.4	.5	.9	4.7	2.3	-	T
Scarlet oak	.3	.4	2.1	1.5	1.1	.2	.2	.3	2.0	.2	1.2	1.1
White oak	.9	1.5	4.5	.6	.3	.2	.7	1.6	6.9	.5	.6	.5
Chestnut oak	.3	.9	6.2	.8	.3	T	.4	.1	1.0	.9	T	.5
Yellow birch	.5	.9	1.2	.4	.6	.6	T	T	T	T	T	.2
Black birch	1.4	1.6	1.6	1.6	2.0	1.9	1.2	1.5	.8	1.3	4.4	3.2
Paper birch	T	T	T	.1	.1	-	-	-	-	-	-	-
American beech	T	T	T	T	T	T	T	T	T	T	T	.4
White ash	.5	.7	.4	.7	.3	.4	.1	.5	.4	.1	T	-
Black ash	T	T	-	-	-	-	-	-	-	T	-	-
Basswood	T	T	T	T	-	.2	-	-	-	-	-	-
Tulip poplar	.1	.7	T	T	.2	.4	T	-	-	-	-	T
American elm	T	T	T	T	-	-	T	-	-	-	-	-
Bigtooth aspen	.3	.6	T	T	-	-	.6	.5	-	-	-	-
Tupelo	T	T	T	T	T	T	T	-	T	-	-	T
Black locust	-	-	-	-	-	-	T	-	-	-	-	-
Butternut	.1	T	-	-	T	-	.1	T	-	-	-	-
Black cherry	T	T	-	-	-	T	.2	T	-	-	-	-
Sassafras	T	.1	.3	.1	T	.1	.2	T	T	T	T	.3
MAJOR SPECIES	7.4	11.1	24.3	12.7	8.7	7.4	6.4	9.0	18.6	10.0	7.7	8.4
Eastern red cedar	.2	T	T	-	-	-	.2	-	-	-	-	-
American chestnut	T	T	.1	.2	.4	T	.1	T	.1	.2	.5	T
Flowering dogwood	.2	.2	.2	.2	.9	.1	T	T	T	T	.3	-
Bluebeech	.7	.4	.5	.1	T	T	.4	.1	T	T	-	T
Shadbush	T	T	T	T	T	T	T	.1	T	.1	T	-
Hophornbeam	.2	.1	.3	T	T	T	T	T	.2	-	T	-
Gray birch	1.3	1.1	T	T	-	-	.9	.7	-	-	T	-
MINOR SPECIES	2.8	2.0	1.2	.6	1.3	.3	1.9	1.1	.4	.4	.9	T
ALL SPECIES	10.2	13.1	25.6	13.3	10.0	7.7	8.3	10.1	19.0	10.4	8.6	8.5

Table 9a. Periodic accretion (ft^2/acre/decade) during 1927-1997 on stems persisting through each interval. Average over all tracts (does not include muck). T represents less than 0.1 ft^2/acre.

	Combined moisture classes						Moist sites					
SPECIES	1927 -1937	1937 -1957	1957 -1967	1967 -1977	1977 -1987	1987 -1997	1927 -1937	1937 -1957	1957 -1967	1967 -1977	1977 -1987	1987 -1997
Eastern white pine	T	-	-	T	T	T	-	-	-	-	-	-
Eastern hemlock	T	T	T	T	T	T	T	T	T	T	T	.1
Sugar maple	.3	.3	.3	.6	.7	.5	1.0	.8	.9	1.6	1.6	1.3
Red maple	2.7	1.5	2.3	2.9	2.9	2.0	4.8	3.0	3.4	3.4	3.9	3.5
Bitternut hickory	T	T	T	T	T	T	T	-	-	-	T	-
Mockernut hickory	.2	.1	T	T	T	T	-	T	T	T	T	T
Pignut hickory	.5	.3	.4	T	T	.1	.2	.3	.2	.2	.2	.2
Shagbark hickory	.2	.1	T	T	T	T	T	.1	T	T	T	T
Northern red oak	5.3	4.3	3.3	3.0	3.8	4.7	4.4	4.2	2.7	2.3	2.9	3.3
Black oak	2.6	2.0	1.4	1.3	1.4	1.6	.7	.7	.6	.6	.5	.7
Scarlet oak	2.0	1.4	.9	.7	.8	.7	1.2	.8	.4	.3	.4	.6
White oak	2.5	1.2	.6	.5	.7	.7	.7	.3	.2	.2	.4	.3
Chestnut oak	2.1	1.4	.5	.3	.4	.5	1.7	1.1	.4	T	.1	.1
Yellow birch	1.8	.8	.8	1.4	2.4	1.2	3.7	2.0	1.9	2.6	3.5	2.9
Black birch	3.6	2.1	2.2	3.1	3.2	2.9	2.2	1.7	2.0	2.1	2.6	2.5
Paper birch	T	T	T	T	-	-	-	-	-	-	-	-
American beech	.1	.2	.4	.8	1.3	1.6	.2	.1	.3	.5	.8	1.0
White ash	.9	.4	.3	.3	.2	.2	1.5	.8	.8	.7	.5	.3
Black ash	T	-	-	-	-	-	-	-	-	-	-	-
Basswood	T	T	T	T	T	-	.2	-	-	-	-	-
Tulip poplar	1.1	.8	1.0	1.6	1.8	1.4	1.5	1.4	1.5	2.3	2.3	2.0
American elm	T	T	T	-	T	T	.2	.2	T	-	-	-
Bigtooth aspen	.5	T	T	-	-	-	1.1	-	-	-	-	-
Tupelo	T	T	T	T	T	T	.1	T	.2	.2	.4	.3
Black locust	T	T	T	T	T	T	-	-	-	-	-	-
Butternut	T	-	-	-	-	-	-	-	-	-	-	-
Black cherry	T	T	-	-	T	T	T	T	-	-	-	-
Sassafras	.1	T	T	T	.1	T	T	T	T	T	T	T
MAJOR SPECIES	26.9	16.9	14.6	16.7	20.0	18.3	25.7	17.7	15.5	17.0	20.1	19.3
Eastern red cedar	-	T	-	-	-	-	-	-	-	-	-	-
American chestnut	-	-	T	.1	T	T	-	-	T	T	T	T
Flowering dogwood	.2	T	T	.2	T	T	T	T	T	.2	T	-
Bluebeech	.3	.1	T	T	T	T	.7	.3	T	T	.1	.1
Shadbush	T	T	T	T	T	T	.2	T	T	-	T	-
Hophornbeam	.1	T	T	T	T	T	T	T	T	T	T	.4
Gray birch	.5	T	T	-	-	-	.7	T	-	-	-	-
MINOR SPECIES	1.2	.3	.2	.4	.1	.2	1.8	.4	.2	.2	.2	.5
ALL SPECIES	28.1	17.1	14.8	17.0	20.1	18.5	27.4	18.2	15.7	17.3	20.3	19.8

Table 9b. Periodic accretion (ft^2/acre/decade) during 1927-1997 on stems persisting through each interval. Average over all tracts (does not include muck). T represents less than 0.1 ft^2/acre.

	Medium sites						Dry sites					
SPECIES	1927 -1937	1937 -1957	1957 -1967	1967 -1977	1977 -1987	1987 -1997	1927 -1937	1937 -1957	1957 -1967	1967 -1977	1977 -1987	1987 -1997
Eastern white pine	T	-	-	T	T	T	-	-	-	-	-	T
Eastern hemlock	T	T	T	T	T	T	-	-	-	-	-	-
Sugar maple	.3	.2	.3	.5	.6	.5	T	T	T	T	.2	T
Red maple	2.3	1.3	2.1	2.9	2.7	1.6	2.0	.5	2.1	2.3	2.7	2.5
Bitternut hickory	T	T	T	T	T	T	-	-	-	-	-	-
Mockernut hickory	.3	.2	T	T	T	T	.3	.1	T	T	T	-
Pignut hickory	.4	.2	.4	T	T	.1	1.4	.4	.3	T	T	T
Shagbark hickory	.2	.1	T	T	T	T	T	T	-	-	-	-
Northern red oak	5.8	4.5	3.5	3.3	4.1	5.1	4.1	3.5	2.8	2.6	3.6	4.1
Black oak	2.5	1.9	1.4	1.3	1.4	1.6	5.2	3.8	2.2	2.1	2.5	2.5
Scarlet oak	1.9	1.4	.9	.6	.7	.5	3.0	2.1	1.4	1.2	1.6	1.6
White oak	2.5	1.3	.7	.5	.7	.8	4.7	1.6	.6	.6	.8	.9
Chestnut oak	2.5	1.5	.5	.3	.4	.6	.7	.7	.6	.6	.9	.5
Yellow birch	1.7	.6	.8	1.4	2.6	1.0	T	T	T	T	.2	T
Black birch	3.8	2.2	2.2	3.2	3.2	2.8	4.0	1.9	2.6	4.0	4.0	3.3
Paper birch	T	T	T	T	-	-	-	-	-	-	-	-
American beech	T	.1	.3	.7	1.2	1.6	.4	.6	.8	1.4	2.4	2.5
White ash	.9	.3	.3	.2	.2	.2	.4	T	T	-	-	-
Black ash	T	-	-	-	-	-	-	-	-	-	-	-
Basswood	T	T	T	T	T	-	-	-	-	-	-	-
Tulip poplar	1.2	.9	1.0	1.7	1.9	1.4	T	.1	.1	.2	.3	.3
American elm	T	T	-	-	T	T	-	-	-	-	-	-
Bigtooth aspen	.4	T	T	-	-	-	.2	-	-	-	-	-
Tupelo	T	T	T	T	T	T	-	T	-	-	T	-
Black locust	-	-	-	-	-	-	T	T	T	.1	.1	.1
Butternut	T	-	-	-	-	-	T	-	-	-	-	-
Black cherry	T	-	-	-	T	T	-	-	-	-	-	-
Sassafras	.2	T	T	T	.1	.1	T	T	T	.1	.1	T
MAJOR SPECIES	27.3	17.0	14.6	16.9	20.1	18.1	26.7	15.5	13.8	15.4	19.4	18.6
Eastern red cedar	-	T	-	-	-	-	-	-	-	-	-	-
American chestnut	-	-	.1	.2	T	T	-	-	T	.2	T	T
Flowering dogwood	.2	.1	.1	.2	T	T	T	T	T	T	T	-
Bluebeech	.3	T	T	T	T	T	T	T	-	-	T	T
Shadbush	T	T	T	T	-	T	.1	T	T	T	-	-
Hophornbeam	.1	T	T	T	T	T	T	T	-	-	T	T
Gray birch	.6	T	T	-	-	-	.3	-	-	-	-	-
MINOR SPECIES	1.2	.3	.3	.4	.1	.1	.5	T	.2	.3	T	T
ALL SPECIES	28.5	17.2	14.8	17.3	20.2	18.2	27.2	15.6	13.9	15.6	19.4	18.6

Table 10a. Diameter distribution (stems/acre) during 1927-1997. Average over all tracts (does not include muck). T represents less than 0.1 stem/acre.

	Combined moisture classes							Moist sites						
Diameter class (inches)	1927	1937	1957	1967	1977	1987	1997	1927	1937	1957	1967	1977	1987	1997
0.5-2.4	1026.5	528.2	332.5	297.2	457.9	426.9	356.1	921.9	480.0	330.4	239.4	395.5	406.7	308.1
2.5-4.4	267.3	219.3	113.4	79.3	89.0	93.1	79.5	289.9	211.9	116.8	71.0	69.8	83.9	75.1
4.5-6.4	87.4	106.9	73.5	47.9	42.7	45.9	44.8	99.2	122.1	72.8	45.8	35.8	39.9	35.2
6.5-8.4	33.3	50.0	45.2	34.1	31.7	28.8	30.0	39.9	52.8	51.6	39.3	32.3	30.5	30.5
8.5-10.4	14.2	27.9	31.5	23.0	21.3	20.4	18.5	20.0	25.8	29.9	25.8	27.0	22.9	19.4
10.5-12.4	5.1	11.9	22.7	18.9	16.5	17.3	17.3	5.9	18.2	20.5	21.7	19.4	21.7	24.6
12.5-14.4	2.9	5.6	12.9	12.9	12.9	12.7	12.7	4.1	8.2	11.2	12.9	14.7	15.3	17.0
14.5- 16.4	1.5	2.3	6.8	8.2	9.6	10.5	10.3	3.5	1.2	11.7	8.8	8.8	10.6	8.2
16.5- 18.4	.5	1.3	2.8	4.3	5.6	5.6	7.8	-	2.3	1.8	6.5	3.5	4.7	9.4
18.5-20.4	.2	.8	1.5	2.1	3.1	4.3	4.9	-	-	2.3	1.8	4.1	4.7	3.5
>= 20.5	T	-	.9	1.8	2.7	5.5	8.0	.6	-	1.2	2.3	3.5	5.9	8.2
All classes	1439.1	954.2	643.8	529.7	693.1	671.1	590.0	1385.0	922.5	650.2	475.4	614.4	646.7	539.3
Saplings	1293.9	747.5	445.8	376.5	546.9	520.1	435.7	1211.9	691.9	447.2	310.4	465.4	490.6	383.2
Poles	134.9	184.9	150.3	105.0	95.8	95.1	93.2	159.0	200.7	154.3	110.9	95.1	93.3	85.1
Sawtimber	10.3	21.8	47.6	48.2	50.4	55.9	61.1	14.1	29.9	48.7	54.0	54.0	62.8	71.0

Table 10b. Diameter distribution (stems/acre) during 1927-1997. Average over all tracts (does not include muck). T represents less than 0.1 stem/acre.

	Medium sites							Dry sites						
Diameter class (inches)	1927	1937	1957	1967	1977	1987	1997	1927	1937	1957	1967	1977	1987	1997
0.5-2.4	1061.7	539.1	337.7	304.2	461.0	422.9	367.2	979.6	531.7	309.7	330.8	515.3	469.7	358.7
2.5-4.4	260.8	219.1	118.5	85.2	91.3	93.1	78.6	272.3	228.7	85.1	60.6	100.1	104.2	89.2
4.5-6.4	86.4	103.8	70.9	46.6	45.2	47.4	45.7	79.0	104.2	87.1	56.5	38.8	45.6	51.1
6.5-8.4	34.8	49.0	41.6	31.5	29.8	28.4	30.1	18.4	51.7	55.1	40.2	40.2	28.6	28.6
8.5-10.4	14.3	30.1	33.1	22.6	18.9	19.0	17.9	6.8	19.7	25.9	21.8	26.5	23.8	20.4
10.5-12.4	5.8	11.9	23.2	18.2	16.1	15.3	14.5	.7	4.8	23.1	19.1	15.0	21.8	22.5
12.5-14.4	2.8	5.7	14.2	12.8	12.8	12.5	11.6	2.0	2.0	8.8	13.6	11.6	10.9	12.9
14.5- 16.4	1.3	2.7	6.0	9.0	9.8	10.5	10.9	-	1.4	4.8	4.1	9.5	10.2	9.5
16.5- 18.4	.6	1.1	3.7	4.1	6.4	5.5	7.2	.7	.7	-	2.7	4.1	6.8	8.8
18.5-20.4	.3	1.0	1.4	2.6	3.4	4.7	5.1	-	.7	.7	-	.7	2.0	5.4
>= 20.5	-	-	.9	1.6	2.7	6.0	9.1	-	-	.7	2.0	2.0	2.7	2.7
All classes	1468.8	963.6	651.1	538.3	697.4	665.4	598.1	1359.4	945.5	601.1	551.4	763.8	726.3	609.9
Saplings	1322.5	758.2	456.2	389.4	552.4	516.0	445.8	1251.9	760.4	394.8	391.4	615.4	573.9	447.9
Poles	135.5	183.0	145.6	100.7	93.9	94.9	93.8	104.2	175.6	168.1	118.4	105.5	98.0	100.1
Sawtimber	10.8	22.4	49.3	48.2	51.1	54.6	58.5	3.4	9.5	38.1	41.5	42.9	54.5	61.9

Table 11a. Diameter distribution (stems/acre) by species groups during 1927-1997. Average over all tracts and moisture classes (does not include muck). T represents less than 0.1 stem/acre.

	Oak							Maple						
Diameter class (inches)	1927	1937	1957	1967	1977	1987	1997	1927	1937	1957	1967	1977	1987	1997
0.5-2.4	181.7	79.4	16.5	5.3	9.9	17.6	10.5	229.8	144.2	103.1	101.2	139.9	128.3	95.9
2.5-4.4	76.9	52.2	13.3	3.3	1.1	1.1	1.2	54.3	51.6	36.7	33.4	37.3	36.1	27.3
4.5-6.4	36.1	37.4	20.5	3.9	1.8	1.0	1.0	11.8	20.4	19.8	18.3	18.1	18.8	16.3
6.5-8.4	16.1	25.5	18.1	6.4	3.2	2.0	1.4	4.3	5.4	9.0	11.0	12.1	11.5	12.2
8.5-10.4	7.1	16.3	16.9	8.0	5.8	4.5	3.2	1.8	2.8	3.1	3.9	5.2	6.3	5.0
10.5-12.4	2.2	6.5	14.9	9.6	6.4	5.8	4.7	.5	.8	1.8	2.0	2.5	2.6	3.7
12.5-14.4	1.5	3.3	9.3	9.0	7.5	6.3	4.6	.3	.4	.7	1.1	1.3	1.9	1.6
14.5- 16.4	1.0	1.7	4.6	5.8	7.1	6.8	6.6	T	T	T	.2	.4	.9	1.5
16.5- 18.4	-	.8	2.4	3.0	3.9	4.3	6.0	-	T	T	T	T	T	.2
18.5-20.4	T	.3	1.1	1.6	2.3	3.0	4.0	-	-	T	T	T	.3	T
>= 20.5	-	-	.7	1.3	2.0	3.7	5.7	-	-	-	T	T	T	.2
All classes	322.6	223.3	118.3	57.2	50.8	56.0	48.8	303.0	225.8	174.5	171.3	217.2	206.8	163.9
Sapling	258.6	131.6	29.9	8.6	11.0	18.7	11.7	284.2	195.8	139.8	134.5	177.2	164.4	123.2
Poles	59.2	79.1	55.5	18.3	10.8	7.4	5.6	17.9	28.6	31.9	33.2	35.4	36.5	33.5
Sawtimber	4.7	12.5	32.9	30.3	29.1	29.9	31.5	.9	1.4	2.7	3.5	4.5	5.9	7.2

Table 11b. Diameter distribution (stems/acre) by species groups during 1927-1997. Average over all tracts and moisture classes (does not include muck). T represents less than 0.1 stem/acre.

	Birch							Other species						
Diameter class (inches)	1927	1937	1957	1967	1977	1987	1997	1927	1937	1957	1967	1977	1987	1997
0.5-2.4	140.7	83.6	61.1	69.5	138.7	155.5	127.3	474.2	220.9	151.7	121.2	169.4	125.5	122.5
2.5-4.4	44.8	43.7	28.7	23.3	29.2	36.8	31.9	91.3	71.8	34.7	19.3	21.4	19.1	19.1
4.5-6.4	15.8	21.7	20.8	18.1	16.9	20.0	19.9	23.7	27.4	12.5	7.5	5.9	6.2	7.6
6.5-8.4	8.1	10.3	11.2	11.2	13.0	12.5	13.3	4.8	8.9	7.0	5.6	3.3	2.8	3.0
8.5-10.4	3.5	5.5	7.2	7.6	8.1	6.8	7.9	1.9	3.3	4.2	3.4	2.3	2.8	2.4
10.5-12.4	1.8	3.2	4.8	5.3	5.8	6.9	6.6	.7	1.5	1.3	2.1	1.8	2.1	2.4
12.5-14.4	.7	1.1	1.9	2.1	3.1	3.6	4.6	.5	.8	1.1	.8	1.0	1.0	2.0
14.5- 16.4	.4	.4	1.1	1.3	1.3	2.0	1.6	-	T	1.0	1.0	.9	.9	.7
16.5- 18.4	T	.4	T	.3	.6	.7	1.0	.4	-	.3	.9	1.0	.5	.7
18.5-20.4	T	T	T	.2	.2	.2	.3	-	.4	.2	.2	.6	.8	.5
>= 20.5	T	-	-	-	-	.2	.2	-	-	.2	.4	.7	1.5	2.0
All classes	216.1	170.0	136.9	138.9	216.9	245.1	214.6	597.4	335.1	214.1	162.4	208.2	163.1	162.7
Sapling	185.6	127.3	89.8	92.8	167.8	192.3	159.2	565.5	292.7	186.3	140.5	190.9	144.6	141.6
Poles	27.4	37.5	39.2	36.9	38.1	39.3	41.1	30.4	39.7	23.7	16.5	11.5	11.8	13.0
Sawtimber	3.1	5.2	7.9	9.1	11.0	13.5	14.2	1.6	2.7	4.0	5.3	5.9	6.7	8.1

Table 12a. Stand density (stems/acre) of canopy (dominant and codominant) trees during 1927-1997. Average over all tracts (does not include muck). T represents less than 0.1 stem/acre.

	Combined moisture classes							Moist sites						
Species	1927	1937	1957	1967	1977	1987	1997	1927	1937	1957	1967	1977	1987	1997
Eastern white pine	T	T	-	-	-	-	-	-	-	-	-	-	-	-
Sugar maple	3.1	1.5	1.5	2.0	2.3	2.8	2.6	8.2	4.1	4.7	7.0	8.2	8.8	8.2
Red maple	30.2	15.6	9.6	12.6	10.4	7.8	7.4	58.7	38.1	20.5	25.2	18.2	17.0	18.8
Bitternut hickory	T	T	T	T	T	-	-	-	-	-	-	-	-	-
Mockernut hickory	2.5	1.5	1.5	.7	T	T	.2	-	-	.6	.6	-	-	.6
Pignut hickory	5.3	2.7	2.7	2.6	1.1	1.0	1.0	1.8	1.8	2.3	1.8	1.8	1.8	1.8
Shagbark hickory	2.6	1.8	1.4	1.3	.5	.2	.3	1.2	.6	1.2	1.2	.6	-	.6
Northern red oak	29.9	25.0	23.0	19.1	15.8	15.4	15.4	17.6	17.6	16.4	12.9	10.0	9.4	10.0
Black oak	12.8	10.1	10.9	8.1	7.8	7.2	7.2	2.3	2.9	2.3	1.8	1.8	1.8	1.8
Scarlet oak	11.9	10.5	9.0	7.1	5.5	4.6	4.5	6.5	4.7	3.5	2.3	2.3	2.3	2.3
White oak	17.7	12.4	9.4	5.2	4.4	4.0	4.0	5.3	4.1	1.8	1.8	1.8	1.8	1.8
Chestnut oak	13.3	11.3	10.7	4.3	3.1	2.5	2.6	7.0	6.5	7.0	2.9	1.2	.6	.6
Yellow birch	13.8	6.5	6.5	7.0	5.3	5.2	5.4	29.3	10.6	18.2	19.4	14.1	11.7	12.3
Black birch	29.7	18.0	15.9	16.5	13.0	11.0	10.6	13.5	9.4	14.1	14.7	12.3	12.3	13.5
Paper birch	.3	.2	.2	.3	T	-	-	-	-	-	-	-	-	-
American beech	.6	.5	.5	.7	1.0	1.3	1.8	.6	.6	.6	.6	.6	-	1.2
White ash	11.4	6.9	3.4	4.6	3.2	2.3	1.5	14.7	11.7	8.8	12.9	8.8	5.9	3.5
Black ash	.2	T	-	-	-	-	-	1.2	.6	-	-	-	-	-
Basswood	.5	.4	T	T	T	-	-	1.2	.6	-	-	-	-	-
Tulip poplar	6.0	5.6	3.6	3.9	4.0	4.0	4.0	7.0	5.3	4.1	4.1	4.1	4.1	4.1
American elm	.5	.2	.5	T	-	-	-	2.9	1.2	2.9	.6	-	-	-
Bigtooth aspen	11.2	6.6	.3	T	-	-	-	31.7	18.8	-	-	-	-	-
Tupelo	.2	T	T	T	T	.2	.2	-	-	-	-	-	.6	.6
Black locust	-	-	T	T	T	T	T	-	-	-	-	-	-	-
Butternut	1.1	.2	-	-	-	-	-	.6	-	-	-	-	-	-
Black cherry	1.1	.3	-	-	-	-	-	4.1	.6	-	-	-	-	-
Sassafras	.7	.7	.2	.2	-	-	-	.6	-	-	-	-	-	-
MAJOR SPECIES	206.7	138.6	111.0	96.7	77.9	69.7	68.9	216.0	139.7	109.2	109.7	85.7	78.1	82.2
Eastern red cedar	.4	-	-	-	-	-	-	-	-	-	-	-	-	-
American chestnut	T	-	-	-	-	-	-	-	-	-	-	-	-	-
Flowering dogwood	.3	-	.3	T	-	-	-	-	-	-	.6	-	-	-
Bluebeech	T	-	.3	-	-	-	-	-	-	.6	-	-	-	-
Hophornbeam	.8	.3	.2	-	-	-	-	.6	.6	.6	-	-	-	-
Gray birch	28.1	6.4	T	-	-	-	-	46.9	5.3	.6	-	-	-	-
MINOR SPECIES	29.8	6.7	.9	T	-	-	-	47.5	5.9	1.8	.6	-	-	-
ALL SPECIES	236.5	145.2	111.9	96.8	77.9	69.7	68.9	263.5	145.5	110.9	110.3	85.7	78.1	82.2

Table 12b. Stand density (stems/acre) of canopy (dominant and codominant) trees during 1927-1997. Average over all tracts (does not include muck). T represents less than 0.1 stem/acre.

	Medium sites							Dry sites						
Species	1927	1937	1957	1967	1977	1987	1997	1927	1937	1957	1967	1977	1987	1997
Eastern white pine	.1	.1	-	-	-	-	-	-	-	-	-	-	-	-
Sugar maple	2.4	1.1	1.0	1.1	1.3	1.8	1.7	.7	-	-	-	-	.7	.7
Red maple	24.6	12.6	8.8	11.9	10.1	7.0	5.7	23.8	3.4	.7	1.4	2.7	1.4	2.7
Bitternut hickory	.1	.1	.1	.1	.1	-	-	-	-	-	-	-	-	-
Mockernut hickory	3.1	2.0	1.8	.7	.1	.1	.1	2.7	.7	.7	.7	-	-	-
Pignut hickory	5.1	2.6	2.4	2.4	.9	.9	.9	10.2	4.8	4.8	4.8	1.4	.7	.7
Shagbark hickory	3.4	2.3	1.7	1.6	.6	.3	.3	.7	.7	-	-	-	-	-
Northern red oak	33.4	28.0	25.6	20.7	16.9	16.3	16.2	27.2	19.1	18.4	18.4	17.0	17.7	17.7
Black oak	11.9	9.9	9.9	7.7	7.8	7.2	7.1	29.3	19.1	25.2	17.7	15.0	13.6	14.3
Scarlet oak	12.1	10.5	9.2	7.1	5.1	4.0	4.0	17.7	17.0	14.3	12.9	10.9	10.2	9.5
White oak	18.5	12.4	10.4	5.7	4.5	4.3	4.3	28.6	22.5	13.6	6.8	6.8	5.4	5.4
Chestnut oak	15.9	13.8	12.2	4.1	2.7	2.4	2.6	8.2	4.8	7.5	6.8	7.5	5.4	5.4
Yellow birch	12.6	6.8	5.0	5.4	4.3	4.7	4.8	1.4	-	-	-	-	-	-
Black birch	32.0	21.2	18.6	18.8	14.8	11.4	10.5	37.4	12.9	4.8	7.5	5.4	7.5	7.5
Paper birch	.4	.3	.3	.4	.1	-	-	-	-	-	-	-	-	-
American beech	.4	.3	.4	.6	.9	1.1	1.4	1.4	1.4	.7	1.4	2.0	3.4	4.1
White ash	11.6	6.1	2.8	3.4	2.6	1.8	1.3	6.1	4.8	-	.7	-	-	-
Black ash	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Basswood	.4	.4	.1	.1	.1	-	-	-	-	-	-	-	-	-
Tulip poplar	6.8	6.7	4.1	4.5	4.5	4.5	4.7	.7	.7	.7	.7	1.4	1.4	.7
American elm	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bigtooth aspen	6.3	4.4	.4	.1	-	-	-	10.9	2.7	-	-	-	-	-
Tupelo	.3	.1	.1	.1	.1	.1	.1	-	-	-	-	-	-	-
Black locust	-	-	-	-	-	-	-	-	-	.7	.7	.7	.7	.7
Butternut	1.1	.3	-	-	-	-	-	1.4	-	-	-	-	-	-
Black cherry	.4	.3	-	-	-	-	-	.7	-	-	-	-	-	-
Sassafras	.9	1.0	.3	.3	-	-	-	-	-	-	-	-	-	-
MAJOR SPECIES	204.0	143.3	115.5	97.0	77.6	68.0	65.6	209.0	114.4	91.9	80.3	70.8	68.1	69.4
Eastern red cedar	.4	-	-	-	-	-	-	.7	-	-	-	-	-	-
American chestnut	-	-	-	-	-	-	-	.7	-	-	-	-	-	-
Flowering dogwood	.4	-	.4	-	-	-	-	-	-	-	-	-	-	-
Bluebeech	.1	-	.3	-	-	-	-	-	-	-	-	-	-	-
Hophornbeam	1.0	.3	.1	-	-	-	-	-	-	-	-	-	-	-
Gray birch	24.3	7.1	-	-	-	-	-	24.5	4.1	-	-	-	-	-
MINOR SPECIES	26.3	7.4	.9	-	-	-	-	25.9	4.1	-	-	-	-	-
ALL SPECIES	230.3	150.7	116.4	97.0	77.6	68.0	65.6	234.9	118.4	91.9	80.3	70.8	68.1	69.4

Table 13a. Periodic regression (stems/acre/decade) of trees that moved from upper to lower canopy position during 1927-1997. Average over all tracts (does not include muck). T represents < 0.1 stem/acre, "-" no live stems at beginning of period.

	Combined moisture classes						Moist sites					
SPECIES	1927 -1937	1937 -1957	1957 -1967	1967 -1977	1977 -1987	1987 -1997	1927 -1937	1937 -1957	1957 -1967	1967 -1977	1977 -1987	1987 -1997
Eastern white pine	-	-	-	-	-	-	-	-	-	-	-	-
Eastern hemlock	-	-	-	-	-	-	-	-	-	-	-	-
Sugar maple	1.7	.2	.2	.3	.3	.2	4.7	.3	.6	1.2	1.2	.6
Red maple	16.1	2.9	.6	3.4	3.3	1.6	22.3	5.6	-	5.9	4.1	1.8
Bitternut hickory	-	-	-	-	T	-	-	-	-	-	-	-
Mockernut hickory	1.3	.2	.3	T	-	-	-	-	-	.6	-	-
Pignut hickory	2.4	.2	-	T	-	-	-	-	-	-	-	-
Shagbark hickory	1.1	.3	-	-	.3	-	1.2	.3	-	-	.6	-
Northern red oak	7.1	1.4	.5	.2	.3	.4	2.3	.6	-	-	-	-
Black oak	3.7	.3	T	-	.3	-	-	-	-	-	-	-
Scarlet oak	1.7	.8	-	.2	.2	T	1.8	-	-	-	-	-
White oak	6.5	1.7	.3	.3	.4	-	2.3	1.2	-	-	-	-
Chestnut oak	2.3	.6	.4	.3	.5	-	1.2	-	-	-	-	-
Yellow birch	7.8	.9	.2	1.9	1.5	.8	18.8	.9	-	4.1	4.1	.6
Black birch	10.1	2.2	1.1	3.5	2.6	1.4	4.1	.6	-	2.3	.6	-
Paper birch	-	-	-	-	-	-	-	-	-	-	-	-
American beech	.2	T	-	-	T	-	-	-	-	-	.6	-
White ash	4.8	1.4	T	.6	.7	.6	3.5	2.1	-	.6	1.8	2.3
Black ash	T	-	-	-	-	-	.6	-	-	-	-	-
Basswood	T	T	-	-	T	-	.6	-	-	-	-	-
Tulip poplar	.6	.1	-	-	.2	.2	2.3	-	-	-	-	.6
American elm	.4	-	T	-	-	-	2.3	-	.6	-	-	-
Bigtooth aspen	1.4	-	-	-	-	-	2.9	-	-	-	-	-
Tupelo	T	-	-	-	-	-	-	-	-	-	-	-
Black locust	-	-	-	-	-	-	-	-	-	-	-	-
Butternut	.4	-	-	-	-	-	-	-	-	-	-	-
Black cherry	.3	T	-	-	-	-	1.2	.3	-	-	-	-
Sassafras	T	.1	-	T	-	-	-	-	-	-	-	-
MAJOR SPECIES	70.0	13.6	3.8	11.0	10.9	5.2	72.2	11.7	1.2	14.7	12.9	5.9
Eastern red cedar	.2	-	-	-	-	-	-	-	-	-	-	-
American chestnut	-	-	-	-	-	-	-	-	-	-	-	-
Flowering dogwood	.3	-	.3	T	-	-	-	-	-	.6	-	-
Bluebeech	T	-	T	-	-	-	-	-	.6	-	-	-
Shadbush	-	-	-	-	-	-	-	-	-	-	-	-
Hophornbeam	.5	T	T	-	-	-	-	-	-	-	-	-
Gray birch	11.8	T	-	-	-	-	22.3	-	-	-	-	-
MINOR SPECIES	12.9	.1	.5	T	-	-	22.3	-	.6	.6	-	-
ALL SPECIES	82.9	13.8	4.3	11.1	10.9	5.2	94.5	11.7	1.8	15.3	12.9	5.9

Table 13b. Periodic regression (stems/acre/decade) of trees that moved from upper to lower canopy position during 1927-1997. Average over all tracts (does not include muck). T represents < 0.1 stem/acre, "-" no live stems at beginning of period.

	Medium sites						Dry sites					
SPECIES	1927 -1937	1937 -1957	1957 -1967	1967 -1977	1977 -1987	1987 -1997	1927 -1937	1937 -1957	1957 -1967	1967 -1977	1977 -1987	1987 -1997
Eastern white pine	-	-	-	-	-	-	-	-	-	-	-	-
Eastern hemlock	-	-	-	-	-	-	-	-	-	-	-	-
Sugar maple	1.1	.3	.1	.1	.1	.1	.7	-	-	-	-	-
Red maple	13.6	2.6	.9	3.4	3.6	1.8	20.4	1.0	-	.7	1.4	-
Bitternut hickory	-	-	-	-	.1	-	-	-	-	-	-	-
Mockernut hickory	1.4	.3	.4	-	-	-	2.0	-	-	-	-	-
Pignut hickory	2.6	.3	-	.1	-	-	4.8	.3	-	-	-	-
Shagbark hickory	1.3	.3	-	-	.3	-	-	.3	-	-	-	-
Northern red oak	7.7	1.7	.6	.3	.4	.6	9.5	1.0	.7	-	-	-
Black oak	3.1	.3	.1	-	.1	-	10.9	1.0	-	-	1.4	-
Scarlet oak	1.7	.8	-	-	.3	.1	1.4	1.7	-	1.4	-	-
White oak	7.0	1.2	.3	.3	.3	-	8.8	4.4	.7	.7	1.4	-
Chestnut oak	2.3	.8	.6	.4	.3	-	3.4	.3	-	-	2.0	-
Yellow birch	6.5	1.1	.3	1.7	1.1	1.0	1.4	-	-	-	-	-
Black birch	9.4	2.0	1.6	3.8	3.6	1.7	20.4	4.8	-	3.4	.7	1.4
Paper birch	-	-	-	-	-	-	-	-	-	-	-	-
American beech	.3	-	-	-	-	-	-	.3	-	-	-	-
White ash	5.7	1.3	.1	.7	.6	.3	2.0	1.0	-	-	-	-
Black ash	-	-	-	-	-	-	-	-	-	-	-	-
Basswood	-	.1	-	-	.1	-	-	-	-	-	-	-
Tulip poplar	.3	.2	-	-	.3	-	-	-	-	-	-	.7
American elm	-	-	-	-	-	-	-	-	-	-	-	-
Bigtooth aspen	.7	-	-	-	-	-	2.7	-	-	-	-	-
Tupelo	.1	-	-	-	-	-	-	-	-	-	-	-
Black locust	-	-	-	-	-	-	-	-	-	-	-	-
Butternut	.4	-	-	-	-	-	.7	-	-	-	-	-
Black cherry	.1	-	-	-	-	-	-	-	-	-	-	-
Sassafras	.1	.2	-	.1	-	-	-	-	-	-	-	-
MAJOR SPECIES	65.5	13.5	5.0	11.1	11.2	5.7	89.2	16.3	1.4	6.1	6.8	2.0
Eastern red cedar	.3	-	-	-	-	-	-	-	-	-	-	-
American chestnut	-	-	-	-	-	-	-	-	-	-	-	-
Flowering dogwood	.4	-	.4	-	-	-	-	-	-	-	-	-
Bluebeech	.1	-	-	-	-	-	-	-	-	-	-	-
Shadbush	-	-	-	-	-	-	-	-	-	-	-	-
Hophornbeam	.7	T	.1	-	-	-	-	-	-	-	-	-
Gray birch	9.1	.1	-	-	-	-	12.9	-	-	-	-	-
MINOR SPECIES	10.7	.2	.6	-	-	-	12.9	-	-	-	-	-
ALL SPECIES	76.1	13.7	5.5	11.1	11.2	5.7	102.1	16.3	1.4	6.1	6.8	2.0

Table 14a. Periodic mortality (stems/acre/decade) of canopy (dominant and codominant) trees during 1927-1997. Average over all tracts (does not include muck). T represents less than 0.1 stem/acre, "-" no live stems at beginning of period.

	Combined moisture classes						Moist sites					
SPECIES	1927 -1937	1937 -1957	1957 -1967	1967 -1977	1977 -1987	1987 -1997	1927 -1937	1937 -1957	1957 -1967	1967 -1977	1977 -1987	1987 -1997
Eastern white pine	-	T	-	-	-	-	-	-	-	-	-	-
Eastern hemlock	-	-	-	-	-	-	-	-	-	-	-	-
Sugar maple	.2	T	-	-	-	-	-	.3	-	-	-	-
Red maple	1.0	1.7	.4	1.0	.7	.6	2.9	5.6	.6	2.3	-	1.2
Bitternut hickory	-	-	-	-	-	-	-	-	-	-	-	-
Mockernut hickory	T	-	.5	.6	-	-	-	-	-	-	-	-
Pignut hickory	.3	T	.3	1.5	T	-	-	-	.6	-	-	-
Shagbark hickory	-	.1	.4	.8	-	-	-	-	.6	.6	-	-
Northern red oak	.4	1.4	4.0	3.5	.4	-	-	1.2	4.1	2.9	.6	-
Black oak	.3	.4	2.9	.6	.3	.2	-	.3	.6	-	-	-
Scarlet oak	.2	.3	2.3	1.6	.7	.3	-	.6	1.2	-	-	-
White oak	.3	1.0	4.1	.7	.2	T	-	-	-	-	-	-
Chestnut oak	.4	.9	6.2	1.1	.2	-	-	.3	4.1	1.8	.6	-
Yellow birch	.6	.6	.9	.4	.2	T	1.2	.9	1.8	2.3	-	-
Black birch	3.7	1.6	1.0	1.3	.9	1.0	.6	-	.6	1.2	.6	.6
Paper birch	T	-	-	.2	T	-	-	-	-	-	-	-
American beech	-	-	-	-	-	-	-	-	-	-	-	-
White ash	.2	.6	T	1.0	.5	.3	.6	-	.6	3.5	1.8	.6
Black ash	-	T	-	-	-	-	-	.3	-	-	-	-
Basswood	T	T	-	-	-	-	-	.3	-	-	-	-
Tulip poplar	.4	.9	-	-	.2	-	-	.9	-	-	.6	-
American elm	-	-	.3	T	-	-	-	-	1.8	.6	-	-
Bigtooth aspen	3.3	3.2	.2	T	-	-	10.0	9.4	-	-	-	-
Tupelo	-	-	-	-	-	-	-	-	-	-	-	-
Black locust	-	-	-	-	-	-	-	-	-	-	-	-
Butternut	.5	T	-	-	-	-	.6	-	-	-	-	-
Black cherry	.5	T	-	-	-	-	2.3	-	-	-	-	-
Sassafras	T	T	-	T	-	-	.6	-	-	-	-	-
MAJOR SPECIES	12.6	13.5	23.5	14.4	4.4	2.5	18.8	20.0	16.4	15.3	4.1	2.3
Eastern red cedar	.2	-	-	-	-	-	-	-	-	-	-	-
American chestnut	T	-	-	-	-	-	-	-	-	-	-	-
Flowering dogwood	-	-	-	-	-	-	-	-	-	-	-	-
Bluebeech	-	-	.2	-	-	-	-	-	-	-	-	-
Shadbush	-	-	-	-	-	-	-	-	-	-	-	-
Hophornbeam	-	T	T	-	-	-	-	-	.6	-	-	-
Gray birch	10.4	3.0	T	-	-	-	19.4	2.3	.6	-	-	-
MINOR SPECIES	10.7	3.1	.4	-	-	-	19.4	2.3	1.2	-	-	-
ALL SPECIES	23.3	16.5	23.9	14.4	4.4	2.5	38.1	22.3	17.6	15.3	4.1	2.3

Table14b. Periodic mortality (stems/acre/decade) of canopy (dominant and codominant) trees during 1927-1997. Average over all tracts (does not include muck). T represents less than 0.1 stem/acre, "-" no live stems at beginning of period.

	Combined moisture classes						Moist sites					
SPECIES	1927 -1937	1937 -1957	1957 -1967	1967 -1977	1977 -1987	1987 -1997	1927 -1937	1937 -1957	1957 -1967	1967 -1977	1977 -1987	1987 -1997
Eastern white pine	-	T	-	-	-	-	-	-	-	-	-	-
Eastern hemlock	-	-	-	-	-	-	-	-	-	-	-	-
Sugar maple	.3	-	-	-	-	-	-	-	-	-	-	-
Red maple	.6	1.0	.4	.9	1.0	.6	.7	.7	-	-	-	-
Bitternut hickory	-	-	-	-	-	-	-	-	-	-	-	-
Mockernut hickory	.1	-	.7	.7	-	-	-	-	-	.7	-	-
Pignut hickory	.1	-	.3	1.4	-	-	1.4	.7	-	3.4	.7	-
Shagbark hickory	-	.2	.4	1.0	-	-	-	-	-	-	-	-
Northern red oak	.6	1.6	4.8	3.8	.4	-	-	.7	-	2.7	-	-
Black oak	.1	.5	2.6	.1	.4	.3	1.4	-	7.5	3.4	-	-
Scarlet oak	.1	.4	2.1	2.1	.9	.1	.7	-	4.1	.7	.7	1.4
White oak	.3	1.3	4.5	.9	.3	-	.7	1.0	6.8	.7	-	.7
Chestnut oak	.4	1.1	7.7	1.0	.1	-	.7	.3	1.4	.7	-	-
Yellow birch	.6	.7	.9	-	.3	.1	-	-	-	-	-	-
Black birch	4.1	2.2	1.3	1.6	1.1	1.0	5.4	.7	-	-	-	1.4
Paper birch	.1	-	-	.3	.1	-	-	-	-	-	-	-
American beech	-	-	-	-	-	-	-	-	-	-	-	-
White ash	.1	.6	-	.4	.3	.3	-	1.4	-	.7	-	-
Black ash	-	-	-	-	-	-	-	-	-	-	-	-
Basswood	.1	-	-	-	-	-	-	-	-	-	-	-
Tulip poplar	.6	1.1	-	-	.1	-	-	-	-	-	-	-
American elm	-	-	-	-	-	-	-	-	-	-	-	-
Bigtooth aspen	1.3	2.1	.3	.1	-	-	5.4	1.4	-	-	-	-
Tupelo	-	-	-	-	-	-	-	-	-	-	-	-
Black locust	-	-	-	-	-	-	-	-	-	-	-	-
Butternut	.4	.1	-	-	-	-	.7	-	-	-	-	-
Black cherry	-	.1	-	-	-	-	.7	-	-	-	-	-
Sassafras	-	.1	-	.1	-	-	-	-	-	-	-	-
MAJOR SPECIES	10.1	13.3	26.0	14.5	5.1	2.4	17.7	6.8	19.7	12.9	1.4	3.4
Eastern red cedar	.1	-	-	-	-	-	.7	-	-	-	-	-
American chestnut	-	-	-	-	-	-	.7	-	-	-	-	-
Flowering dogwood	-	-	-	-	-	-	-	-	-	-	-	-
Bluebeech	-	-	.3	-	-	-	-	-	-	-	-	-
Shadbush	-	-	-	-	-	-	-	-	-	-	-	-
Hophornbeam	-	T	-	-	-	-	-	-	-	-	-	-
Gray birch	8.7	3.4	-	-	-	-	8.2	2.0	-	-	-	-
MINOR SPECIES	8.8	3.5	.3	-	-	-	9.5	2.0	-	-	-	-
ALL SPECIES	18.9	16.8	26.3	14.5	5.1	2.4	27.2	8.8	19.7	12.9	1.4	3.4

Table 15a. Periodic canopy ingrowth (stems/acre/decade) during 1927-1997. Average over all tracts (does not include muck). T represents less than 0.1 stem/acre.

	Combined moisture classes						Moist sites					
SPECIES	1927 -1937	1937 -1957	1957 -1967	1967 -1977	1977 -1987	1987 -1997	1927 -1937	1937 -1957	1957 -1967	1967 -1977	1977 -1987	1987 -1997
Eastern hemlock	-	-	-	-	-	T	-	-	-	-	-	.6
Sugar maple	.2	.3	.7	.6	.9	-	.6	.9	2.9	2.3	1.8	-
Red maple	2.4	1.6	4.0	2.2	1.5	1.8	4.7	2.1	5.3	1.2	2.9	4.7
Mockernut hickory	.3	.2	-	T	-	T	-	.3	-	-	-	.6
Pignut hickory	.2	.3	.2	-	-	-	-	.3	-	-	-	-
Shagbark hickory	.2	.2	.3	-	-	T	.6	.6	.6	-	-	.6
Northern red oak	2.4	1.9	.6	.4	.3	.4	2.3	1.2	.6	-	-	.6
Black oak	1.2	1.1	.3	.3	-	.2	.6	-	-	-	-	-
Scarlet oak	.3	.4	.4	T	-	.4	-	-	-	-	-	-
White oak	1.5	1.2	.2	.2	.2	T	1.2	-	-	-	-	-
Chestnut oak	.6	1.2	.2	.2	T	T	.6	.6	-	-	-	-
Yellow birch	1.1	1.5	1.6	.6	1.6	1.2	1.2	5.6	2.9	1.2	1.8	1.2
Black birch	2.2	2.7	2.6	1.4	1.5	2.0	.6	2.9	1.2	1.2	1.2	1.8
Paper birch	-	-	T	-	-	-	-	-	-	-	-	-
American beech	T	T	.2	.3	.4	.5	-	-	-	-	-	1.2
White ash	.5	.3	1.4	.2	.2	T	1.2	.6	4.7	-	.6	.6
Basswood	T	-	-	-	-	-	-	-	-	-	-	-
Tulip poplar	.4	T	.3	T	.4	.2	.6	.3	-	-	.6	.6
American elm	T	.1	-	-	-	-	.6	.9	-	-	-	-
Bigtooth aspen	T	T	-	-	-	-	-	-	-	-	-	-
Tupelo	-	-	-	-	T	-	-	-	-	-	.6	-
Black locust	-	T	-	-	-	-	-	-	-	-	-	-
Sassafras	.2	-	-	-	-	-	-	-	-	-	-	-
MAJOR SPECIES	14.0	13.3	13.0	6.6	7.1	7.1	14.7	16.1	18.2	5.9	9.4	12.3
Flowering dogwood	-	.1	T	-	-	-	-	-	.6	-	-	-
Bluebeech	-	.1	-	-	-	-	-	.3	-	-	-	-
Hophornbeam	-	T	-	-	-	-	-	-	-	-	-	-
Gray birch	.5	-	-	-	-	-	-	-	-	-	-	-
MINOR SPECIES	.5	.3	T	-	-	-	-	.3	.6	-	-	-
ALL SPECIES	14.5	13.6	13.1	6.6	7.1	7.1	14.7	16.4	18.8	5.9	9.4	12.3

Table 15b. Periodic canopy ingrowth (stems/acre/decade) during 1927-1997. Average over all tracts (does not include muck). T represents less than 0.1 stem/acre.

	Medium sites						Dry sites					
SPECIES	1927 -1937	1937 -1957	1957 -1967	1967 -1977	1977 -1987	1987 -1997	1927 -1937	1937 -1957	1957 -1967	1967 -1977	1977 -1987	1987 -1997
Eastern hemlock	-	-	-	-	-	-	-	-	-	-	-	-
Sugar maple	.1	.2	.3	.3	.7	-	-	-	-	-	.7	-
Red maple	2.3	1.7	4.4	2.4	1.4	1.1	.7	.3	.7	2.0	-	1.4
Mockernut hickory	.4	.2	-	.1	-	-	-	-	-	-	-	-
Pignut hickory	.1	.2	.3	-	-	-	.7	1.0	-	-	-	-
Shagbark hickory	.1	.2	.3	-	-	-	-	-	-	-	-	-
Northern red oak	2.7	2.1	.6	.3	.3	.4	1.4	1.4	.7	1.4	.7	-
Black oak	1.3	.8	.4	.3	-	.1	1.4	4.1	-	.7	-	.7
Scarlet oak	.1	.5	-	.1	-	.4	1.4	.3	2.7	-	-	.7
White oak	1.1	1.5	.1	-	.3	-	3.4	1.0	.7	1.4	-	.7
Chestnut oak	.6	1.1	.1	-	.1	.1	.7	2.0	.7	1.4	-	-
Yellow birch	1.3	.9	1.6	.6	1.8	1.4	-	-	-	-	-	-
Black birch	2.7	2.9	3.0	1.4	1.3	1.8	1.4	1.4	2.7	1.4	2.7	2.7
Paper birch	-	-	.1	-	-	-	-	-	-	-	-	-
American beech	.1	T	.1	.3	.3	.3	-	-	.7	.7	1.4	.7
White ash	.3	.3	.7	.3	.1	-	.7	-	.7	-	-	-
Basswood	.1	-	-	-	-	-	-	-	-	-	-	-
Tulip poplar	.4	T	.4	-	.4	.1	-	-	-	.7	-	-
American elm	-	-	-	-	-	-	-	-	-	-	-	-
Bigtooth aspen	.1	T	-	-	-	-	-	-	-	-	-	-
Tupelo	-	-	-	-	-	-	-	-	-	-	-	-
Black locust	-	-	-	-	-	-	-	.3	-	-	-	-
Sassafras	.3	-	-	-	-	-	-	-	-	-	-	-
MAJOR SPECIES	14.3	12.9	12.5	6.1	6.8	6.0	11.6	11.9	9.5	9.5	5.4	6.8
Flowering dogwood	-	.2	-	-	-	-	-	-	-	-	-	-
Bluebeech	-	.1	-	-	-	-	-	-	-	-	-	-
Hophornbeam	-	T	-	-	-	-	-	-	-	-	-	-
Gray birch	.6	-	-	-	-	-	.7	-	-	-	-	-
MINOR SPECIES	.6	.4	-	-	-	-	.7	-	-	-	-	-
ALL SPECIES	14.9	13.3	12.5	6.1	6.8	6.0	12.3	11.9	9.5	9.5	5.4	6.8

Table 16a. Stand basal area (ft^2/acre) of canopy (dominant and codominant) trees during 1927-1997. Average over all tracts (does not include muck). T represents less than 0.1 ft^2/acre.

	Combined moisture classes							Moist sites						
Species	1927	1937	1957	1967	1977	1987	1997	1927	1937	1957	1967	1977	1987	1997
Eastern white pine	T	T	-	-	-	-	-	-	-	-	-	-	-	-
Sugar maple	.6	.6	.8	1.1	1.4	2.0	2.2	2.1	2.0	2.8	3.9	4.8	6.1	6.5
Red maple	4.6	4.3	4.0	5.6	5.7	5.5	5.7	12.4	12.4	10.2	13.7	11.9	13.5	16.0
Bitternut hickory	T	T	T	T	T	-	-	-	-	-	-	-	-	-
Mockernut hickory	.4	.4	.5	.3	T	T	T	-	-	T	T	-	-	.1
Pignut hickory	1.0	1.1	1.3	1.6	.6	.6	.8	.4	.5	1.0	.9	1.1	1.2	1.5
Shagbark hickory	.4	.4	.5	.5	.2	.1	.2	.1	.1	.2	.4	.2	-	.3
Northern red oak	6.3	10.2	17.3	18.7	19.2	22.2	26.8	3.5	7.0	14.2	14.2	13.6	16.0	19.3
Black oak	2.7	4.4	8.1	8.2	9.2	9.9	11.3	1.1	1.8	3.1	3.4	4.0	4.4	5.1
Scarlet oak	2.8	4.4	6.2	5.8	5.4	5.2	5.9	1.4	2.3	3.1	1.8	2.1	2.5	3.0
White oak	3.5	4.5	5.6	4.0	4.2	4.5	5.3	.8	1.2	1.1	1.3	1.5	1.9	2.2
Chestnut oak	4.0	5.4	7.3	3.3	2.7	2.6	3.2	2.5	3.9	5.9	2.8	1.0	.4	.5
Yellow birch	3.4	2.8	3.5	3.9	3.4	3.7	4.2	8.9	5.6	10.3	11.5	9.2	9.1	10.7
Black birch	7.0	6.9	8.2	9.4	9.2	8.9	9.4	8.3	5.9	9.6	11.6	12.1	13.4	14.6
Paper birch	T	T	.1	.1	T	-	-	-	-	-	-	-	-	-
American beech	.2	.3	.6	.7	1.0	1.3	1.9	.1	.3	.6	.7	.8	-	.1
White ash	1.7	1.8	1.6	2.1	1.9	1.7	1.4	2.6	3.2	3.9	5.5	4.7	3.7	2.5
Black ash	T	T	-	-	-	-	-	.3	.2	-	-	-	-	-
Basswood	.1	.2	T	.1	.1	-	-	.5	.5	-	-	-	-	-
Tulip poplar	1.6	2.6	3.3	4.3	5.8	6.9	8.2	2.3	3.3	5.2	6.7	8.8	9.5	11.5
American elm	.1	T	.2	T	-	-	-	.6	.3	1.2	.2	-	-	-
Bigtooth aspen	1.7	1.6	T	T	-	-	-	4.6	4.1	-	-	-	-	-
Tupelo	T	T	T	T	T	T	.1	-	-	-	-	-	.1	.2
Black locust	-	-	T	T	T	T	T	-	-	-	-	-	-	-
Butternut	.1	T	-	-	-	-	-	.1	-	-	-	-	-	-
Black cherry	T	T	-	-	-	-	-	.2	T	-	-	-	-	-
Sassafras	T	.1	T	T	-	-	-	.1	-	-	-	-	-	-
MAJOR SPECIES	42.6	52.2	69.2	69.9	70.1	75.4	86.7	53.0	54.6	72.5	78.6	75.8	81.8	94.7
Eastern red cedar	T	-	-	-	-	-	-	-	-	-	-	-	-	-
American chestnut	T	-	-	-	-	-	-	-	-	-	-	-	-	-
Flowering dogwood	T	-	T	T	-	-	-	-	-	-	.1	-	-	-
Bluebeech	T	-	T	-	-	-	-	-	-	T	-	-	-	-
Hophornbeam	T	T	T	-	-	-	-	.2	.2	.2	-	-	-	-
Gray birch	1.7	.7	T	-	-	-	-	2.7	.5	.1	-	-	-	-
MINOR SPECIES	1.8	.7	.1	T	-	-	-	2.9	.7	.4	.1	-	-	-
ALL SPECIES	44.4	52.9	69.3	69.9	70.1	75.4	86.7	55.9	55.3	72.9	78.7	75.8	81.8	94.7

Table 16b. Stand basal area (ft^2/acre) of canopy (dominant and codominant) trees during 1927-1997. Average over all tracts (does not include muck). T represents less than 0.1 ft^2/acre.

	Medium sites							Dry sites						
Species	1927	1937	1957	1967	1977	1987	1997	1927	1937	1957	1967	1977	1987	1997
Eastern white pine	.1	.1	-	-	-	-	-	-	-	-	-	-	-	-
Sugar maple	.4	.4	.5	.6	.9	1.4	1.6	T	-	-	-	-	.2	.2
Red maple	3.3	3.1	3.3	4.7	4.8	4.1	3.6	1.8	.6	.2	.3	2.6	2.7	3.9
Bitternut hickory	T	T	T	T	T	-	-	-	-	-	-	-	-	-
Mockernut hickory	.5	.5	.7	.4	T	T	T	.3	.2	.3	.4	-	-	-
Pignut hickory	.9	1.0	1.3	1.7	.5	.5	.6	2.1	2.2	1.8	2.1	.8	.5	.6
Shagbark hickory	.5	.5	.6	.6	.2	.2	.3	T	T	-	-	-	-	-
Northern red oak	7.5	11.8	19.2	20.7	21.3	24.4	29.4	3.6	6.1	11.8	14.2	15.6	19.1	23.0
Black oak	2.7	4.5	8.0	8.2	9.5	10.1	11.4	4.3	6.7	14.2	13.7	13.8	15.4	18.5
Scarlet oak	3.1	4.6	6.5	6.0	5.2	4.7	5.4	3.0	5.7	8.8	9.5	10.0	10.6	11.4
White oak	3.9	4.8	6.4	4.6	4.6	5.1	5.9	4.7	6.9	6.8	4.7	5.2	5.2	5.9
Chestnut oak	4.9	6.5	8.4	3.3	2.8	3.0	3.6	1.6	1.8	3.5	3.5	3.9	3.6	4.2
Yellow birch	2.7	2.7	2.6	2.8	2.6	3.1	3.4	.4	-	-	-	-	-	-
Black birch	7.0	7.5	8.9	10.0	9.6	8.7	9.1	5.7	5.1	3.0	4.4	3.7	4.9	5.0
Paper birch	T	.1	.1	.2	.1	-	-	-	-	-	-	-	-	-
American beech	T	T	.2	.3	.5	.9	1.6	1.3	1.5	2.3	2.8	3.3	4.2	5.3
White ash	1.6	1.6	1.4	1.7	1.6	1.6	1.5	.7	.8	-	.1	-	-	-
Black ash	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Basswood	T	.1	.1	.1	.2	-	-	-	-	-	-	-	-	-
Tulip poplar	1.8	2.9	3.4	4.5	6.1	7.5	9.0	T	.2	.4	.5	.9	1.3	.5
American elm	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bigtooth aspen	1.1	1.2	.1	T	-	-	-	1.2	.5	-	-	-	-	-
Tupelo	T	T	T	T	.1	.1	.1	-	-	-	-	-	-	-
Black locust	-	-	-	-	-	-	-	-	-	.2	.2	.3	.5	.6
Butternut	.2	T	-	-	-	-	-	T	-	-	-	-	-	-
Black cherry	T	T	-	-	-	-	-	T	-	-	-	-	-	-
Sassafras	T	.2	T	T	-	-	-	-	-	-	-	-	-	-
MAJOR SPECIES	42.4	54.6	71.7	70.6	70.8	75.4	86.4	31.1	38.4	53.4	56.4	60.1	68.1	79.1
Eastern red cedar	T	-	-	-	-	-	-	.1	-	-	-	-	-	-
American chestnut	-	-	-	-	-	-	-	T	-	-	-	-	-	-
Flowering dogwood	T	-	T	-	-	-	-	-	-	-	-	-	-	-
Bluebeech	T	-	T	-	-	-	-	-	-	-	-	-	-	-
Hophornbeam	T	T	T	-	-	-	-	-	-	-	-	-	-	-
Gray birch	1.5	.8	-	-	-	-	-	1.3	.3	-	-	-	-	-
MINOR SPECIES	1.6	.8	T	-	-	-	-	1.5	.3	-	-	-	-	-
ALL SPECIES	44.1	55.3	71.8	70.6	70.8	75.4	86.4	32.6	38.7	53.4	56.4	60.1	68.1	79.1

Table 17a. Periodic basal area mortality and regression (ft^2/acre/decade) of canopy (dominant and codominant) trees during 1927-1997. Average over all tracts (does not include muck). T represents less than 0.1 ft^2/acre.

	Combined moisture classes						Moist sites					
SPECIES	1927 -1937	1937 -1957	1957 -1967	1967 -1977	1977 -1987	1987 -1997	1927 -1937	1937 -1957	1957 -1967	1967 -1977	1977 -1987	1987 -1997
Eastern white pine	0	T	-	-	-	-	-	-	-	-	-	-
Sugar maple	.2	T	T	T	T	T	.6	.2	T	.3	.3	.3
Red maple	1.5	1.1	.3	1.6	1.6	1.4	2.9	3.2	.6	4.3	2.1	2.3
Bitternut hickory	0	0	0	0	T	-	-	-	-	-	-	-
Mockernut hickory	.2	T	.3	.3	0	0	-	-	0	T	-	-
Pignut hickory	.2	.1	T	1.1	T	0	0	0	.3	0	0	0
Shagbark hickory	T	T	.1	.3	T	0	.1	T	.1	.2	.2	-
Northern red oak	.7	.8	1.9	2.5	.7	.2	.3	.4	2.6	2.9	.4	0
Black oak	.4	.2	1.3	.4	.6	.3	0	T	.3	0	0	0
Scarlet oak	.2	.4	1.4	1.2	.9	.5	.1	.3	1.6	0	0	0
White oak	.6	.6	2.1	.4	.4	T	.2	.2	0	0	0	0
Chestnut oak	.5	.6	4.5	1.0	.4	0	.1	.2	3.6	1.9	.7	0
Yellow birch	1.5	.4	.6	1.2	.7	.5	4.7	.5	1.3	3.9	1.9	.2
Black birch	2.3	1.2	.8	1.9	1.8	1.6	3.8	.3	.1	1.4	.7	.9
Paper birch	T	0	0	T	T	-	-	-	-	-	-	-
American beech	T	T	0	0	.1	0	0	0	0	0	.8	-
White ash	.4	.4	T	.5	.5	.4	.5	.3	T	1.4	1.9	1.7
Black ash	T	T	-	-	-	-	.1	T	-	-	-	-
Basswood	T	T	0	0	.1	-	T	.2	-	-	-	-
Tulip poplar	T	.5	0	0	.6	.1	.3	.4	0	0	1.3	T
American elm	T	0	.2	T	-	-	.5	0	1.0	.2	-	-
Bigtooth aspen	.6	.8	T	T	-	-	1.6	2.1	-	-	-	-
Tupelo	T	0	0	0	0	0	-	-	-	-	-	0
Black locust	-	-	0	0	0	0	-	-	-	-	-	-
Butternut	T	T	-	-	-	-	.1	-	-	-	-	-
Black cherry	T	T	-	-	-	-	.2	T	-	-	-	-
Sassafras	T	T	0	T	-	-	.1	-	-	-	-	-
MAJOR SPECIES	9.6	7.4	13.6	12.6	8.8	5.2	16.3	8.6	11.7	16.5	10.3	5.5
Eastern red cedar	T	-	-	-	-	-	-	-	-	-	-	-
American chestnut	T	-	-	-	-	-	-	-	-	-	-	-
Flowering dogwood	T	-	T	T	-	-	-	-	-	.1	-	-
Bluebeech	T	-	T	-	-	-	-	-	T	-	-	-
Hophornbeam	T	T	T	-	-	-	0	0	.2	-	-	-
Gray birch	1.2	.3	T	-	-	-	2.4	.2	.1	-	-	-
MINOR SPECIES	1.4	.3	.1	T	-	-	2.4	.2	.4	.1	-	-
ALL SPECIES	11.0	7.8	13.8	12.6	8.8	5.2	18.7	8.8	12.1	16.7	10.3	5.5

Table 17b. Periodic basal area mortality and regression (ft^2/acre/decade) of canopy (dominant and codominant) trees during 1927-1997. Average over all tracts (does not include muck). T represents less than 0.1 ft^2/acre.

	Medium sites						Dry sites					
SPECIES	1927 -1937	1937 -1957	1957 -1967	1967 -1977	1977 -1987	1987 -1997	1927 -1937	1937 -1957	1957 -1967	1967 -1977	1977 -1987	1987 -1997
Eastern white pine	0	T	-	-	-	-	-	-	-	-	-	-
Sugar maple	.1	T	T	T	T	T	T	-	-	-	-	0
Red maple	1.2	.7	.2	1.2	1.7	1.4	1.6	.3	0	.2	.3	0
Bitternut hickory	0	0	0	0	T	-	-	-	-	-	-	-
Mockernut hickory	.2	T	.4	.4	0	0	.1	0	0	.4	-	-
Pignut hickory	.2	T	T	1.3	0	0	.6	.6	0	1.3	.3	0
Shagbark hickory	.1	T	.2	.4	T	0	0	T	-	-	-	-
Northern red oak	.7	1.0	2.0	2.7	1.0	.3	.7	.4	.2	1.3	0	0
Black oak	.3	.2	1.3	.2	.7	.4	.9	.1	2.7	2.1	.7	0
Scarlet oak	.2	.4	1.4	1.5	1.2	.5	.1	.3	1.5	.7	.9	1.1
White oak	.7	.6	2.5	.5	.4	0	.9	1.2	2.9	.6	.6	.5
Chestnut oak	.6	.7	5.5	.9	.3	0	.5	.1	1.0	.7	.8	0
Yellow birch	.9	.5	.5	.7	.6	.6	.4	-	-	-	-	-
Black birch	1.8	1.3	1.1	2.1	2.3	1.8	2.5	1.7	0	1.9	.4	1.4
Paper birch	T	0	0	.1	.1	-	-	-	-	-	-	-
American beech	T	0	0	0	0	0	0	T	0	0	0	0
White ash	.5	.4	T	.4	.3	.2	.2	.4	-	.1	-	-
Black ash	-	-	-	-	-	-	-	-	-	-	-	-
Basswood	T	T	0	0	.2	-	-	-	-	-	-	-
Tulip poplar	T	.6	0	0	.5	0	0	0	0	0	0	.9
American elm	-	-	-	-	-	-	-	-	-	-	-	-
Bigtooth aspen	.3	.6	T	T	-	-	.8	.3	-	-	-	-
Tupelo	T	0	0	0	0	0	-	-	-	-	-	-
Black locust	-	-	-	-	-	-	-	-	0	0	0	0
Butternut	.1	T	-	-	-	-	T	-	-	-	-	-
Black cherry	T	T	-	-	-	-	T	-	-	-	-	-
Sassafras	T	T	0	T	-	-	-	-	-	-	-	-
MAJOR SPECIES	8.0	7.5	15.3	12.4	9.5	5.4	9.5	5.5	8.2	9.2	4.1	3.9
Eastern red cedar	T	-	-	-	-	-	.1	-	-	-	-	-
American chestnut	-	-	-	-	-	-	T	-	-	-	-	-
Flowering dogwood	T	-	T	-	-	-	-	-	-	-	-	-
Bluebeech	T	-	T	-	-	-	-	-	-	-	-	-
Hophornbeam	T	T	T	-	-	-	-	-	-	-	-	-
Gray birch	1.0	.4	-	-	-	-	1.1	.2	-	-	-	-
MINOR SPECIES	1.1	.4	T	-	-	-	1.3	.2	-	-	-	-
ALL SPECIES	9.2	7.9	15.3	12.4	9.5	5.4	10.7	5.7	8.2	9.2	4.1	3.9

Table 18a. Canopy basal area ingrowth (ft^2/acre/decade) during 1927-1997. Average over all tracts (does not include muck). T represents less than 0.1 ft^2/acre.

	Combined moisture classes						Moist sites					
SPECIES	1927 -1937	1937 -1957	1957 -1967	1967 -1977	1977 -1987	1987 -1997	1927 -1937	1937 -1957	1957 -1967	1967 -1977	1977 -1987	1987 -1997
Eastern hemlock	-	-	-	-	-	T	-	-	-	-	-	.4
Sugar maple	T	T	.1	.1	.3	-	.1	.2	.7	.4	.7	-
Red maple	.4	.4	1.1	.9	.6	.9	.6	.8	2.2	.4	1.6	3.0
Mockernut hickory	T	T	-	T	-	T	-	T	-	-	-	.1
Pignut hickory	T	T	T	-	-	-	-	T	-	-	-	-
Shagbark hickory	T	T	T	-	-	T	.1	.1	.2	-	-	.3
Northern red oak	.4	.8	.2	.1	T	.3	.6	.6	T	-	-	T
Black oak	.2	.4	.1	.1	-	.2	T	-	-	-	-	-
Scarlet oak	T	T	.2	T	-	.3	-	-	-	-	-	-
White oak	.3	.3	T	T	.1	T	.2	-	-	-	-	-
Chestnut oak	.1	.4	T	T	T	T	.1	.2	-	-	-	-
Yellow birch	.2	.6	.6	.2	.6	.5	.3	2.4	1.5	.3	.8	.4
Black birch	.3	.8	.9	.5	.5	1.1	T	1.1	.5	.6	.4	.4
Paper birch	-	-	T	-	-	-	-	-	-	-	-	-
American beech	T	T	T	T	.1	.2	-	-	-	-	-	.1
White ash	T	T	.3	.1	.1	T	.1	.1	1.0	-	.5	.3
Basswood	T	-	-	-	-	-	-	-	-	-	-	-
Tulip poplar	T	T	.1	T	.1	.2	.2	.2	-	-	T	.5
American elm	T	T	-	-	-	-	.1	.4	-	-	-	-
Bigtooth aspen	T	T	-	-	-	-	-	-	-	-	-	-
Tupelo	-	-	-	-	T	-	-	-	-	-	.1	-
Black locust	-	T	-	-	-	-	-	-	-	-	-	-
Sassafras	T	-	-	-	-	-	-	-	-	-	-	-
MAJOR SPECIES	2.3	4.2	3.9	2.6	2.7	4.0	2.6	6.2	6.2	1.7	4.2	5.6
Flowering dogwood	-	T	T	-	-	-	-	-	.1	-	-	-
Bluebeech	-	T	-	-	-	-	-	T	-	-	-	-
Hophornbeam	-	T	-	-	-	-	-	-	-	-	-	-
Gray birch	T	-	-	-	-	-	-	-	-	-	-	-
MINOR SPECIES	T	T	T	-	-	-	-	T	.1	-	-	-
ALL SPECIES	2.3	4.3	4.0	2.6	2.7	4.0	2.6	6.2	6.3	1.7	4.2	5.6

Table 18b. Canopy basal area ingrowth (ft^2/acre/decade) during 1927-1997. Average over all tracts (does not include muck). T represents less than 0.1 ft^2/acre.

	Medium sites						Dry sites					
SPECIES	1927 -1937	1937 -1957	1957 -1967	1967 -1977	1977 -1987	1987 -1997	1927 -1937	1937 -1957	1957 -1967	1967 -1977	1977 -1987	1987 -1997
Eastern hemlock	-	-	-	-	-	-	-	-	-	-	-	-
Sugar maple	T	T	T	T	.3	-	-	-	-	-	.2	-
Red maple	.4	.4	1.1	.8	.5	.4	T	T	.1	2.4	-	.6
Mockernut hickory	T	T	-	T	-	-	-	-	-	-	-	-
Pignut hickory	T	T	T	-	-	-	T	.3	-	-	-	-
Shagbark hickory	T	T	T	-	-	-	-	-	-	-	-	-
Northern red oak	.4	.9	.2	.1	.1	.5	.2	.3	.1	.3	.1	-
Black oak	.2	.3	.2	.1	-	.1	.2	1.2	-	.2	-	.8
Scarlet oak	T	.1	-	.1	-	.4	.2	T	1.1	-	-	.3
White oak	.2	.4	T	-	.2	-	.8	.3	.3	.6	-	.5
Chestnut oak	.2	.4	T	-	T	.1	.1	.6	.4	.6	-	-
Yellow birch	.2	.3	.5	.3	.7	.6	-	-	-	-	-	-
Black birch	.4	.8	1.0	.4	.4	1.2	.2	.4	.9	.7	1.2	1.0
Paper birch	-	-	T	-	-	-	-	-	-	-	-	-
American beech	T	T	T	T	.1	.2	-	-	.2	.2	.4	.4
White ash	T	T	.2	.2	T	-	.1	-	.1	-	-	-
Basswood	T	-	-	-	-	-	-	-	-	-	-	-
Tulip poplar	T	T	.2	-	.1	.1	-	-	-	.2	-	-
American elm	-	-	-	-	-	-	-	-	-	-	-	-
Bigtooth aspen	T	T	-	-	-	-	-	-	-	-	-	-
Tupelo	-	-	-	-	-	-	-	-	-	-	-	-
Black locust	-	-	-	-	-	-	-	T	-	-	-	-
Sassafras	T	-	-	-	-	-	-	-	-	-	-	-
MAJOR SPECIES	2.3	3.9	3.5	2.2	2.6	3.7	2.0	3.4	3.2	5.2	1.9	3.6
Flowering dogwood	-	T	-	-	-	-	-	-	-	-	-	-
Bluebeech	-	T	-	-	-	-	-	-	-	-	-	-
Hophornbeam	-	T	-	-	-	-	-	-	-	-	-	-
Gray birch	T	-	-	-	-	-	T	-	-	-	-	-
MINOR SPECIES	T	T	-	-	-	-	T	-	-	-	-	-
ALL SPECIES	2.3	4.0	3.5	2.2	2.6	3.7	2.0	3.4	3.2	5.2	1.9	3.6

Table19a. Stand density (stems/acre) of subcanopy (intermediate and suppressed) trees during 1927-1997. Average over all tracts (does not include muck). T represents less than 0.1 stem/acre.

	Combined moisture classes							Moist sites						
Species	1927	1937	1957	1967	1977	1987	1997	1927	1937	1957	1967	1977	1987	1997
Eastern white pine	-	T	.9	T	.4	.5	.5	-	.6	-	-	-	-	-
Eastern hemlock	.3	.3	.3	.3	.4	.3	.2	.6	.6	.6	.6	.6	.6	-
Sugar maple	34.2	32.6	32.5	29.6	30.8	31.1	28.6	68.7	71.0	68.7	60.4	55.2	54.0	49.9
Red maple	235.5	176.1	130.9	127.1	173.7	165.0	125.2	203.6	148.5	105.0	78.6	85.7	83.3	54.0
Bitternut hickory	2.1	1.0	T	-	.2	.3	.2	2.3	1.2	-	-	1.2	1.2	.6
Mockernut hickory	11.2	8.3	4.3	1.6	.6	.7	.2	4.1	1.8	-	-	.6	.6	-
Pignut hickory	43.2	24.1	8.2	3.4	2.5	3.7	3.8	10.6	7.6	2.9	1.8	5.3	8.2	8.2
Shagbark hickory	7.5	5.4	3.4	1.5	.6	.8	.5	5.3	4.1	2.3	-	.6	1.2	-
Northern red oak	69.8	45.4	19.7	5.7	3.6	5.4	5.1	53.4	39.3	21.7	5.3	2.3	3.5	2.3
Black oak	24.7	18.5	5.9	1.1	1.5	3.4	1.8	8.2	4.1	1.8	-	.6	.6	-
Scarlet oak	10.3	6.5	2.9	T	.5	.9	.6	2.9	4.1	1.2	-	-	-	-
White oak	113.8	69.4	17.9	3.4	2.7	4.8	2.7	35.8	15.8	8.8	.6	.6	1.2	.6
Chestnut oak	18.0	13.9	8.9	3.0	5.9	7.7	4.7	10.0	12.9	1.2	-	2.3	.6	.6
Yellow birch	75.0	63.7	53.7	48.8	94.5	113.1	101.3	125.6	119.1	85.1	72.8	148.5	184.9	152.6
Black birch	96.9	81.2	60.2	66.2	103.9	115.8	97.3	32.9	28.2	20.5	23.5	54.0	59.3	47.5
Paper birch	.4	.4	.5	.2	T	-	-	-	-	-	-	-	-	-
American beech	13.8	12.9	17.8	25.9	44.7	54.9	61.9	1.2	1.2	15.8	19.4	31.1	46.4	46.9
White ash	54.9	34.9	14.7	6.2	4.1	3.5	2.4	51.1	32.9	19.4	5.9	7.6	7.0	6.5
Black ash	.5	.2	-	T	-	-	-	.6	.6	-	-	-	-	-
Basswood	2.6	1.6	.6	T	-	T	-	2.3	2.9	1.2	-	-	-	-
Tulip poplar	6.0	3.4	1.7	1.0	6.0	9.9	8.2	4.7	5.3	1.8	1.2	18.8	26.4	22.9
American elm	3.8	2.8	.9	.4	T	T	T	15.3	12.3	3.5	1.2	-	-	-
Bigtooth aspen	3.1	1.9	T	-	-	-	-	5.3	2.9	-	-	-	-	-
Tupelo	7.7	5.5	3.9	4.2	7.9	8.3	5.9	20.0	14.1	11.2	12.3	28.8	27.6	17.6
Black locust	.3	T	-	-	-	-	-	-	-	-	-	-	-	-
Butternut	3.1	.8	-	-	T	-	-	2.9	.6	-	-	-	-	-
Black cherry	9.9	1.4	T	-	T	.6	.9	29.3	4.7	.6	-	-	-	.6
Sassafras	13.0	6.0	6.1	10.5	22.9	15.8	8.3	10.6	4.7	9.4	8.2	11.2	6.5	2.9
MAJOR SPECIES	861.7	618.3	396.2	340.4	507.8	546.8	460.4	707.2	541.1	382.6	291.7	454.8	512.9	413.7
Eastern red cedar	2.9	.2	T	-	-	-	-	-	-	-	-	-	-	-
American chestnut	11.7	1.6	37.2	40.4	49.7	14.5	12.5	2.9	.6	11.7	8.8	14.7	4.1	1.8
Flowering dogwood	39.6	33.9	28.6	31.1	42.1	6.8	2.7	15.8	10.6	15.3	20.5	27.0	5.3	2.3
Bluebeech	187.1	99.6	51.0	17.2	11.0	18.9	23.0	275.8	156.7	95.7	38.7	25.2	37.0	31.7
Shadbush	18.1	13.6	2.7	1.2	1.2	.7	.5	25.8	20.0	3.5	1.2	2.9	.6	.6
Hophornbeam	34.2	19.2	15.3	2.4	3.2	13.7	21.7	30.5	18.2	29.9	4.1	4.1	8.8	7.0
Gray birch	46.8	22.0	.7	T	T	-	-	63.4	29.3	.6	-	-	-	-
MINOR SPECIES	340.4	190.1	135.6	92.4	107.3	54.5	60.5	414.3	235.3	156.7	73.4	73.9	55.8	43.4
ALL SPECIES	1202.1	808.4	531.8	432.8	615.2	601.4	521.0	1121.5	776.4	539.3	365.0	528.8	568.7	457.2

Table 19b. Stand density (stems/acre) of subcanopy (intermediate and suppressed) trees during 1927-1997. Average over all tracts (does not include muck). T represents less than 0.1 stem/acre.

	Medium sites							Dry sites						
Species	1927	1937	1957	1967	1977	1987	1997	1927	1937	1957	1967	1977	1987	1997
Eastern white pine	-	-	1.3	.1	.6	.6	.6	-	-	-	-	-	.7	.7
Eastern hemlock	.3	.3	.3	.3	.4	.3	.3	-	-	-	-	-	-	-
Sugar maple	30.8	28.3	28.4	26.6	28.8	29.8	28.0	10.2	8.8	10.2	8.2	12.3	10.9	6.8
Red maple	237.8	179.7	131.7	128.7	180.6	169.6	129.8	261.4	190.6	157.2	175.6	243.0	237.6	185.8
Bitternut hickory	2.4	1.1	.1	-	-	.1	.1	-	-	-	-	-	-	-
Mockernut hickory	11.1	8.1	4.5	1.6	.6	.6	.3	19.7	17.0	8.2	3.4	.7	1.4	-
Pignut hickory	41.2	20.5	8.2	3.7	2.4	2.7	3.0	90.5	60.6	14.3	4.1	-	3.4	2.7
Shagbark hickory	8.2	5.7	4.0	2.1	.7	.9	.7	6.8	5.4	2.0	-	-	-	-
Northern red oak	74.9	46.2	18.5	4.8	2.8	4.4	4.1	64.7	49.0	23.1	10.2	8.8	12.3	12.9
Black oak	19.9	13.9	5.1	.9	1.3	2.3	1.3	66.7	57.2	14.3	3.4	3.4	12.3	6.1
Scarlet oak	9.2	4.8	2.4	-	.3	.6	.6	23.8	17.0	7.5	.7	2.0	3.4	1.4
White oak	121.3	71.0	16.9	3.3	2.6	4.0	2.1	168.1	123.9	33.4	7.5	6.1	12.9	8.2
Chestnut oak	20.5	14.2	11.4	3.4	6.5	8.2	5.0	15.7	13.6	6.1	4.8	6.8	13.6	8.2
Yellow birch	76.3	61.8	56.1	51.6	98.0	115.5	107.3	10.2	8.8	5.4	7.5	15.0	18.4	12.9
Black birch	107.0	85.9	60.5	66.2	99.9	112.4	95.0	123.2	119.8	104.8	115.7	181.1	198.1	166.1
Paper birch	.6	.6	.7	.3	.1	-	-	-	-	-	-	-	-	-
American beech	14.8	13.2	16.1	22.4	39.9	49.7	58.5	23.8	25.2	28.6	50.4	83.0	89.9	95.3
White ash	63.4	39.1	15.5	7.5	4.0	3.4	2.0	19.1	17.0	5.4	-	.7	-	-
Black ash	.6	.1	-	-	-	-	-	-	-	-	.7	-	-	-
Basswood	3.3	1.6	.6	.1	-	.1	-	-	-	-	-	-	-	-
Tulip poplar	7.4	3.7	2.0	1.1	4.1	7.8	6.3	.7	-	-	-	-	.7	.7
American elm	1.7	1.1	.4	.3	.1	.1	.1	.7	-	-	-	-	-	-
Bigtooth aspen	1.6	1.1	.1	-	-	-	-	8.2	4.1	-	-	-	-	-
Tupelo	5.7	4.3	2.7	3.0	4.4	5.3	4.3	3.4	1.4	1.4	.7	.7	.7	-
Black locust	-	-	-	-	-	-	-	2.0	.7	-	-	-	-	-
Butternut	2.7	.6	-	-	.1	-	-	5.4	2.0	-	-	-	-	-
Black cherry	5.3	.6	-	-	.1	.9	1.1	9.5	1.4	-	-	-	-	-
Sassafras	12.6	6.3	5.4	10.4	25.4	18.0	10.1	17.7	6.1	5.4	13.6	24.5	15.7	6.1
MAJOR SPECIES	880.4	613.7	393.0	338.4	503.9	537.3	460.6	951.7	729.7	427.5	406.4	588.2	631.7	514.0
Eastern red cedar	3.8	.3	.1	-	-	-	-	2.0	-	-	-	-	-	-
American chestnut	11.1	1.4	41.9	46.3	50.7	16.1	14.1	24.5	3.4	44.2	49.0	85.8	19.1	17.7
Flowering dogwood	49.2	43.5	35.9	37.9	51.9	8.4	3.3	21.1	15.0	8.8	10.9	12.9	.7	.7
Bluebeech	194.9	100.7	48.0	15.3	9.4	17.5	25.0	47.0	27.9	13.6	1.4	2.0	4.8	3.4
Shadbush	15.3	12.2	2.6	.9	.7	.9	.6	22.5	12.9	2.7	2.7	1.4	-	-
Hophornbeam	39.2	20.5	12.4	2.3	3.3	17.3	28.8	14.3	14.3	12.3	.7	2.0	2.0	4.8
Gray birch	44.0	20.0	.9	.1	-	-	-	40.8	23.1	-	-	.7	-	-
MINOR SPECIES	357.6	198.6	141.8	102.9	115.9	60.1	71.7	172.2	96.7	81.7	64.7	104.8	26.5	26.5
ALL SPECIES	1238.0	812.3	534.7	441.3	619.8	597.4	532.3	1123.9	826.4	509.2	471.1	693.0	658.3	540.5

Table 20a. Periodic mortality (stems/acre/decade) of subcanopy (intermediate and suppressed) trees during 1927-1997. Average over all tracts (does not include muck). T represents < 0.1 stem/acre, "-" no live stems at beginning of period.

	Combined moisture classes						Moist sites					
SPECIES	1927 -1937	1937 -1957	1957 -1967	1967 -1977	1977 -1987	1987 -1997	1927 -1937	1937 -1957	1957 -1967	1967 -1977	1977 -1987	1987 -1997
Eastern white pine	-	T	.9	0	T	0	-	.3	-	-	-	-
Eastern hemlock	0	0	0	0	T	0	0	0	0	0	0	0
Sugar maple	6.0	5.6	5.2	4.1	3.5	4.5	8.2	12.6	10.6	10.0	5.9	7.6
Red maple	83.8	44.6	27.1	22.6	40.3	50.1	80.4	36.4	31.1	22.9	20.5	29.9
Bitternut hickory	1.1	.4	T	-	0	.2	1.2	.6	-	-	0	1.2
Mockernut hickory	4.0	2.3	3.2	1.2	0	.4	2.3	.6	-	-	0	0
Pignut hickory	21.6	8.8	5.1	1.9	.3	.8	3.5	2.3	1.8	0	0	1.2
Shagbark hickory	2.9	1.1	1.8	1.0	.2	.3	1.8	.6	1.8	-	0	.6
Northern red oak	29.1	14.5	14.6	3.0	.7	1.5	20.0	10.0	16.4	4.7	0	1.2
Black oak	10.0	6.0	4.7	.4	.2	1.8	2.9	1.5	1.8	-	0	.6
Scarlet oak	3.6	2.4	2.4	0	.2	.4	0	1.5	1.2	-	-	-
White oak	52.8	27.9	14.8	2.3	1.1	2.3	21.1	6.2	8.2	.6	0	.6
Chestnut oak	6.6	4.6	6.6	1.5	1.7	4.2	1.2	5.6	1.2	-	1.8	0
Yellow birch	23.0	14.3	16.2	11.1	16.2	25.5	37.6	23.2	23.5	24.6	24.1	46.4
Black birch	30.1	19.8	11.4	13.9	21.2	30.0	9.4	7.0	4.1	4.7	8.2	14.7
Paper birch	0	T	.2	T	T	-	-	-	-	-	-	-
American beech	2.5	3.1	1.5	2.0	4.5	5.4	-	.3	0	1.8	3.5	4.7
White ash	22.6	13.3	8.2	4.1	2.2	2.0	17.6	12.3	10.6	1.8	4.7	2.9
Black ash	.4	T	-	T	-	-	.6	.3	-	-	-	-
Basswood	1.2	.6	.5	T	-	T	.6	.9	1.2	-	-	-
Tulip poplar	2.6	1.2	.6	T	1.4	2.9	1.8	1.8	1.2	0	2.3	5.9
American elm	1.6	.8	.6	.4	0	0	5.9	3.5	2.9	1.2	-	-
Bigtooth aspen	2.6	.9	T	-	-	-	5.3	1.5	-	-	-	-
Tupelo	2.9	1.1	.8	.5	1.2	2.4	7.0	2.1	1.8	.6	5.9	10.0
Black locust	.2	0	-	-	-	-	-	-	-	-	-	-
Butternut	2.8	.4	-	-	T	-	2.3	.3	-	-	-	-
Black cherry	8.7	.7	T	-	0	.3	25.8	2.3	.6	-	-	-
Sassafras	6.8	2.1	2.8	4.9	11.1	9.0	5.9	1.8	5.3	5.9	5.9	4.1
MAJOR SPECIES	329.6	176.8	129.4	75.1	106.2	143.9	262.3	135.3	125.0	78.6	82.7	131.5
Eastern red cedar	1.3	T	T	-	-	-	-	-	-	-	-	-
American chestnut	9.8	.6	20.3	32.4	45.4	11.0	1.8	.3	4.7	7.0	12.3	2.9
Flowering dogwood	11.9	8.5	5.6	6.5	36.6	4.1	5.3	.9	1.8	3.5	21.7	2.9
Bluebeech	94.0	35.4	37.0	11.7	3.2	5.8	131.5	51.1	65.1	27.6	6.5	9.4
Shadbush	6.0	6.2	2.0	.6	.8	.3	8.8	9.1	2.3	.6	2.3	0
Hophornbeam	17.2	4.8	13.5	1.0	.4	1.9	15.8	3.2	25.8	1.2	0	3.5
Gray birch	36.6	10.8	.6	T	T	-	56.3	14.4	.6	-	-	-
MINOR SPECIES	176.9	66.3	79.0	52.2	86.6	23.0	219.5	78.9	100.4	39.9	42.8	18.8
ALL SPECIES	506.5	243.1	208.4	127.3	192.8	167.0	481.8	214.2	225.4	118.5	125.6	150.2

Table 20b. Periodic mortality (stems/acre/decade) of subcanopy (intermediate and suppressed) trees during 1927-1997. Average over all tracts (does not include muck). T represents < 0.1 stem/acre, "-" no live stems at beginning of period.

	Medium sites						Dry sites					
SPECIES	1927 -1937	1937 -1957	1957 -1967	1967 -1977	1977 -1987	1987 -1997	1927 -1937	1937 -1957	1957 -1967	1967 -1977	1977 -1987	1987 -1997
Eastern white pine	-	-	1.3	0	.1	0	-	-	-	-	-	0
Eastern hemlock	0	0	0	0	.1	0	-	-	-	-	-	-
Sugar maple	6.3	4.8	4.5	3.4	3.3	3.8	2.0	1.4	2.0	.7	2.0	4.1
Red maple	81.1	45.7	25.7	22.0	43.6	51.3	100.7	49.0	29.3	25.2	47.7	68.1
Bitternut hickory	1.3	.5	.1	-	-	0	-	-	-	-	-	-
Mockernut hickory	4.3	2.2	3.7	1.1	0	.3	4.8	4.4	4.8	2.7	0	1.4
Pignut hickory	22.4	7.4	4.7	1.8	.4	.4	38.8	22.8	10.9	4.1	-	2.0
Shagbark hickory	3.6	.9	1.7	1.4	.3	.3	1.4	2.4	2.0	-	-	-
Northern red oak	31.5	15.5	14.5	2.8	.9	1.1	27.9	15.3	12.9	2.0	.7	3.4
Black oak	8.7	4.3	4.0	.3	.3	1.0	24.5	19.4	11.6	1.4	0	6.8
Scarlet oak	3.8	1.8	2.4	-	.1	.1	6.8	6.5	4.1	0	.7	2.0
White oak	59.8	28.6	13.9	2.6	1.0	2.3	55.8	49.7	26.5	2.7	2.7	4.1
Chestnut oak	8.8	4.6	8.7	1.8	1.8	4.4	2.0	3.4	2.7	1.4	.7	8.2
Yellow birch	23.6	14.6	17.6	9.9	17.0	24.3	3.4	3.1	.7	.7	2.7	6.8
Black birch	34.0	21.2	12.8	15.1	20.2	28.8	35.4	27.9	12.9	19.1	41.5	53.1
Paper birch	0	T	.3	.1	.1	-	-	-	-	-	-	-
American beech	3.0	3.4	1.7	1.7	3.4	3.3	3.4	5.1	2.0	3.4	10.9	16.3
White ash	27.3	14.8	8.4	5.5	1.8	2.1	6.1	7.5	4.8	-	.7	-
Black ash	.4	T	-	-	-	-	-	-	-	.7	-	-
Basswood	1.6	.6	.4	.1	-	.1	-	-	-	-	-	-
Tulip poplar	3.3	1.3	.6	.1	1.4	2.7	.7	-	-	-	-	.7
American elm	.7	.4	.1	.3	0	0	.7	-	-	-	-	-
Bigtooth aspen	1.1	.5	.1	-	-	-	6.8	2.0	-	-	-	-
Tupelo	2.1	1.1	.6	.6	.3	1.0	2.0	0	.7	0	0	.7
Black locust	-	-	-	-	-	-	1.4	0	-	-	-	-
Butternut	2.6	.3	-	-	.1	-	4.8	1.0	-	-	-	-
Black cherry	4.5	.3	-	-	0	.4	8.8	.7	-	-	-	-
Sassafras	5.8	2.3	2.6	5.3	12.5	9.8	12.3	1.4	1.4	2.0	10.2	10.9
MAJOR SPECIES	341.5	177.2	130.4	76.1	109.0	137.7	350.6	222.9	129.3	66.0	120.5	188.6
Eastern red cedar	1.4	T	.1	-	-	-	2.0	-	-	-	-	-
American chestnut	9.0	.5	22.9	37.2	46.0	11.8	23.1	1.4	25.9	38.8	81.0	16.3
Flowering dogwood	14.5	11.1	7.4	8.0	45.3	5.3	7.5	4.8	1.4	2.7	12.3	0
Bluebeech	100.0	36.7	35.2	9.9	3.1	5.5	21.8	11.2	12.9	1.4	0	2.7
Shadbush	4.3	5.6	2.1	.4	.3	.4	10.9	5.4	.7	1.4	1.4	-
Hophornbeam	20.5	5.4	10.8	1.1	.3	1.8	3.4	3.7	12.3	0	1.4	0
Gray birch	33.0	9.8	.7	.1	-	-	31.3	11.6	-	-	.7	-
MINOR SPECIES	182.6	69.2	79.3	56.8	95.0	24.9	100.1	38.1	53.1	44.2	96.7	19.1
ALL SPECIES	524.1	246.3	209.7	133.0	204.0	162.5	450.6	261.1	182.4	110.3	217.2	207.6

Table 21. Stand density (stems/acre) of saplings (≥ 4 feet tall and < 0.5 inches dbh) during 1977-1997. Average over all tracts (does not include muck).

	Combined moisture classes			Moist sites			Medium sites			Dry sites		
SPECIES	1977	1987	1997	1977	1987	1997	1977	1987	1997	1977	1987	1997
Eastern white pine	3	3	1	-	-	-	4	4	2	-	-	-
Eastern hemlock	-	-	-	-	-	-	-	-	-	-	-	-
Other conifer	6	1	-	-	10	-	4	-	-	20	-	-
Sugar maple	23	31	19	19	77	39	26	26	18	10	10	-
Red maple	187	81	43	116	48	-	169	70	44	350	170	80
Pignut hickory	23	14	7	19	10	19	18	12	6	50	30	-
Northern red oak	23	7	4	10	10	-	22	2	6	40	30	-
Black oak	7	9	4	-	-	-	6	10	6	20	10	-
Scarlet oak	10	1	1	-	-	-	-	2	-	70	-	10
White oak	23	6	4	-	-	-	16	4	4	80	20	10
Chestnut oak	14	13	7	10	-	-	18	12	10	-	30	-
Yellow birch	124	45	26	165	29	39	141	56	18	-	10	50
Black birch	146	112	34	58	87	19	149	109	30	220	150	70
American beech	30	60	41	29	68	77	22	56	40	70	70	10
White ash	7	3	-	-	-	-	10	4	-	-	-	-
Basswood	1	1	-	-	-	-	2	2	-	-	-	-
Tulip poplar	23	1	-	29	-	-	24	2	-	10	-	-
Tupelo	4	4	-	10	10	-	4	4	-	-	-	-
Black cherry	4	10	4	-	-	-	6	14	6	-	-	-
Sassafras	21	10	1	-	-	-	28	14	2	10	-	-
MAJOR SPECIES	679	413	198	465	349	193	669	403	192	950	530	230
American chestnut	70	51	30	10	-	-	56	44	28	200	140	70
Flowering dogwood	55	-	-	29	-	-	68	-	-	20	-	-
Bluebeech	71	44	35	165	10	19	56	54	42	50	30	20
Shadbush	13	14	11	10	19	29	14	8	10	10	40	-
Hophornbeam	28	55	28	-	-	-	38	74	36	10	20	20
MINOR SPECIES	238	165	105	214	29	48	232	180	116	290	230	110
ALL SPECIES	917	578	303	679	378	241	901	583	308	1240	760	340

Table 21. Stand density (stems/acre) of saplings (≥ 4 feet tall and < 0.5 inches dbh) during 1977-1997. Average over all tracts (does not include muck).

	Combined moisture classes			Moist sites			Medium sites			Dry sites		
SPECIES	1977	1987	1997	1977	1987	1997	1977	1987	1997	1977	1987	1997
Eastern white pine	3	3	1	-	-	-	4	4	2	-	-	-
Eastern hemlock	-	-	-	-	-	-	-	-	-	-	-	-
Other conifer	6	1	-	-	10	-	4	-	-	20	-	-
Sugar maple	23	31	19	19	77	39	26	26	18	10	10	-
Red maple	187	81	43	116	48	-	169	70	44	350	170	80
Pignut hickory	23	14	7	19	10	19	18	12	6	50	30	-
Northern red oak	23	7	4	10	10	-	22	2	6	40	30	-
Black oak	7	9	4	-	-	-	6	10	6	20	10	-
Scarlet oak	10	1	1	-	-	-	-	2	-	70	-	10
White oak	23	6	4	-	-	-	16	4	4	80	20	10
Chestnut oak	14	13	7	10	-	-	18	12	10	-	30	-
Yellow birch	124	45	26	165	29	39	141	56	18	-	10	50
Black birch	146	112	34	58	87	19	149	109	30	220	150	70
American beech	30	60	41	29	68	77	22	56	40	70	70	10
White ash	7	3	-	-	-	-	10	4	-	-	-	-
Basswood	1	1	-	-	-	-	2	2	-	-	-	-
Tulip poplar	23	1	-	29	-	-	24	2	-	10	-	-
Tupelo	4	4	-	10	10	-	4	4	-	-	-	-
Black cherry	4	10	4	-	-	-	6	14	6	-	-	-
Sassafras	21	10	1	-	-	-	28	14	2	10	-	-
MAJOR SPECIES	679	413	198	465	349	193	669	403	192	950	530	230
American chestnut	70	51	30	10	-	-	56	44	28	200	140	70
Flowering dogwood	55	-	-	29	-	-	68	-	-	20	-	-
Bluebeech	71	44	35	165	10	19	56	54	42	50	30	20
Shadbush	13	14	11	10	19	29	14	8	10	10	40	-
Hophornbeam	28	55	28	-	-	-	38	74	36	10	20	20
MINOR SPECIES	238	165	105	214	29	48	232	180	116	290	230	110
ALL SPECIES	917	578	303	679	378	241	901	583	308	1240	760	340

Table 22. Stand density (stems/acre) of seedlings (< 4 feet tall) during 1977-1997. Average over all tracts (does not include muck).

	Combined moisture classes			Moist sites			Medium sites			Dry sites		
SPECIES	1977	1987	1997	1977	1987	1997	1977	1987	1997	1977	1987	1997
Eastern white pine	9	7	38	-	-	10	12	10	50	-	-	10
Eastern hemlock	1	-	3	10	-	10	-	-	2	-	-	-
Other conifer	9	1	-	10	-	-	8	2	-	10	-	-
Sugar maple	254	134	206	271	261	242	286	135	238	80	-	10
Red maple	2237	1999	3597	2652	1433	4279	2203	2054	3461	1980	2310	3570
Pignut hickory	188	151	185	77	106	213	205	155	199	220	180	90
Northern red oak	4467	935	767	6554	823	639	4232	1011	858	3480	670	450
Black oak	618	560	502	194	242	155	680	594	560	750	720	570
Scarlet oak	375	138	33	358	-	-	217	72	24	1180	610	110
White oak	415	350	416	281	126	290	362	334	449	820	660	380
Chestnut oak	259	194	230	165	155	39	268	193	288	310	240	140
Yellow birch	310	215	160	271	329	571	358	225	105	110	50	10
Black birch	443	256	90	106	116	87	536	302	103	330	170	30
American beech	90	88	198	290	252	223	50	70	195	80	10	190
White ash	284	147	157	465	271	407	290	143	131	70	40	30
Basswood	11	17	6	10	-	-	12	20	8	10	20	-
Tulip poplar	220	80	107	407	232	407	207	64	56	90	-	50
Tupelo	23	51	57	77	261	165	16	18	46	-	-	-
Black cherry	136	209	79	271	77	48	125	260	89	50	90	60
Sassafras	509	535	460	48	106	77	568	519	578	690	1060	270
MAJOR SPECIES	10859	6068	7292	12517	4790	7862	10635	6181	7440	10260	6830	5970
American chestnut	331	204	156	19	-	-	348	205	143	570	410	380
Flowering dogwood	710	20	3	290	-	-	821	28	4	590	-	-
Bluebeech	311	153	156	436	319	213	334	127	169	70	110	30
Shadbush	93	235	240	174	339	348	66	217	234	140	220	160
Hophornbeam	109	220	180	77	97	106	109	266	165	140	120	330
MINOR SPECIES	1553	832	734	996	755	667	1678	843	715	1510	860	900
ALL SPECIES	12413	6901	8027	13513	5545	8529	12313	7024	8155	11770	7690	6870

Table 23. Nectria canker (*Nectria galligena*) incidence (%) of black birch (*Betula lenta*) by tree age and diameter. Total sample size for each diameter and age class is in parentheses. Only combinations with at least 15 stems were included.

	Stem diameter (inches)					
Age	1-3	4-7	8-11	12-15	≥ 16.0	Total
10	4% (165)	- -	- -	- -	- -	4% (165)
20	1% (283)	- -	- -	- -	- -	1% (287)
30	1% (292)	0% (41)	- -	- -	- -	1% (333)
40	2% (59)	5% (41)	- -	- -	- -	3% (103)
50	4% (74)	2% (121)	6% (18)	- -	- -	3% (214)
95	17% (18)	26% (118)	24% (147)	22% (130)	11% (45)	22% (458)
Total	2% (891)	11% (325)	21% (168)	21% (131)	11% (45)	8% 1560)