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The New England Forest: Baseline for New England Forest Health Monitoring

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Abstract

In cooperation with the forestry agencies of the six New England States and the U.S. Environmental Protection Agency, the USDA Forest Service has initiated Forest Health Monitoring (FHM) in New England. The objectives of the program are to assess the condition and stressors of the region's forests, to analyze changes in these data over time, and to identify any relationships between forest condition and stressors. A major component of FHM in New England is 263 permanent plots located across the region on which growth efficiency, foliar condition and nutrition, soil nutrition, and landscape characteristics will be periodically measured and reported. This publication describes the forest resources of New England as reported following the most recent cycle of periodic forest surveys, and discusses the major influences on the region's forests--insects and pathogens, climate and weather, and atmospheric deposition and pollution. This information is intended to serve as a baseline description of New England's forest resource for use in the FHM program.

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Introduction

Forest land is the predominant land cover in New England. The most recent reports from surveys conducted in the early 1980's indicate there are 32.5 million acres of forest land in the six New England states. With a total land area of slightly more than 40 million acres, this means that more than 75 percent of the region is forested. These same 40 million acres are home for an estimated 12.8 million people (U.S. Dep. Comm., Bur. Census 1987). The population density of this region is 204 individuals per square mile, second nationally to the Middle Atlantic States (375 per square mile) and well above the national average of 69 persons per square mile.

The benefits derived from New England's forests accrue to both permanent and seasonal residents and to tourists. They include both commodity and amenity value and range from the specific--wood fiber to support the region's pulp and paper mills--to the abstract--the asthetics of the New England landscape.

The forests of New England have a long and dynamic history. The European settlers found a landscape that was predominantly forested (Cronon 1983). Within a relatively short time, forests were being cleared for agricultural land uses. In the mid-1800's, the process was reversed as many of these agricultural lands, particularly uplands, reverted to forest. Today, a second period of change in forest land use is occurring in New England, this time for residential use. The change is evident in a decrease in the average size of ownership unit and an increase in the number of owners of small acreages (Brooks and Birch 1988). Concurrently, natural stressors have continued to influence forest structure, functions, and processes. Examples are severe weather (for example, hurricanes and drought), insects (for example, gypsy moth [*Lymantria dispar* L.]), and disease (for example, *Armillaria* spp. [Fr.:Fr] Staude). Recently, there has been growing concern about the possible effects of atmospheric pollution, atmospheric deposition, and global warming on the "health" of forests.

In responding to public concerns about the environment, the U.S. Congress has directed the USDA Forest Service to initiate a program to monitor the health of the Nation's forests (Forest Ecosystems and Atmospheric Pollution Act of 1988 [Public Law 100-521]). Specifically, the Act directs the Forest Service to "...conduct such surveys as are necessary to monitor long-term trends in the health and productivity of domestic forest ecosystems."

Through its periodic forest surveys, the Forest Service assesses tree growth, a major attribute of forest productivity. Monitoring trends in forest health and other components of forest-ecosystem productivity requires new survey activities. In New England, in cooperation with State forestry agencies and the U.S. Environmental Protection Agency (EPA), the Forest Service has initiated Forest Health Monitoring (FHM) in New England. In this publication we describe New England forest resources and briefly discuss the major influences on the region's forests. This information is intended to serve as a baseline description of New England's forest resources for use in the FHM program.

Baseline Information

Forest Resources

Under the authority of the Forest and Rangeland Renewable Resources Planning Act of 1974 and the Forest and Rangeland Renewable Resources Research Act of 1978, the Forest Service conducts periodic forest inventories of all states to provide up-to-date information on the forest resources of the Nation. The initial surveys of New England's forest resources were conducted during the 1950's. A second cycle of surveys was conducted from the late 1960's to early 1970's.

This report presents forest resource data from the third survey cycle, completed in 1984. Detailed information is presented in Tables 4 through 18 in the Appendix. The surveys included cooperative efforts by New England State forestry agencies, the USDA Soil Conservation Service, and the Northeastern Forest Experiment Station. The Forest Inventory and Analysis (FIA) project of the Northeastern Station conducted the surveys on all forest land, developed the resource tables, and prepared this report.

The sampling procedure used during the current resurvey included the use of aerial photography, the remeasurement of a sample of ground plots established in earlier surveys, and the establishment of new ground plots. Information in this report is developed solely from aerial photographs and the new ground plot network from the third survey cycle (Table 1). The collected data were summarized using the FINSYS computer system developed at the Northeastern Station. Detailed forest survey information for each New England state is found in published Station Resource Bulletins (Table 2). For additional information about the survey process, contact the Forest Inventory and Analysis Unit, Northeastern Forest Experiment Station, 5 Radnor Corporate Center, Suite 200, 100 Matsonford Road, Radnor, PA 19087-4585 (phone 215-975-4075).

Table 1.--Number of aerial photographic points, forest-survey plots, and Forest Health Monitoring plots by state

State	Aerial photographic Points	Forest-survey Plots	Forest Health Monitoring plots
Maine	62,801	2,475	137
New Hampshire	15,950	697	37
Vermont	16,313	823	35
Massachsetts	14,299	321	32
Connecticut	12,096	320	18
Rhode Island	2,542	95	4
Total	124,001	4,731	263

Table 2.--References for New England Resource Bulletins published by the USDA Forest Service, by State and forest resource category

State	Resource Category	Citation
Maine	Timber	Powell and Dickson 1984
	Wildlife habitat	Brooks et al. 1986
	Ownership	Birch 1986
	Biomass	Wharton et al. 1985
	Forest ecology	Powell 1985
New Hampshire	Timber	Frieswyk and Malley 1985a
	Wildlife habitat	Brooks et al. 1987a
	Ownership	Birch 1989
	Biomass	Frieswyk and Malley 1986a
Vermont	Timber	Frieswyk and Malley 1985b
	Wildlife habitat	Brooks et al. 1987b
	Ownership	Widmann and Birch 1988
	Biomass	Frieswyk and Malley 1986b
Massachsetts	General forest resources	Dickson and McAfee 1988a
Rhode Island	General forest resources	Dickson and McAfee 1988b
Connecticut	Genral forest resources	Dickson and McAfee 1988c
Southern New England	Ownership	Birch (in preparation)

Forest Stressors

Information on historical trends and patterns in principal sources of stress on New England's forests are summarized from published reports. This information includes coverage of forest insects and pathogens, weather and climate, and air pollution and atmospheric deposition.

New England's Forest Resources

Forest Area

The most recent estimate is that 3 of every 4 acres in New England is forested (Appendix, Table 4). This situation has existed for at least the last 40 years: a recent national report of the Nation's forest resources shows that New England forest area has changed little since 1952 (Waddell et al. 1989). The predominance of forest land is common to all parts of New England (Fig. 1). Maine is the most extensively forested, though even Southern New England is more than 60-percent forested.

All but 3 percent of the region's forests is classified as timberland (Appendix, Table 5). This is a commodity-focused classification based on legal access for timber harvests as opposed to areas withdrawn from from timbering such as parks and wilderness areas, and timber-volume productivity. While this is the resource base featured by the forest survey, the statistics that accompany this report generally cover all forest land.

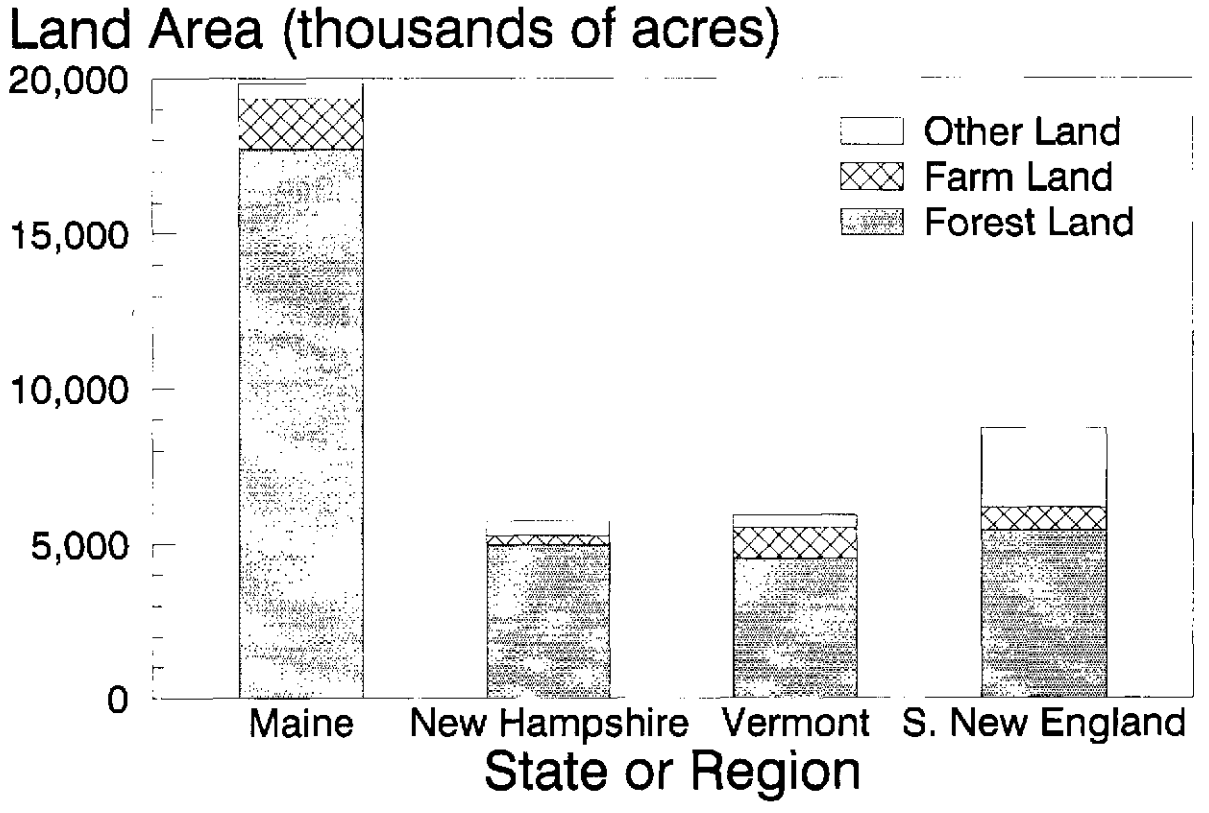


Figure 1.--Land area by state or region and land class, New England.

Most of New England's forests are classified as one of four forest-type groups: white pine, spruce-fir, oak-hickory, or northern hardwoods (Fig. 2; Appendix, Table 6). Other major forest-type groups are oak-pine and aspen-birch. Forest-type classification is based on tree-species dominance. The composition of the major forest-type groups is presented in the following section.

Forest-type groups are not distributed uniformly across New England. Spruce-fir predominates in Maine and is important in northern New Hampshire and Vermont (Fig. 2). Conversely, oak-hickory predominates in southern New England and of is minor importance in the northern New England states. Northern hardwoods are important across the region but this forest-type group is predominant in both New Hampshire and Vermont. White pine is ubiquitous, important in all New England States but predominant in none.

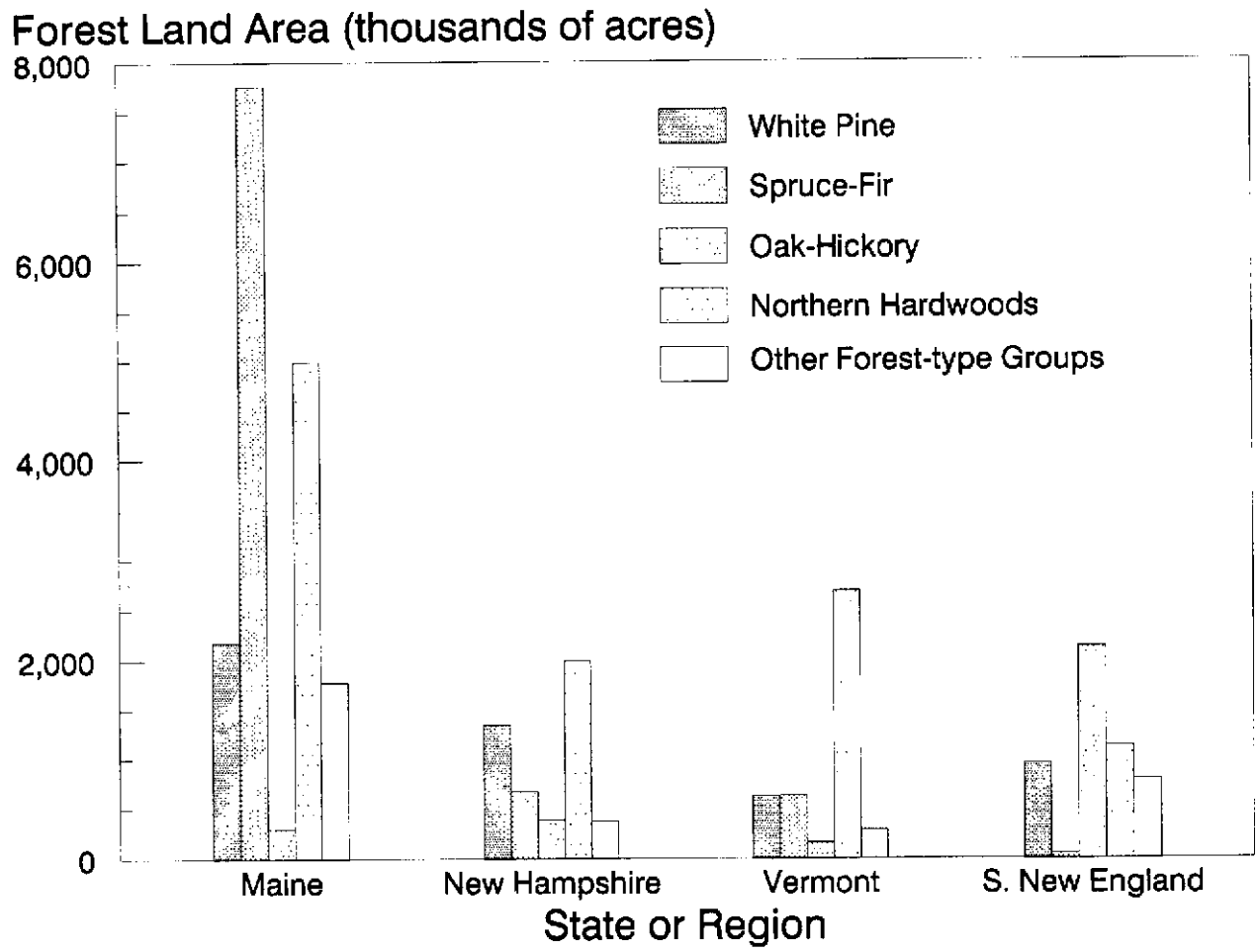


Figure 2.--Forest-land area by forest-type group and state or region, New England

New England's forests have matured to the point where sawtimber-size stands now predominate (Fig. 3; Appendix, Table 6). In the period between the last two forest surveys, sawtimber-size forest area increased by 36 percent while the smaller and younger poletimber-size and sapling/seedling-size forest area decreased by 8 and 51 percent, respectively. Sawtimber-size stands predominate in all major forest-type groups except oak-hickory (Fig. 4).

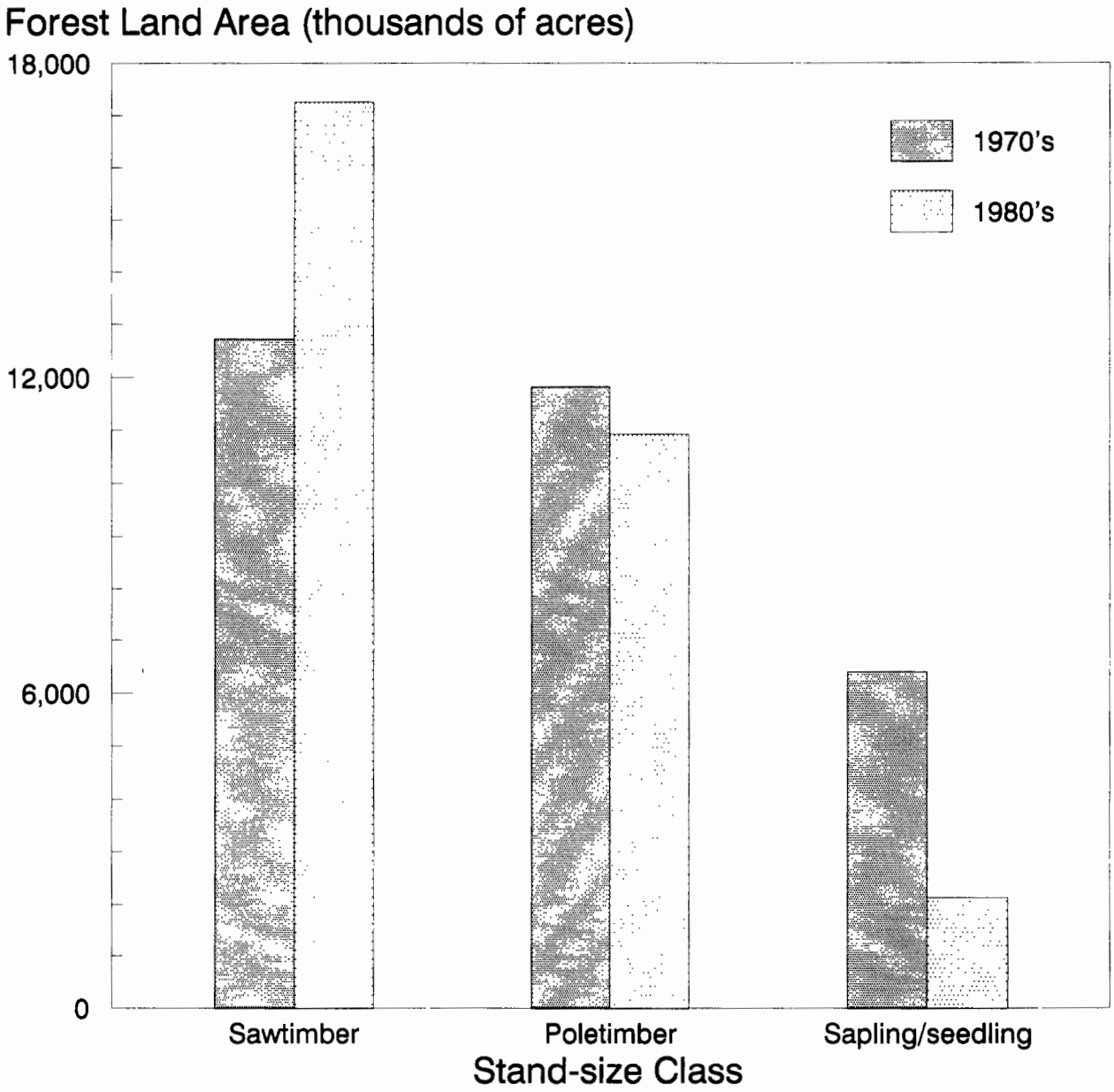


Figure 3.--Forest-land area by survey occasion and stand-size class, New England.

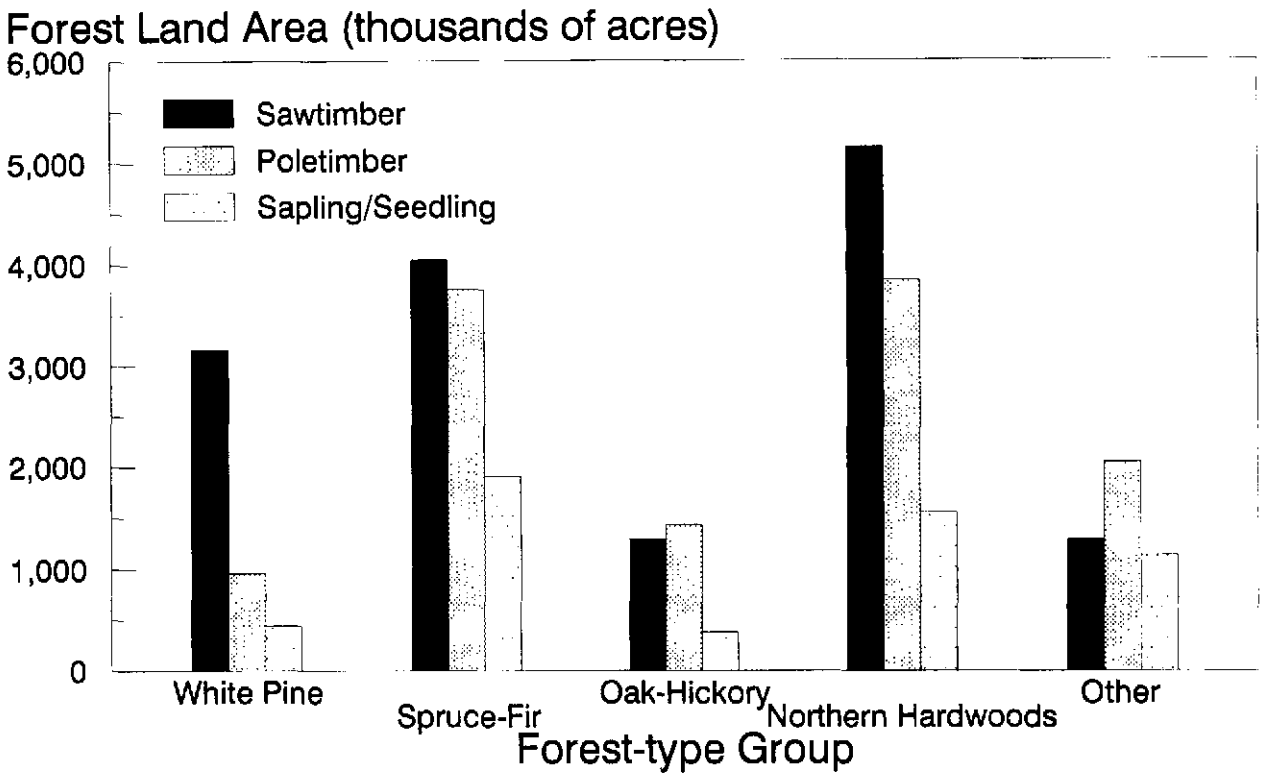


Figure 4.--Forest-land area by major forest type group and stand-size class New England.

Tree Numbers

All forest-type groups. There are an estimated 6.5 billion live trees that are 5 inches and larger in diameter at breast height (d.b.h.) on New England's 32.5 million acres of forest land (Appendix, Table 7). There are an additional 380 million standing-dead trees. The percentage of all trees 5.0 inches and larger in d.b.h. that are dead (5.5 percent) is much less than the average for any forest-cover type reviewed by Tritton and Siccama (1990). Their sample includes a wider period (1970-86) and broader geographic coverage. Also, it is estimated that New England's forests contain more than 149 billion seedling/sapling-size trees. This means that an average acre of New England forest contains 202 live trees 5 inches and larger in d.b.h., 4,602 seedlings and saplings, and 12 standing-dead trees, or 4,816 trees per acre.

Eighty-one tree species or species groups have been surveyed and reported in New England, 16 coniferous and 65 deciduous species (Fig. 5). Balsam fir is the most common species followed by red maple (Fig. 6). Balsam fir also is the dominant species of standing-dead tree. Coniferous and deciduous species occur equally across all size classes except for saplings, which are predominantly deciduous.

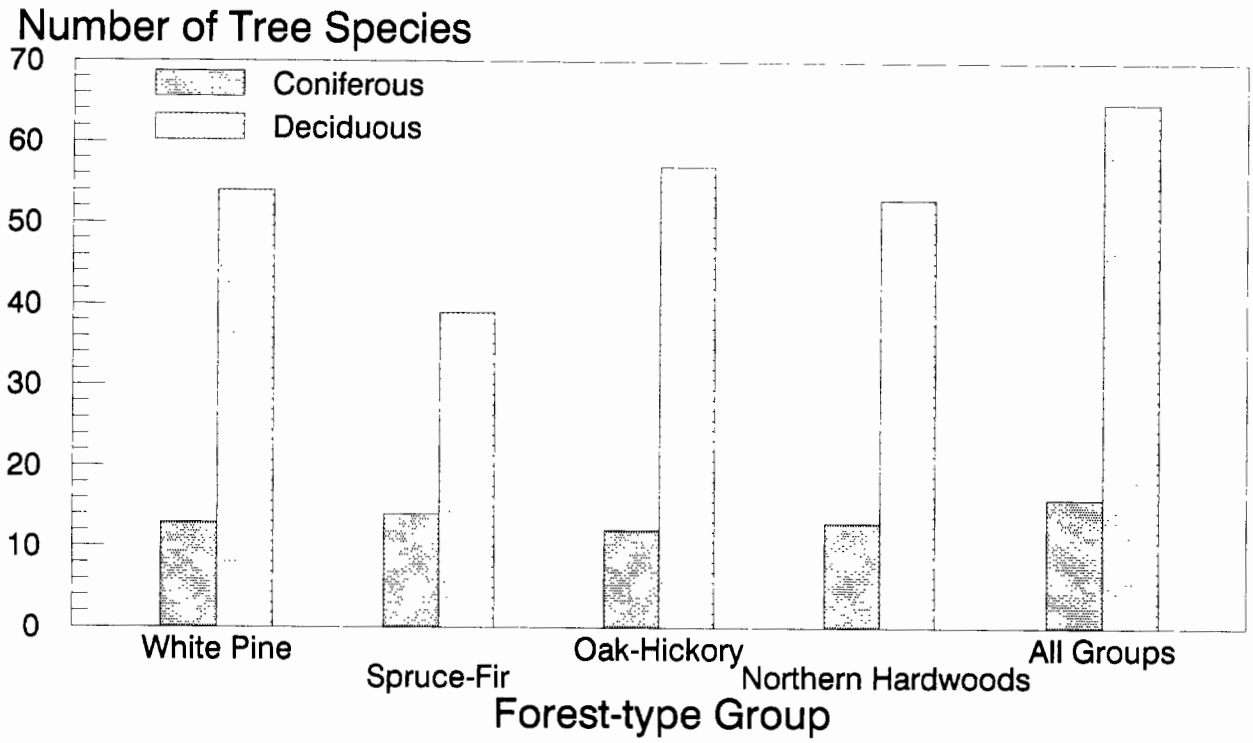


Figure 5.--Number of tree species or species groups on forest land by coniferous and deciduous species and forest-type group, New England.

Describing the "average" acre of forest land obscures the geographic variability that is characteristic of New England's forests. That diversity is seen when one considers these forests by major forest-type group.

White pine forest-type group. This forest-type group comprises an estimated 4.5 million acres of New England's forests. Nearly 70 percent of this forest is classified as sawtimber, the highest percentage of any major forest-type group (Fig. 4). This preponderance of larger size stands probably represents the early-successional establishment and fast growth of this type group.

An average acre of white pine forest contains nearly 3,600 trees, the lowest density for all major forest-type groups. Of these, 3,400 are seedlings and saplings, 204 are live trees larger than saplings, and 9 are standing-dead trees. Fifty-four deciduous and 13 coniferous species are reported for this forest-type group (Fig. 5). The principal tree species is eastern white pine followed by eastern hemlock (Fig. 7). Red maple is the principal deciduous species. Balsam fir, red spruce, and other minor conifers occur as standing-dead trees in disproportion to their occurrence as live trees. Softwoods are more common than deciduous species in all diameter classes except regenerating seedlings and saplings.

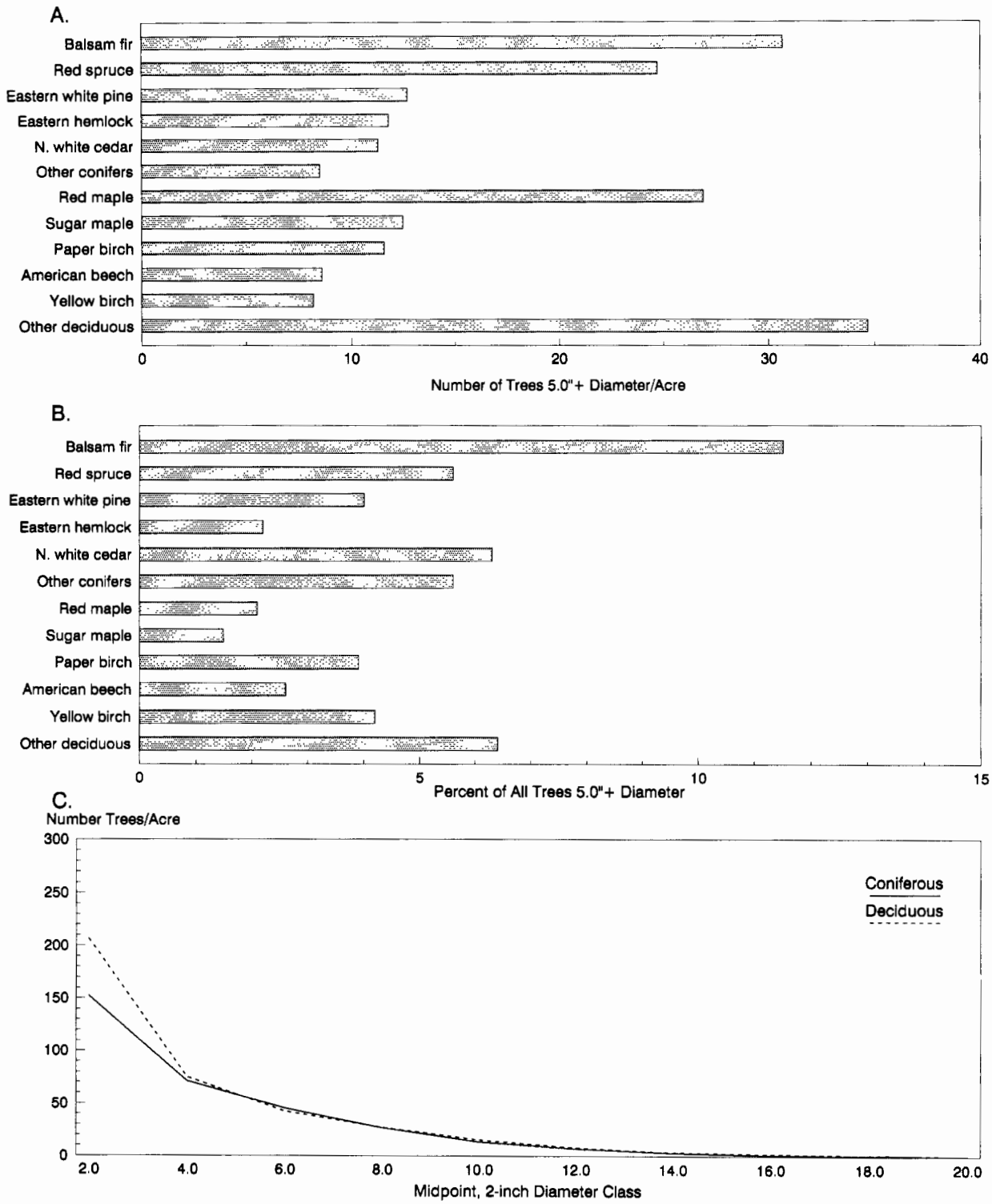


Figure 6.--(A) Average number of trees per acre of forest land acre by principal species, (B) dead trees as a percentage of all trees by principal species, and (C) average number of trees per acre by diameter class and species group, all forest land, New England.

Spruce-fir forest-type group. The spruce-fir forest-type group accounts for 30 percent of all New England forest land, or 9.7 million acres. This forest is most prevalent in Maine and relatively common in northern New Hampshire and Vermont (Fig. 2). This type group has the most balanced distribution of stand-size classes of all major forest-type groups (Fig. 4), probably due to the active forest industry that is based on this resource and the impact of defoliations by the eastern spruce budworm (*Choristoneura fumiferana* Clemens).

An average acre of spruce-fir forest contains more than 5,200 trees, nearly 5,000 seedlings and saplings, 244 larger live trees, and 19 standing-dead trees. This type group has the lowest number of tree species (richness) of the major groups due to a low number of deciduous species (39). Fourteen conifer species were reported; the predominant species are balsam fir and red spruce (Fig. 8).

Deciduous species constitute a small percentage of total stocking, red maple and paper birch being the most common. Balsam fir is the most common standing-dead tree, while quaking aspen the most common standing-dead deciduous species. Conifers are much more common than deciduous species in all diameter classes.

Oak-hickory forest-type group. The oak-hickory forest-type group accounts for slightly less than 10 percent of New England's forest area or 3.1 million acres. This type group is most common in southern New England, where it predominates (Fig. 2).

There are, on average, more than 3,700 trees on an acre of oak-hickory forest. More than 95 percent (3,550) are seedlings and saplings, 167 are larger live trees, and 6.5 are standing dead trees. A representative acre contains 69 species (12 coniferous and 57 deciduous). The principal species are northern red oak and red maple (Fig. 9). White pine is the most common conifer. White and chestnut oak are the most commonly reported standing-dead species, presumably a result of defoliations by the gypsy moth during the early 1980's. The percentage of white oaks recorded as standing-dead is the highest for any species in any major type group. As one might expect for a hardwood type group, deciduous trees outnumber conifers in all diameter classes.

Northern hardwoods forest-type group. Northern hardwoods is marginally the predominant forest-type group in New England. The 10.6 million acres of this type group are only slightly greater than the acreage in spruce-fir forests. Northern hardwoods is the principal forest-type group in New Hampshire and Vermont (Fig. 2).

An average acre of northern hardwoods forest contains nearly 5,500 trees, the highest density for all major forest-type groups. Of these, nearly 5,300 are seedlings or saplings, 182 are larger live trees, and 8 are standing-dead trees. Of the 66 tree species reported for this type group (13 coniferous and 53 deciduous), the principal species are red and sugar maple, American beech, and yellow birch (Fig. 10). The principal conifers are balsam fir, red spruce, and eastern hemlock.

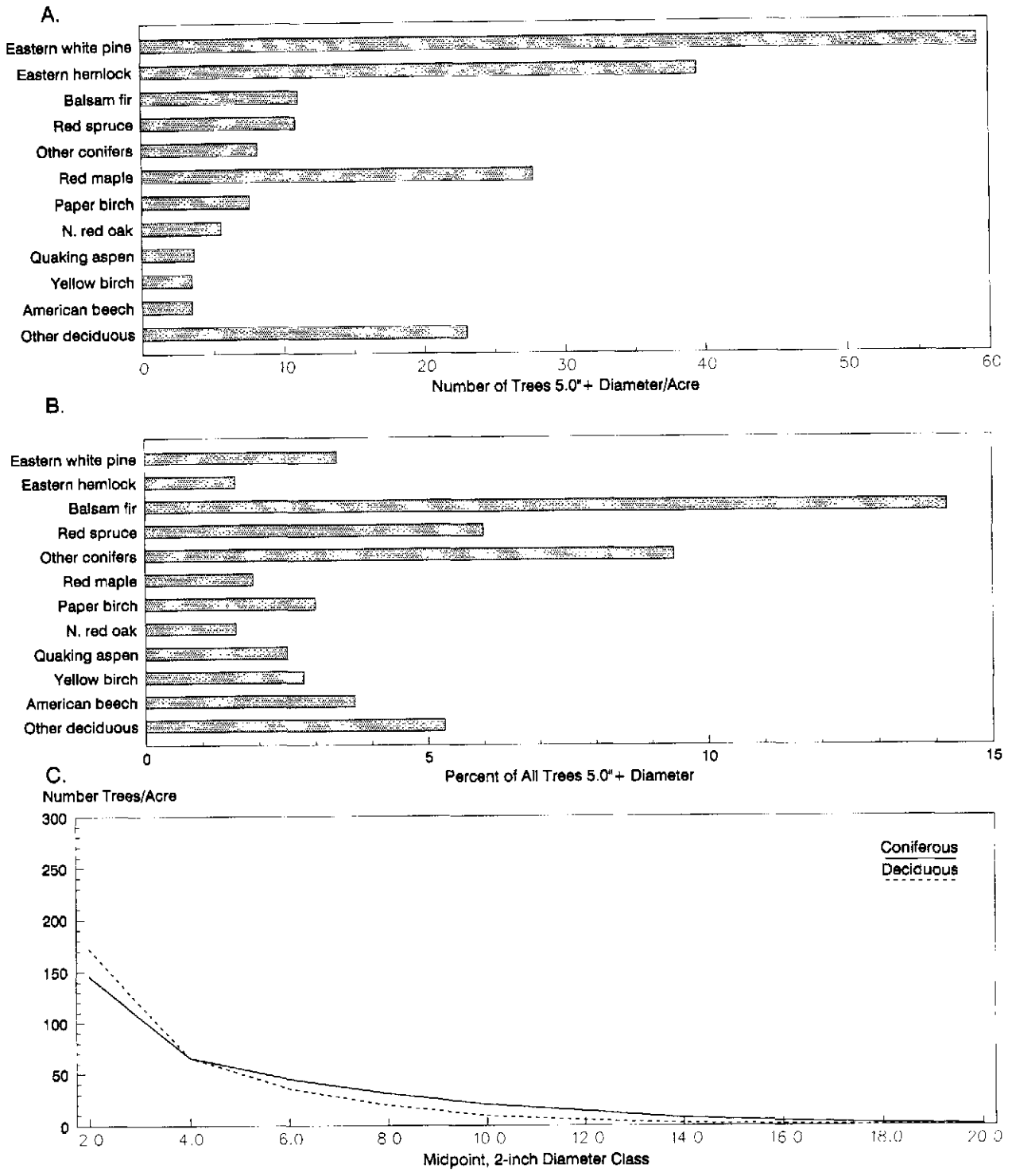


Figure 7.--(A) Average number of trees per acre of forest land acre by principal species, (B) dead trees as a percentage of all trees by principal species, and (C) average number of trees per acre by diameter class and species group, white pine forest land, New England.

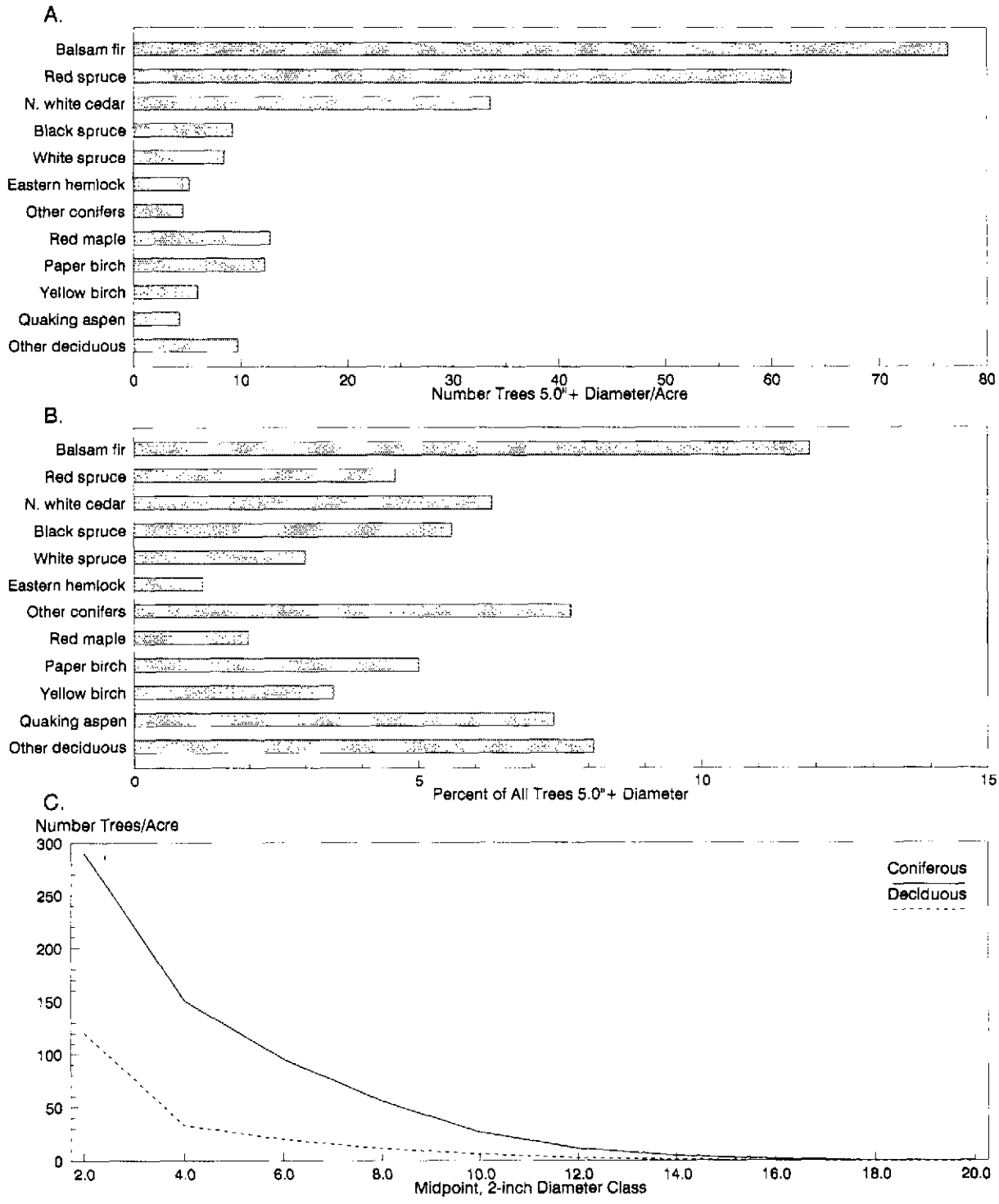


Figure 8.--(A) Average number of trees per acre of forestland acre by principal species, (B) dead trees as a percentage of all trees by principal species, and (C) average number of trees per acre by diameter class and species group, spruce-fir forest land, New England.

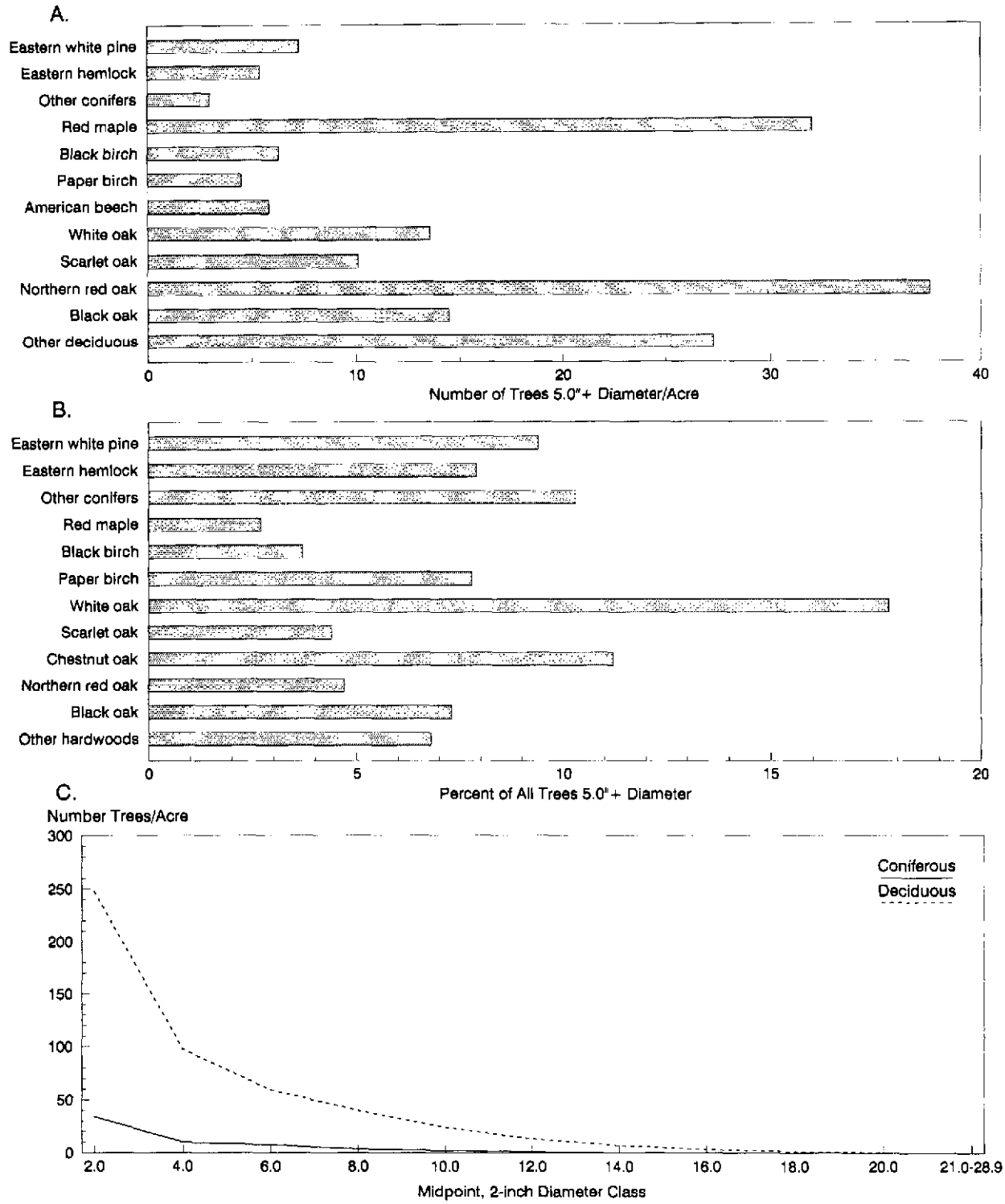


Figure 9.--(A) Average number of trees per acre of forest land acre by principal species, (B) dead trees as a percentage of all trees by principal species, and (C) average number of trees per acre by diameter class and species group, oak-hickory forest land, New England.

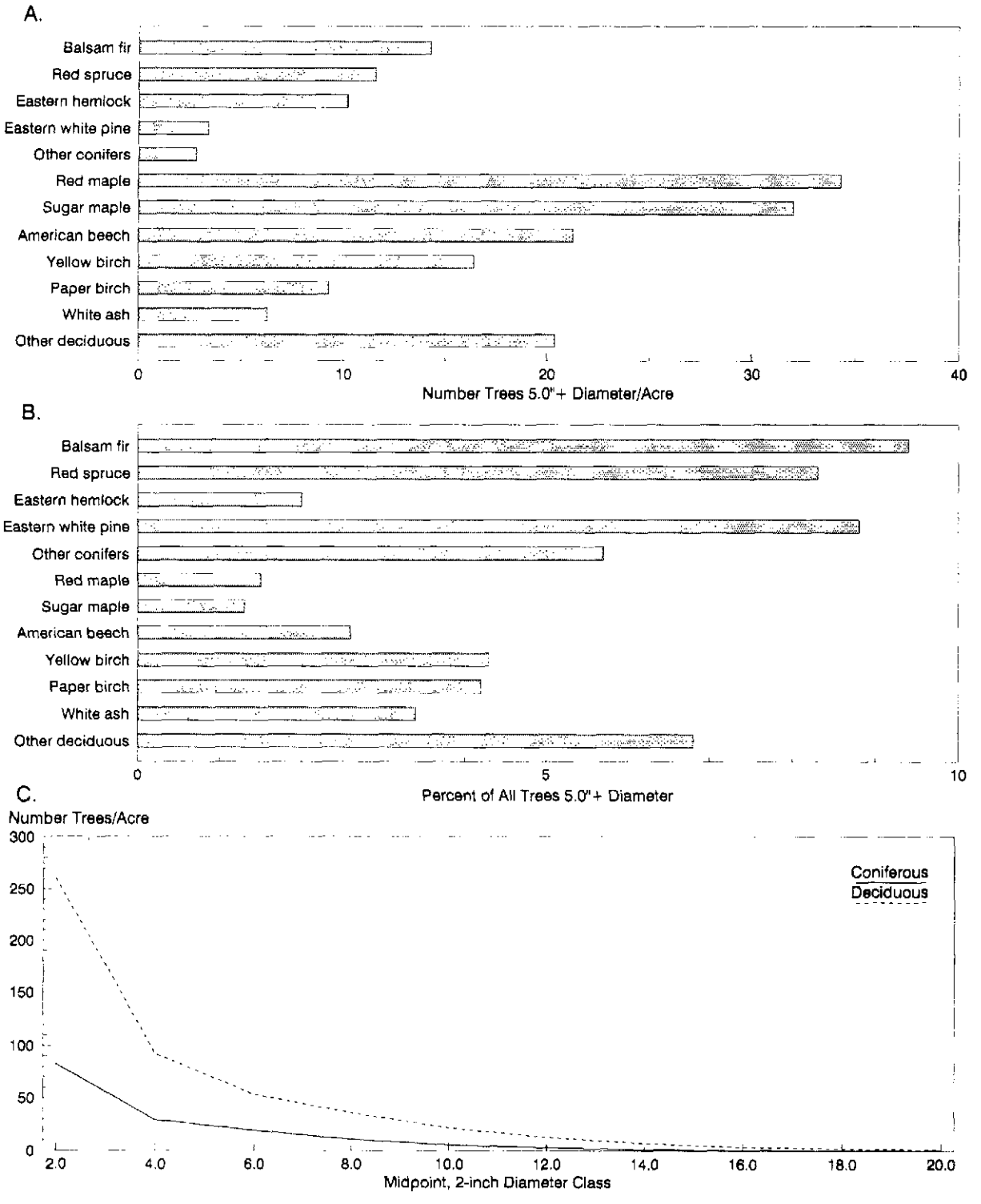


Figure 10.--(A) Average number of trees per acre of forestland acre by principal species, (B) dead trees as a percentage of all trees by principal species, and (C) average number of trees per acre by diameter class and species group, northern hardwoods forest land, New England.

Conifers are the most common standing-dead trees, in disproportion to their occurrence. Deciduous species are more common than conifers in all diameter classes, particularly in the regenerating sapling-size classes.

Recent History (Growth)

As mentioned earlier, forest-land area has changed little between 1952 and 1987 in New England as a whole and for individual states or subregions. Nevertheless, the region's forests are continuously maturing. The area classified as sawtimber-size forest has increased while smaller and younger poletimber- and sapling/seedling-size forests have decreased in area (Fig. 3). The numbers of smaller-size trees are declining for coniferous species and increasing at a low rate for deciduous species (Fig. 11). Meanwhile, the numbers of sawlog-size trees are increasing by more than 3 percent a year. For coniferous species, the rate of increase generally is greater with increasing diameter. Increases in the numbers of deciduous species generally is more constant across all diameter classes.

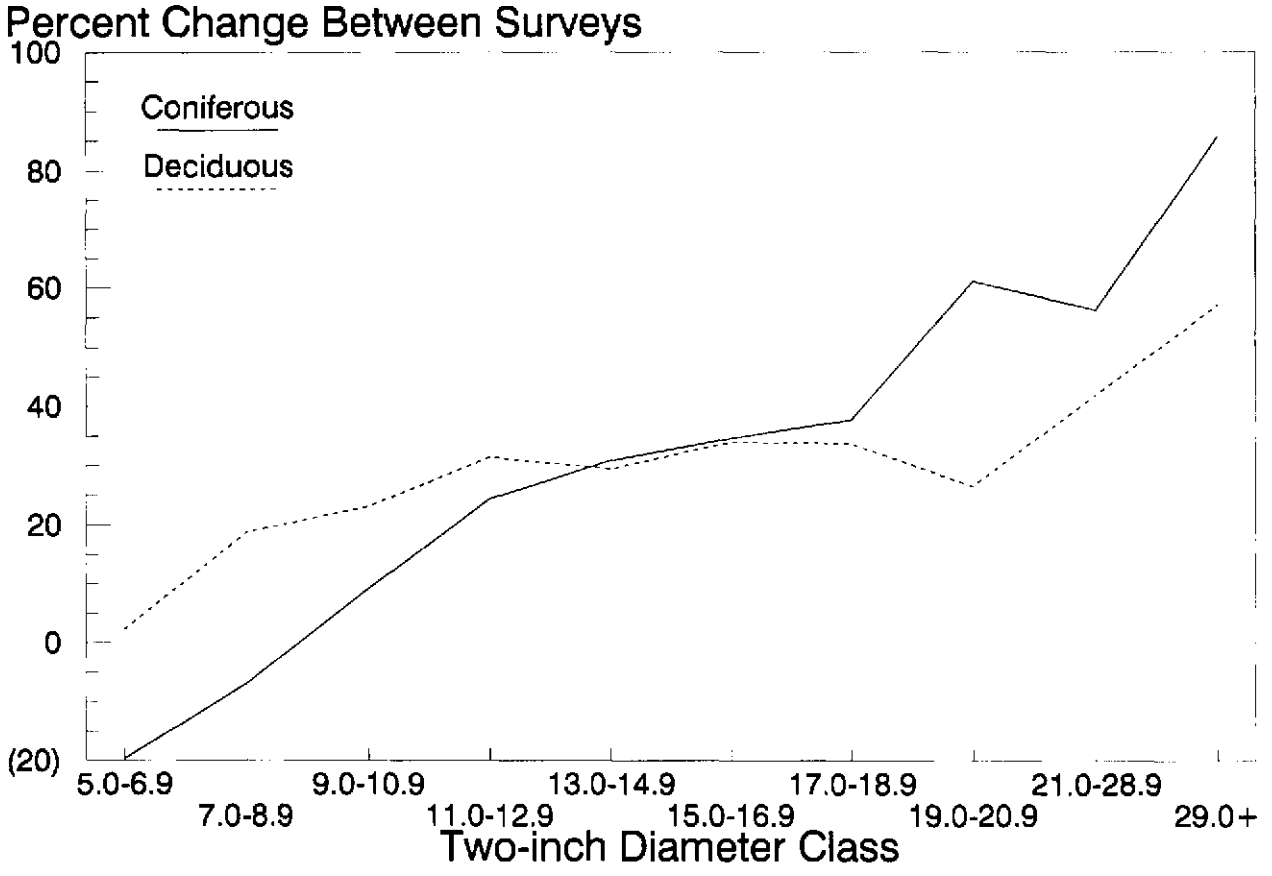


Figure 11.--Change in number of growing-stock trees by coniferous and deciduous species and diameter class, New England, 1970's to 1980's.

As the number and/or basal area of trees per unit of area increases, stocking also increases. Stocking is an index of the level of competition between trees in a forest. As stocking increases there is increasing competition for light, moisture, and nutrients. The most recent survey of New England's forests reported that 83 percent of timberland is classified as fully stocked to overstocked (Fig. 12). The modal basal-area class is 100 to 149 ft^2/acre, while the FIA standard for full stocking is 75 ft^2/acre.

Gross volume growth, the growth of new trees into the 5.0-inch diameter class (ingrowth) and the growth on existing trees (accretion), averaged 66 ft^3/acre over the approximate 10-year period between the last two surveys. Mortality rates, calculated from changes in growing-stock volume, were 28 percent of gross growth for coniferous species and 20 percent for deciduous species across all New England States between the last two forest surveys.

Increasing growth of New England forests and trees also was reported following an analysis of a large collection of cores from New England trees (Smith et al. 1990). This study reported that of 10 major tree species, only red spruce showed a statistically significant decline in basal-area growth between 1950 and 1980. Growth increased significantly for all remaining species for the same period. Further, the rate of growth for many species increased over the 30 years. Only growth rates for red spruce and balsam fir were declining at a significant rate, with balsam fir growth declining most rapidly. Smith et al. (1990) concluded that "none of the 10 major species examined showed trends or levels of growth that appear to be outside ranges explainable by natural variation."

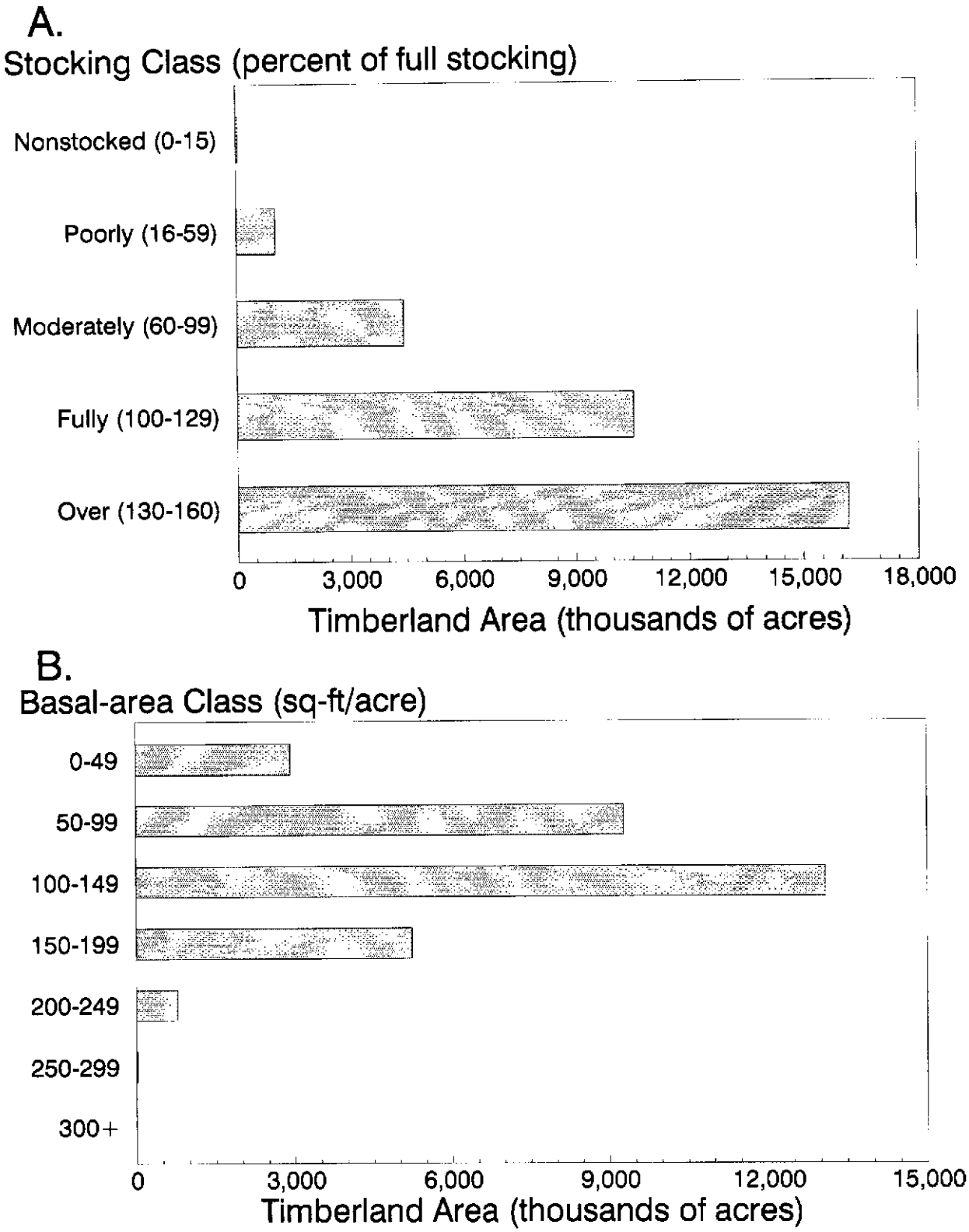


Figure 12.--Timberland area by stocking class (A) and basal-area class (B), New England.

Forest Stressors

Forest productivity is tempered by numerous negative influences or forest stressors. Stress factors may be biotic or abiotic, natural or unnatural (Smith 1990). Biological agents, insects and pathogens, reduce photosynthetic potential by consuming or otherwise damaging foliage or by interfering with other physiological processes. Distributions of climatological means and variability partly determine species distributions and weather disturbances can reduce productivity, cause serious physical injury, and weaken or kill trees. Anthropogenic activities, such as forest harvesting and land use conversions, directly affect forest productivity. Other human activities, such as electric power generation and motor vehicle use contribute to atmospheric pollution and deposition and may indirectly affect forest ecosystems. And the interaction of all of these influences can result in forest declines.

Forest Insects and Pathogens

Numerous diseases and insects damage forest trees in New England (Millers et al. 1989; Skelly et al. 1987). Although trees and forests can survive and be productive despite the effects of pathogen and insect damage, forest composition can be altered, productivity can be reduced, and mortality can be increased.

The Forest Health Protection staff of the USDA Forest Service, Northeastern Area, State and Private Forestry reports annually on the status of forest pests and forest pest damage in the Northeast. In areal extent of damage, the principal forest pests over the last decade have been the eastern spruce budworm and gypsy moth. During the 1980's, these insect pests defoliated millions of forest acres. The current budworm epidemic peaked in 1983 with more than 6 million acres defoliated, primarily in northern New England. Gypsy moth activity peaked in 1981 with more than 7 million acres defoliated, primarily in southern New England. Other regionally important forest insects and diseases are the pear thrips (*Taeniothrips inconsequens* [Uzel]) on sugar and red maple and American beech, scleroderris canker (*Ascocalyx abietina* [Lagerberg] Schlapfer) on northern conifers, diplodia tip blight (*Sphaeropis sapinea* [Fr.:Fr.] Dyko & Sutton) on red and Scots pine, and beech bark complex (beech scale [*Cryptococcus fagisuga* Lindinger] and beech bark disease [*Nectria coccinea* var. *faginata* Loh., Wats., and Ay]).

Regional Climate and Weather

Climate acts directly and indirectly in concert with other environmental, edaphic, and site influences to determine the health and distribution of forest tree species. The competitiveness of individuals species and entire tree populations is determined in part by their ability to adapt to weather extremes.

Atmospheric and soil temperatures affect the following plant processes: 1) enzyme activity, 2) solubility of carbon dioxide and oxygen in plant cells, 3) transpiration, 4) root absorption of water and minerals, and 5) membrane permeability (Spurr and Barnes 1980). The effects of temperature vary by plant process, among populations within a species, and between species. Temperature extremes and unusual temperature events can have an adverse effect on trees, for example, late spring frosts or extremely low winter temperatures without snow cover.

Precipitation provides water to trees indirectly by replenishing soil moisture. Smith (1990) stated that tree growth responds more to water stress than to any other perennial forest site condition. Precipitation must be adequate to satisfy a tree's need for transpiration and photosynthesis. Smith (1990) concluded that current precipitation amounts throughout the Northeastern United States greatly exceed the 400 to 700 mm (15.7 to 27.6 inches) required for forest growth. Nevertheless periods of drought have an negative impact on tree health.

Ludlum (1976) described New England weather as the product of a "vast meteorological mixing bowl where diverse air currents converge." Yet, patterns are evident in long-term (1931-85) temperature and precipitation records (Fig. 13). The annual area-weighted average New England temperature is 18.2°F in January, the coldest month, and 68.0°F in July, the warmest month (Natl. Climatic Data Cent. 1986a). Temperatures are increasingly mild north to south, with an average annual area-weighted Maine of 41.8°F in Maine and 50.0°F in Rhode Island.

Precipitation for the same period shows no pronounced seasonality (Fig. 13). The long-term average annual total precipitation is 41.8 inches of rain or snow for New England (Natl. Climatic Data Cent. 1986b). Monthly totals rarely vary by more than 0.5 inch from the monthly average of 3.5 inches. By state, Vermont is the driest with an average annual area-weighted total precipitation of 39 inches. Connecticut is the wettest state, averaging 46.8 inches of precipitation each year. The EPA's Atmospheric Research and Exposure Assessment Laboratory processed and analyzed climate and weather data from New England to provide information on the temporal and spatial patterns of temperature and precipitation for the most recent 30-years of record.

30-year time series (October 1960-September 1990). Area weighted mean annual temperatures for New England have ranged from 41.9°F in 1963 to 45.9°F in 1983 (Fig. 14). The largest inter-annual range, 3.6°F, occurred between 1982 and 1983. An upward trend began during 1976, but it is uncertain whether this is part of a longer cycle of regional temperatures or whether it reflects "greenhouse" warming.

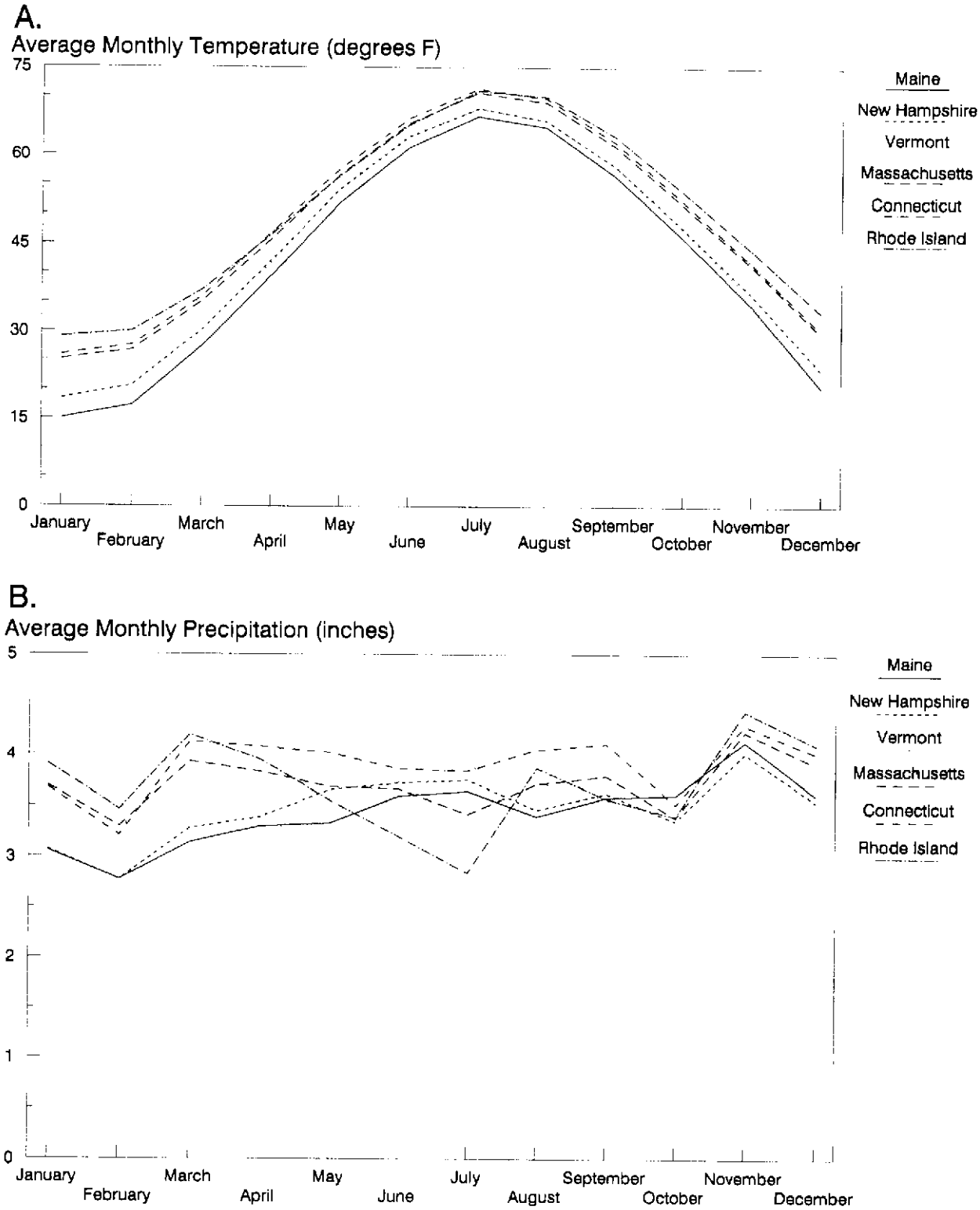


Figure 13.--Area-weighted average temperature (A) and precipitation (B) by month and state, New England, 1931-85.

A highly variable pattern occurred in the time series of area-weighted minimum temperatures. Values ranged from -25.7°F during 1971 to -11.2°F during 1980 (Fig. 14). Particularly large inter-annual variability is noted from 1979 through 1985. An upward trend is suggested beginning during 1970.

Less variability is seen in the time series of area-weighted annual maximum temperatures. Values ranged from 89°F during 1972 to 98°F during 1975 (Fig. 14). The greatest inter-annual range occurred between 1974 and 1975. A downward trend began during 1974. The combined effect of area-weighted maximum and minum temperature trends could narrow annual temperature ranges.

Area-weighted annual precipitation in New England ranged from 31 inches in 1965 to 50.5 inches in 1983 (Fig. 15). The time series appears equally variable throughout the 30 years of data. The largest inter-annual range, 10.8 inches, occurred between 1984 and 1985. A 20-year precipitation cycle from 1964 through 1984 is evident.

10-year summary (October 1980-September 1990). The most recent 10 years suggest an upward trend in mean daily temperature. Extreme variability and an upward trend dominate annual minimum temperature. A downward trend in annual maximum temperatures may be associated with an uncertain (highly variable) decline in annual temperature range. Both extremely wet (30-year maximum in 1984) and moderately dry (widespread drought in 1985) conditions were reported in the 1980's.

Time-averaged regional conditions. Major features of the 30-year temperature maps (Figs. 16, 18, 20, 22) are influenced by latitude and elevation. The effect of latitude is reflected in zonal bands of northward-decreasing temperatures in homogeneous geographic areas (Fig. 16). Distortions in the zonal pattern occur in the mountains of New Hampshire. The 30-year pattern appears "smoother" than the 10-year pattern due to fewer observations in each point average and modest changes in the station set used to compute the statistics. For example, a second elevational disturbance in the 10-year map for mean annual temperature (Fig. 17) is the result of data from a high elevation station (Mount Mansfield). This station was not included in the 30-year data because it did not meet our quality-control criteria. In the case of Maine, there are fewer northern and interior sites that meet our criteria during the most recent decade than during the entire 30-year period.

If the Mount Mansfield area of Vermont is ignored, the large spatial distribution of mean annual temperatures remains unchanged between the two time periods. The major difference appears to be in northern Maine, where temperatures have been slightly milder during the last 10 years.

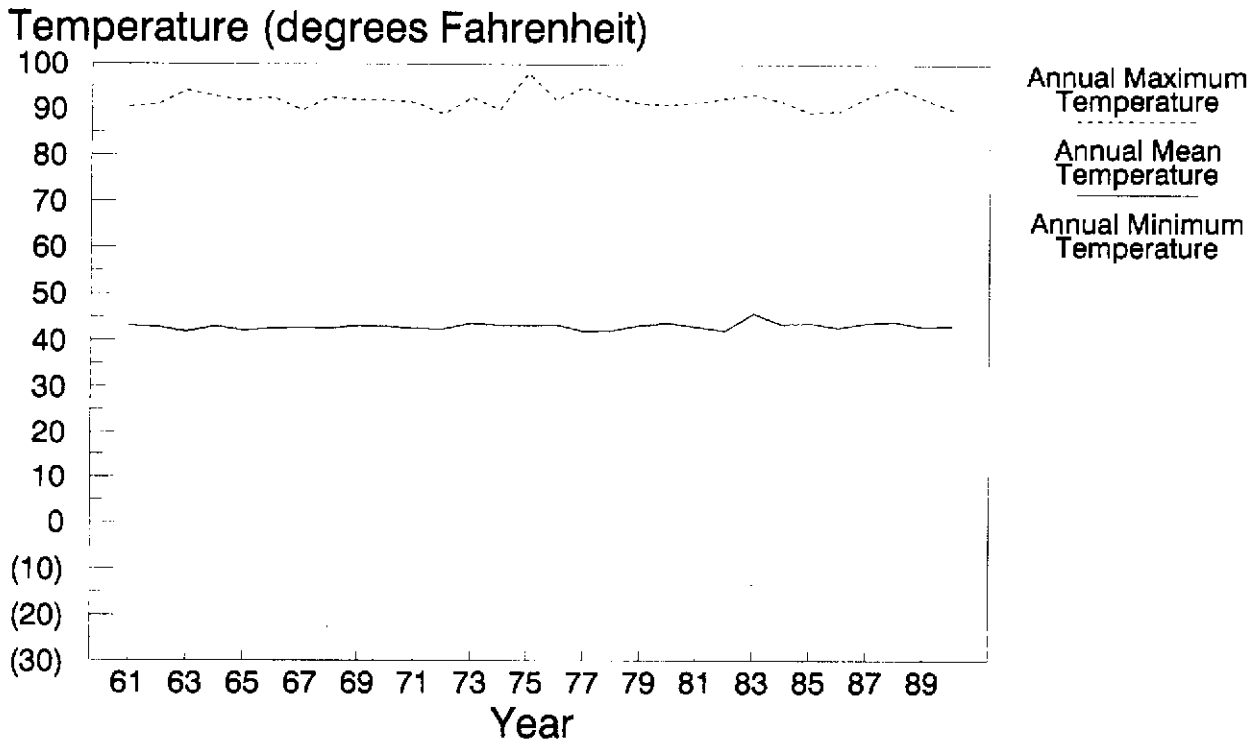


Figure 14.--Mean, extreme minimum, and extreme maximum temperature (°F) for New England, (area-weighted annual), 1961-90.

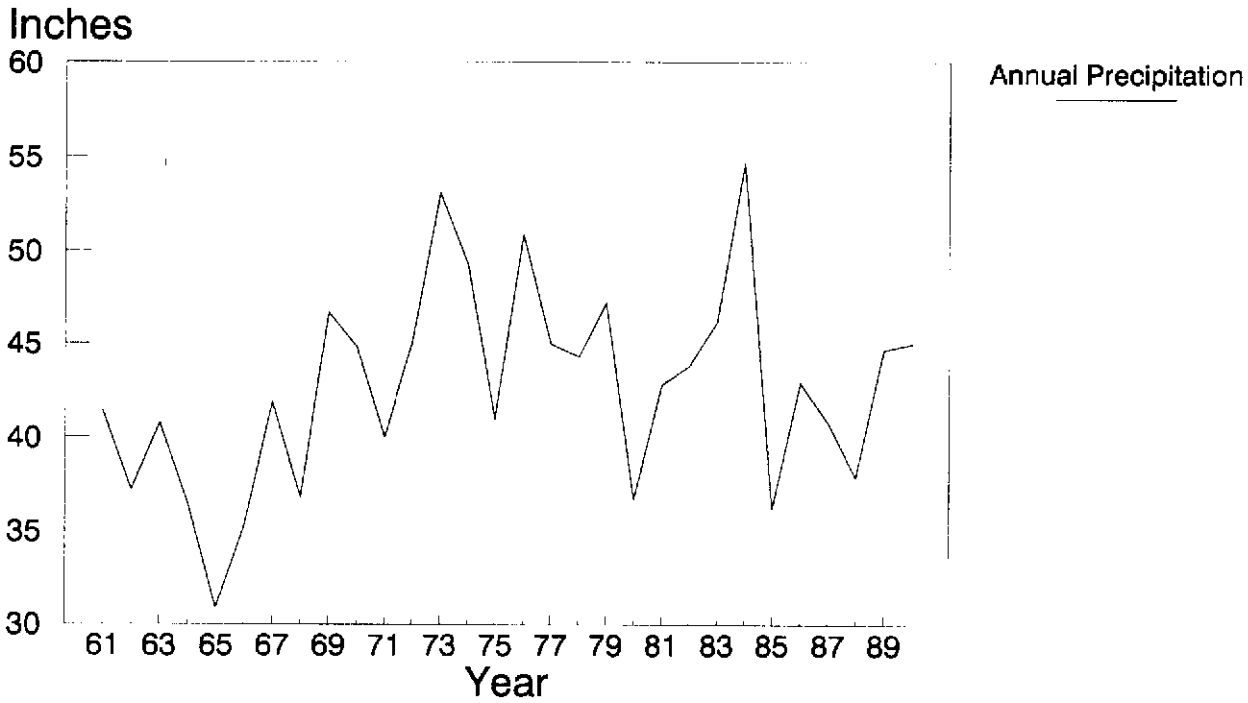


Figure 15.--Precipitation for New England, (area-weighted annual), 1961-90.

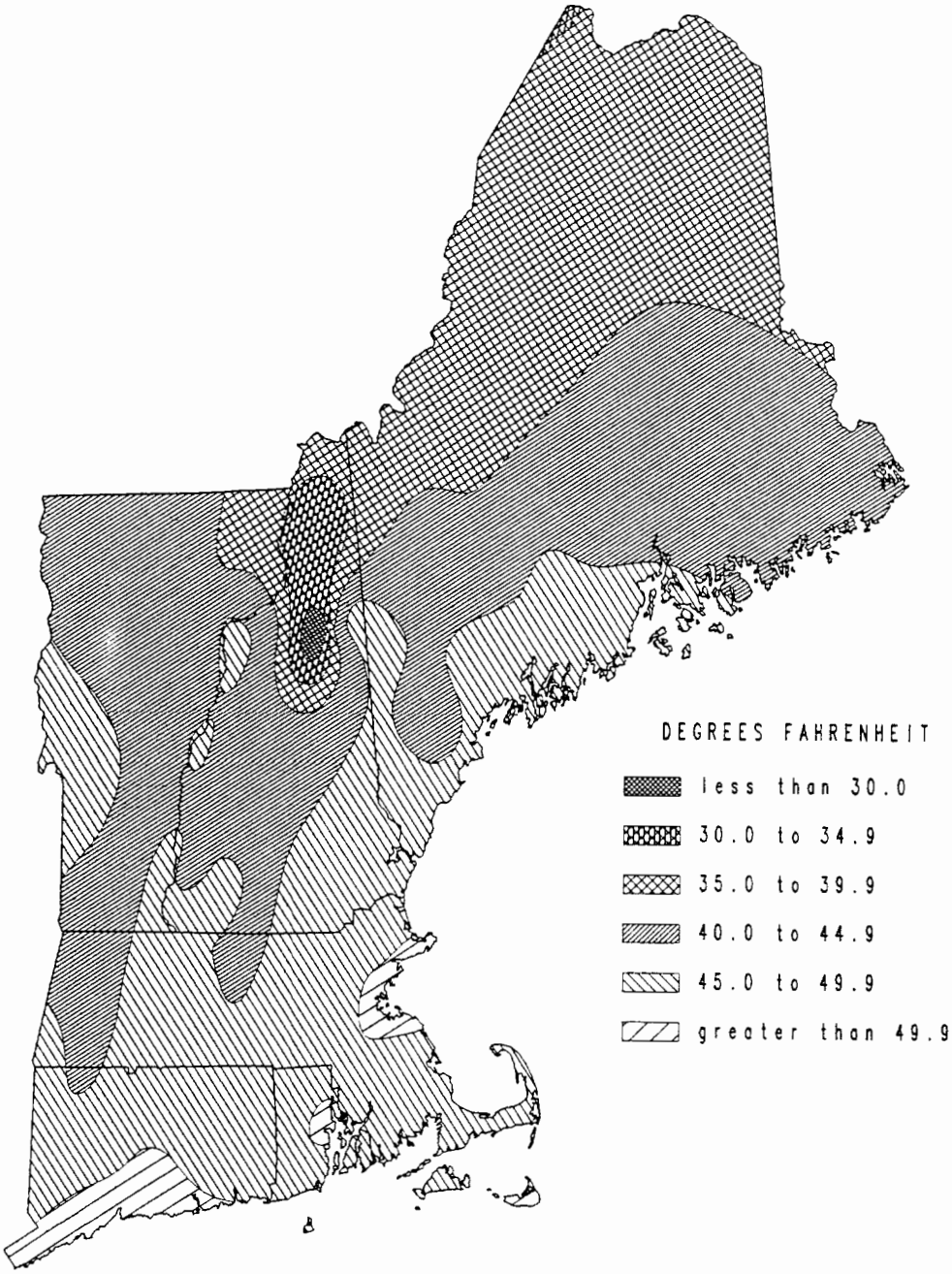


Figure 16.--Thirty-year average mean annual temperature isopleth map, New England.

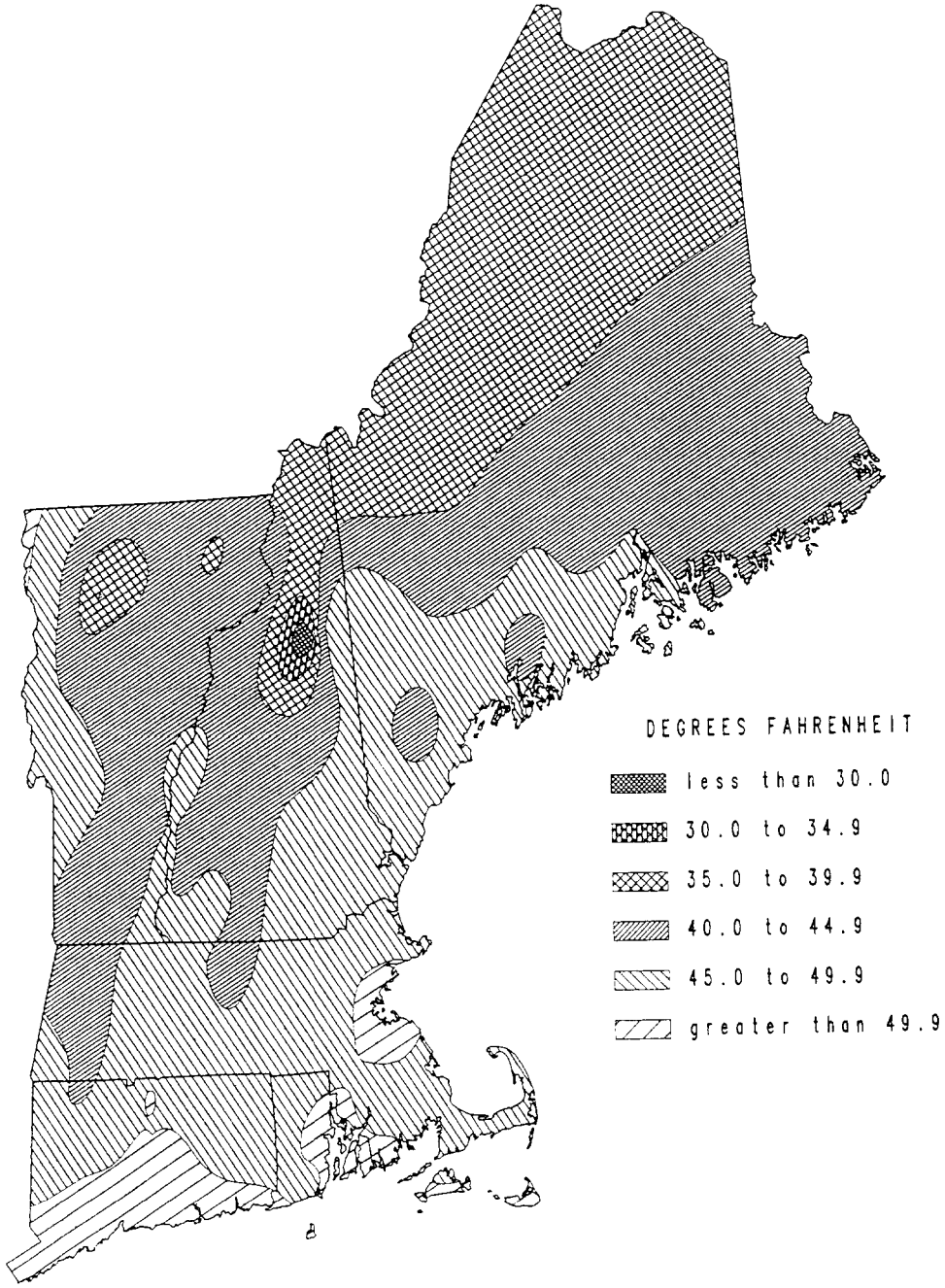


Figure 17.--Ten-year average annual mean temperature isopleth map, New England.

Elevation does not play a major role in patterns of annual minimum temperature across New England. Again, while most of New England appears unchanged, the coldest temperatures in northern Maine have moderated slightly during the most recent decade compared to 30-year normals (Figs. 18 and 19).

Elevational influences reappear in the pattern of annual maximum temperatures. With Mount Mansfield data excluded, the 10- and 30-year patterns are essentially unchanged (Figs. 20 and 21). Inconsistancies between these maps and the regional time series might be caused by the regional weighting process, the loss of quality northern and interior Maine observing sites, or the choice of mapping contour intervals.

The 30-year precipitation pattern indicates relatively wet conditions in the lower portion of New England (Fig. 22). Drying is observed in the colder northern latitudes or leeward of significant mountain ranges. The most recent decade appears to have been substantially wetter than the 30-year period (Fig. 23). Most areas have increased at least one plotting category (that is, 5 inches). Portions of central and northern Maine remain at or near 30-year normal conditions.

Acidic Deposition and Atmospheric Pollution

Extensive research over the last decade has failed to show regional patterns of extensive forest decline or a regional-scale relationship between patterns of forest decline and acidic deposition (Barnard et al. 1990; Garner et al. 1989; Reams et al. 1990). Nor has research shown a relationship between the decline of localized species and acidic deposition and/or atmospheric pollution (ozone). It is likely that airborne chemicals in acidic cloudwater may predispose high-elevation red spruce to winter injury (Barnard et al. 1990). Also, the lack of evidence of a regional growth reduction or decline in eastern white pine despite this species' sensitivity to regional pollutants may be due to the prior elimination of sensitive genotypes, which has resulted in a relatively resistant population (Barnard et al. 1990). However, questions remain as to the long-term consequences of chronic exposure of forest ecosystems to acidic deposition and atmospheric pollution.

New England receives significant acidic deposition and ozone pollution (Garner et al. 1989). Ozone concentrations in summer frequently exceed chronic (20 to 40 ppb for 8 hours) and acute (90 to 150 ppb for 2 hours) thresholds for visible damage to vegetation. Volume-weighted precipitation pH for the region for 1985 was less than 4.5 at all monitoring locations. This is only slightly higher than the values reported for the Ohio-Pennsylvania border, the region receiving the most acidic precipitation in the Eastern United States.The EPA's Atmospheric

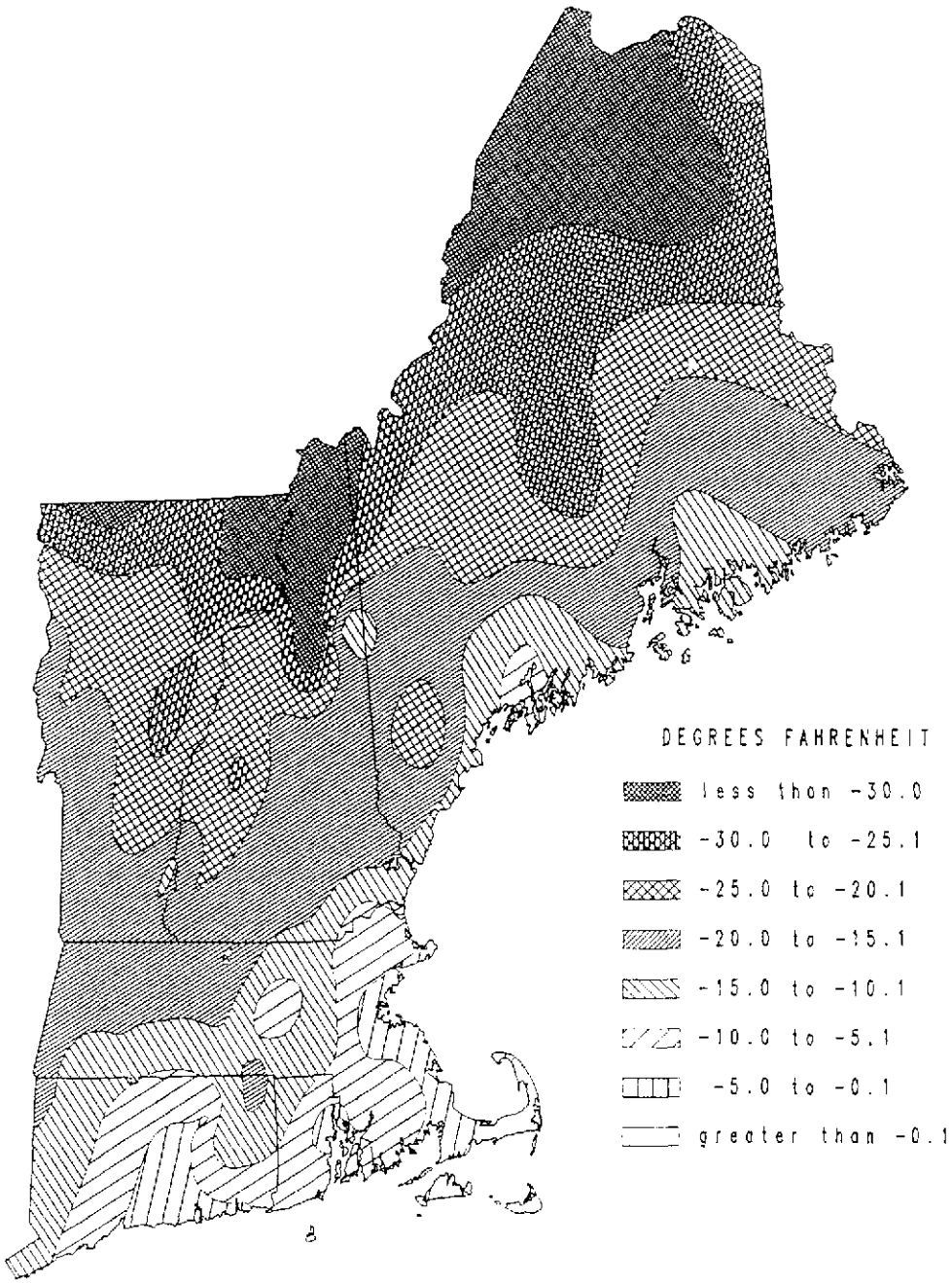


Figure 18.--Thirty-year average annual minimum temperature isopleth map, New England.

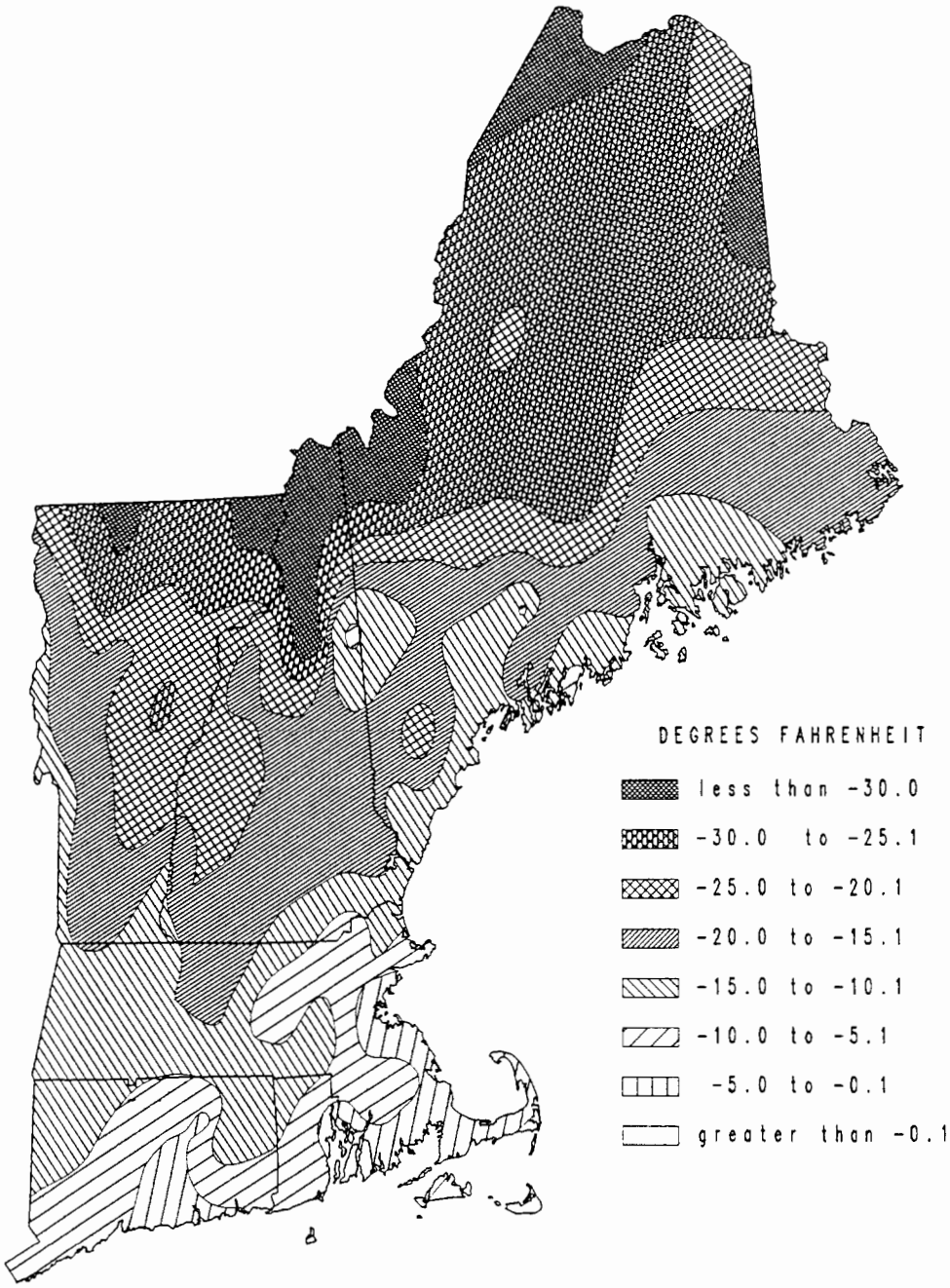


Figure 19.--Ten-year average annual minimum temperature isopleth map, New England.

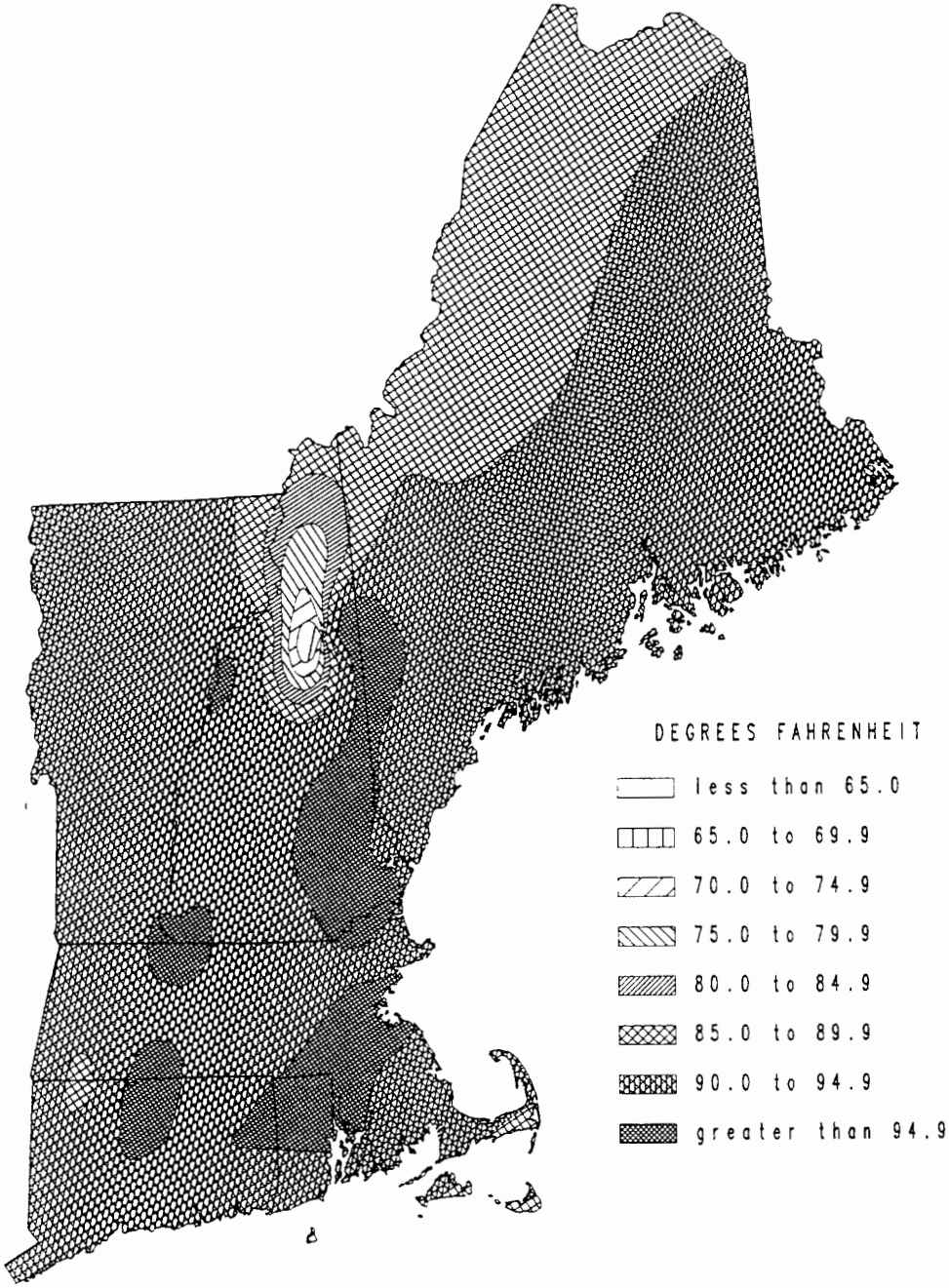


Figure 20.--Thirty-year average annual maximum temperature isopleth map, New England.

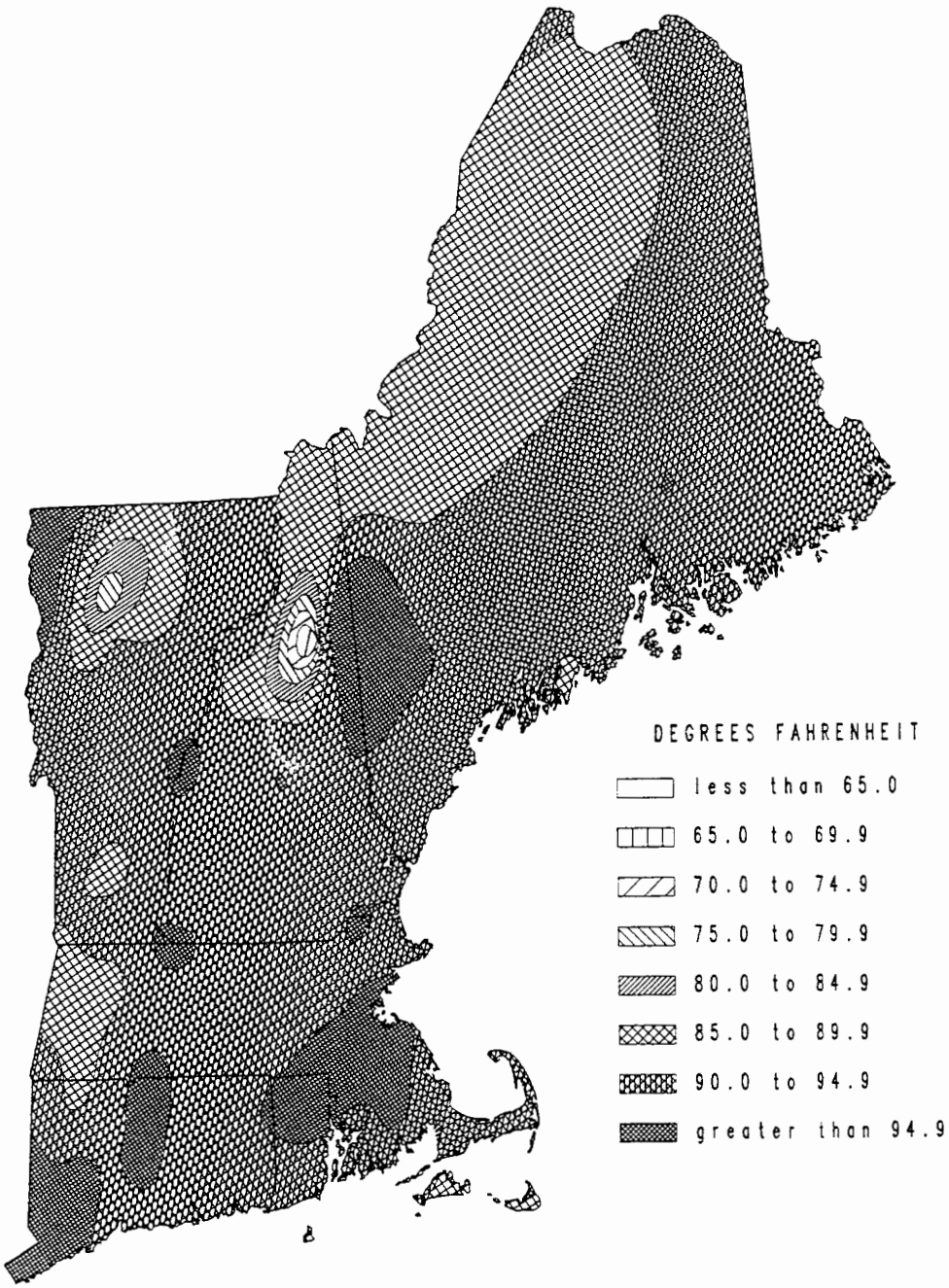


Figure 21.--Ten-year average annual maximum temperature isopleth map, New England.

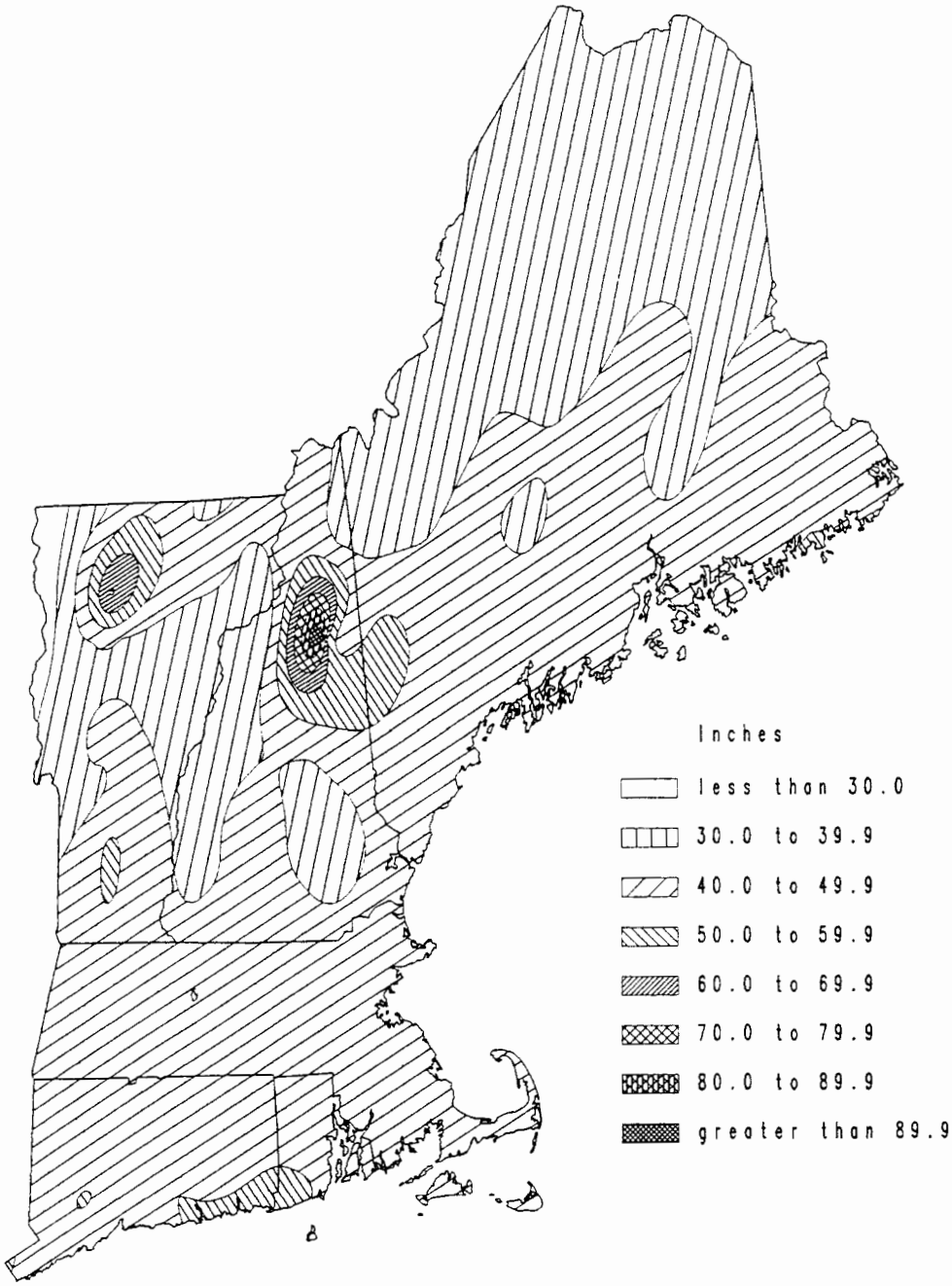


Figure 22.--Thirty-year average annual precipitation isopleth map, New England.

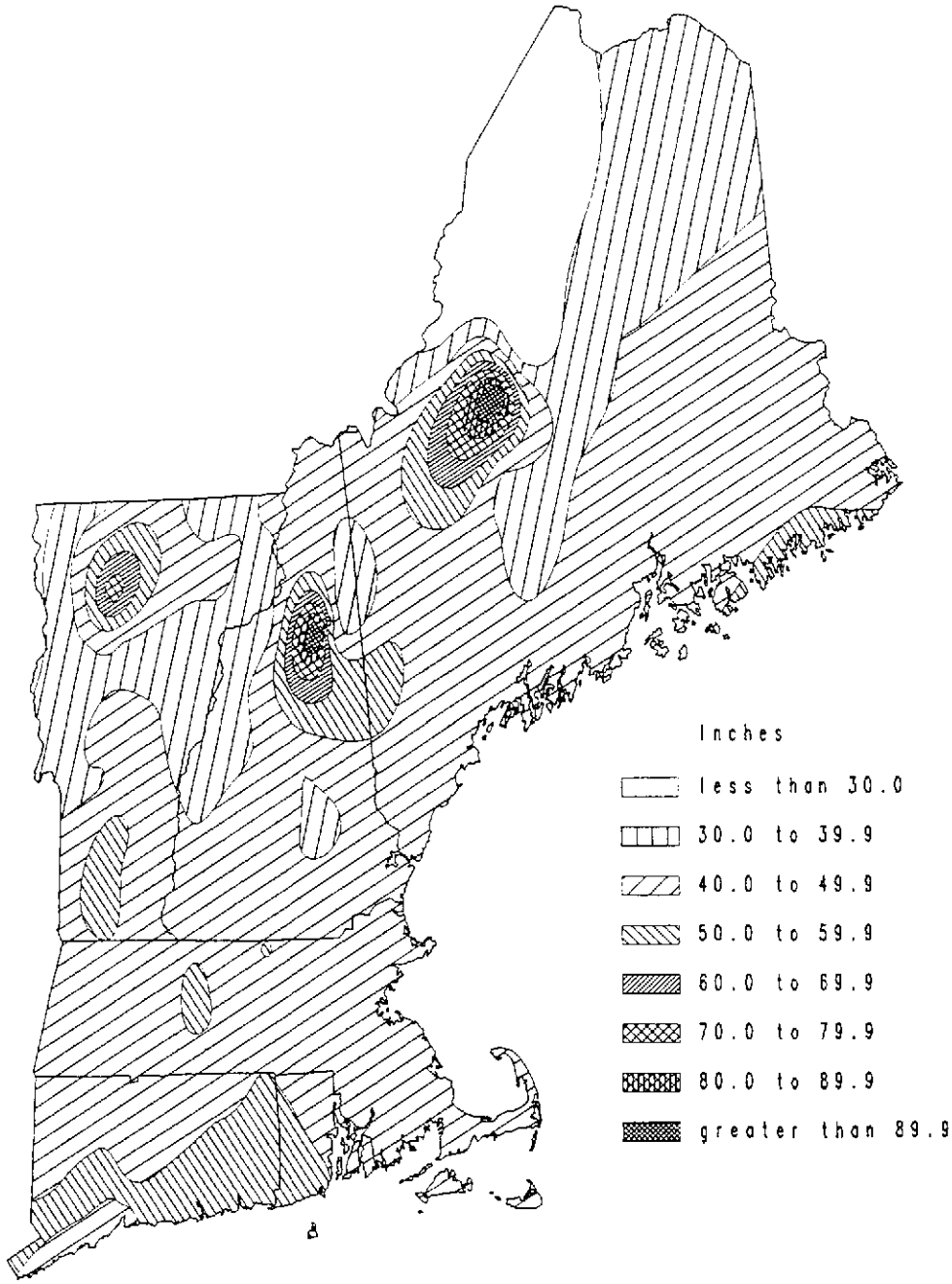


Figure 23.--Ten-year average annual precipitation isopleth map, New England,.

Research and Exposure Assessment Laboratory processed and analyzed atmospheric monitoring data from New England to provide information on the temporal and spatial patterns of ozone pollution and atmospheric deposition for the region.

Ozone. A summary ozone-exposure statistic for six sites, designated as forested by the Atmospheric Information and Retrieval System (AIRS) data base, is described and tabulated in the following discussion (Fig. 24). Hourly average ozone data for five of the six sites were obtained from the AIRS data base. Hubbard Brook hourly average ozone data were obtained from the National Dry Deposition Network. The exact siting conditions for the six sites may be important for any evaluation of ozone values. For example, Mount Greylock in Massachsetts is a high-elevation site (1,064 m) and Acadia National Park in Maine is a coastal site.

The summary ozone-exposure statistic is the seasonal SUM06 index, calculated as the sum of all hourly average concentrations greater than or equal to 0.060 ppm for April through October. The units of the seasonal SUM06 index are ppm-h (parts-per-million hours). The seasonal SUM06 index is a cumulative index and will underestimate ozone exposure if a significant fraction of the ozone hourly average concentrations data is missing. In this report, seasonal SUM06 index values were calculated only if at least 75 percent of the 5,136 total hours of data in April through October were not missing.

The number of nonmissing ozone hourly data for the April through October season, the uncorrected seasonal SUM06 index, and a corrected seasonal SUM06 index are shown in Table 3. The uncorrected index is the sum of the relevant nonmissing values in the data. The corrected index is based on estimates of monthly SUM06 values corrected to 720 hours (30 days) or 744 hours (31 days). See Lefohn et al. (1990) for a description of similar correction procedures.

Table 3 shows the seasonal SUM06 values at the six New England sites for the years 1981-89. For the 1989 values, Stafford, Connecticut and Quabbin Reservoir, Massachusetts show the highest seasonal SUM06 values for the six sites. This reflects the sites' relative closeness to ozone source areas and also to regional ozone transport. The other sites show relatively low SUM06 values.

Across years, the Stafford, Connecticut site reflects the general trend in ozone levels in the Eastern United States with peak years in 1982, 1983, and 1988. See EPA (1990) for a discussion of national trends. The Quabbin Reservoir, Massachusetts site shows a peak value for 1988. Within the time-series of seasonal SUM06 values, 1989 ozone levels are moderate.

Table 3.--Number of valid hourly average ozone readings (N) of a possible 5,136 and uncorrected (Unc) and corrected (Corr) seasonal seasonal SUM06 (ppm-h) values by year and monitoring site, New England

Year	Stafford CT			Acadia NP ME			Mt. Greylock MA			Quabbin Reservoir, MA			Hubbard Brook NH			Chittenden County, VT		
		SUM06			SUM06			SUM06			SUM06			SUM06			SUM06	
	N	Unc	Corr	N	Unc	Corr	N	Unc	Corr	N	Unc	Corr	N	Unc	Corr	N	Unc	Corr
1981	3966	51.6	66.7															
1982	3922	72.9	82.5															
1983	5091	98.8	99.7															
1984	4091	50.2	55.8															
1985	4819	47.8	50.9															
1986	4755	26.8	29.5							4705	29.0	31.0						
1987	4798	29.6	32.0							5030	31.8	32.3						
1988	4702	57.5	63.7							5015	70.1	72.4						
1989	4434	38.6	44.5	4584	17.7	20.1	3923	15.8	19.5	5064	53.7	54.5	4884	13.6	14.0	4082	17.7	19.4

To place the values of the seasonal SUM06 index in context, during 1981-85 and a May through October season, the calculated seasonal SUM06 index was at least 154 ppm-h in each year at the San Bernadino, California site (Bohm and Vandetta, 990). Southern California has experienced elevated ozone levels over many years. This has led to injury and death of trees and agricultural crops (Miller et al. 1989).

Wet deposition. There are 10 wet deposition monitoring sites in the New England States; all are part of the National Atmospheric Deposition Program (NADP) network (Fig. 24). The site near Bennington, Vermont is classified as suburban; the site at Waltham, Massachusetts is urban; and the one at Caribou, Maine is located near a municipal airport runway. All other sites are rural. All sites are less than 400 m in elevation. The longest operating site, begun in October 1978, is that at Hubbard Brook, New Hampshire the shortest period of record, since June 1984, is from the site at Underhill, Vermont.

Figures 25-27 show deposition levels by quarter for the period January 1979 through December 1989, for sulfate, nitrate, and hydrogen ions, respectively. No deposition estimate was made when a quarter failed to satisfy data completeness criteria; this resulted in the data gaps shown in the figures. The data were supplied by NADP (1990).

The median three-month sulfate-deposition value for the 11-year period is 4.8 kg/ha. The median annual sulfate-deposition level was 21.4 kg/ha, with a maximum of 38.3 kg/ha and a minumum of 8.6 kg/ha. Both quarterly and annual sulfate deposition tended to be highest at the three Massachusetts sites and the New Hampshire site (Fig. 25). Sulfate deposition rates in eastern Ohio and western Pennsylvania, some of the highest in the Nation, have frequently been greater than 30 kg/ha/yr (Bowersox 1990; Lynch 1990).

Quarterly nitrate deposition rates at the Quabbin Reservoir, Hubbard Brook, and the two Vermont sites most often exceeded the regional median value of 2.9 kg/ha over the 11 years (Fig. 26). For 1979-89, yearly nitrate deposition values had a median of 12.4 kg/ha, a maximum of 20.8 kg/ha and a minimum of 5.8 kg/ha. Values at these sites also were highest on an annual basis. Nitrate deposition rates for western Pennsylvania frequently exceeded 20 kg/ha/yr (Lynch 1990).The median for quarterly hydrogen ion deposition in New England was 0.10 kg/ha for the 11 years. Most quarterly hydrogen deposition totals exceeded this level at the Quabbin Reservoir and Waltham sites and at Hubbard Brook (Fig. 27).

Median annual hydrogen ion deposition rates for New England were 0.45 kg/ha, with a maximum of 0.75 kg/ha and a minimum of 0.19 kg/ha. Annual hydrogen ion deposition tended to be greatest at Quabbin Reservoir, Waltham, and Hubbard Brook. Over the 11-year period, annual precipitation-weighted pH ranged from 4.23 to 4.73 with a median of 4.42. Hydrogen ion deposition rates in western Pennsylvania often exceed 0.85 kg/ha/yr and associated precipitation pH is less than 4.14 (Lynch 1990).

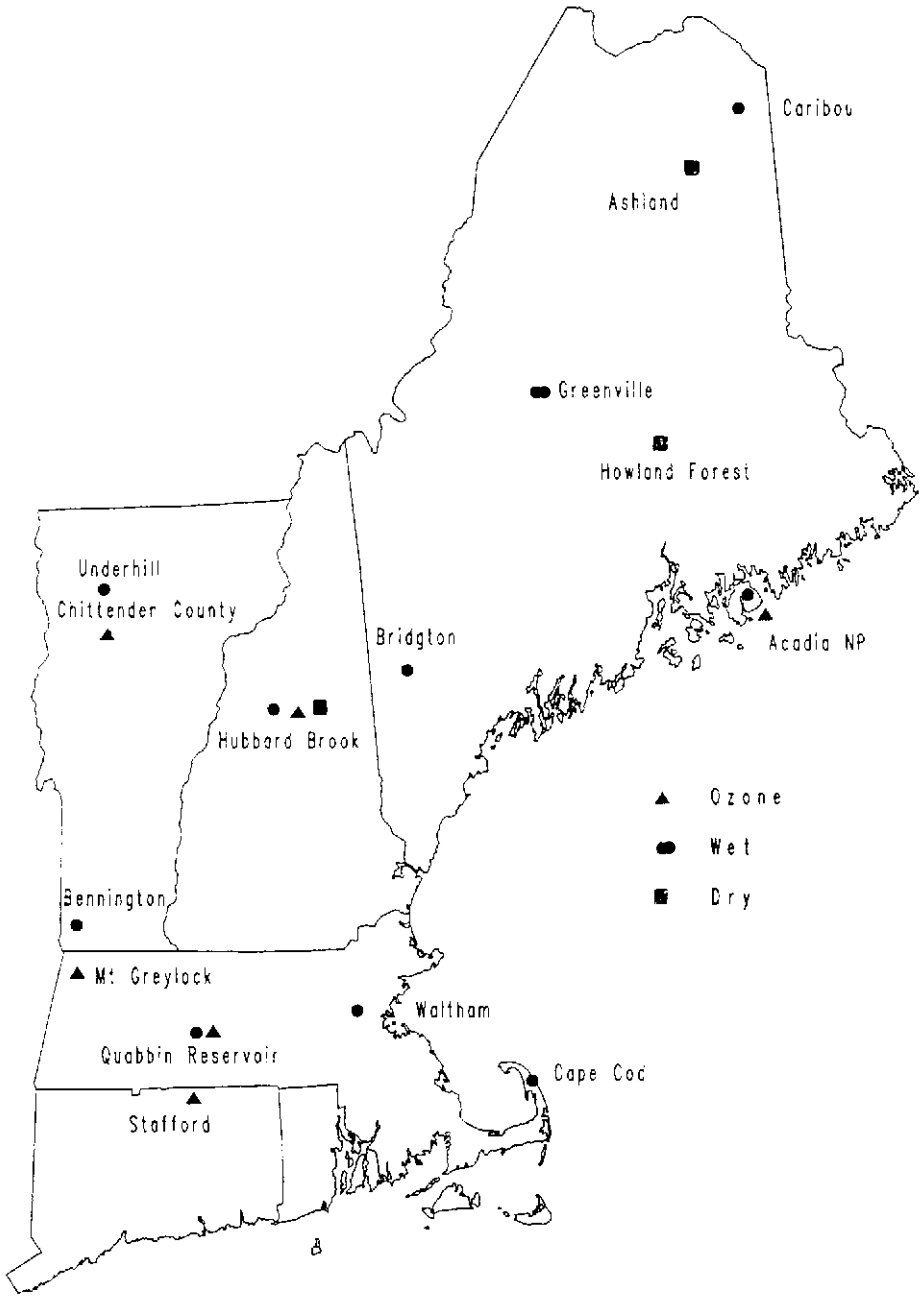


Figure 24.--Location of ozone (in forested areas), wet deposition, and dry deposition monitoring sites in New England.

Sulfate Deposition (kg/ha) By Quarter

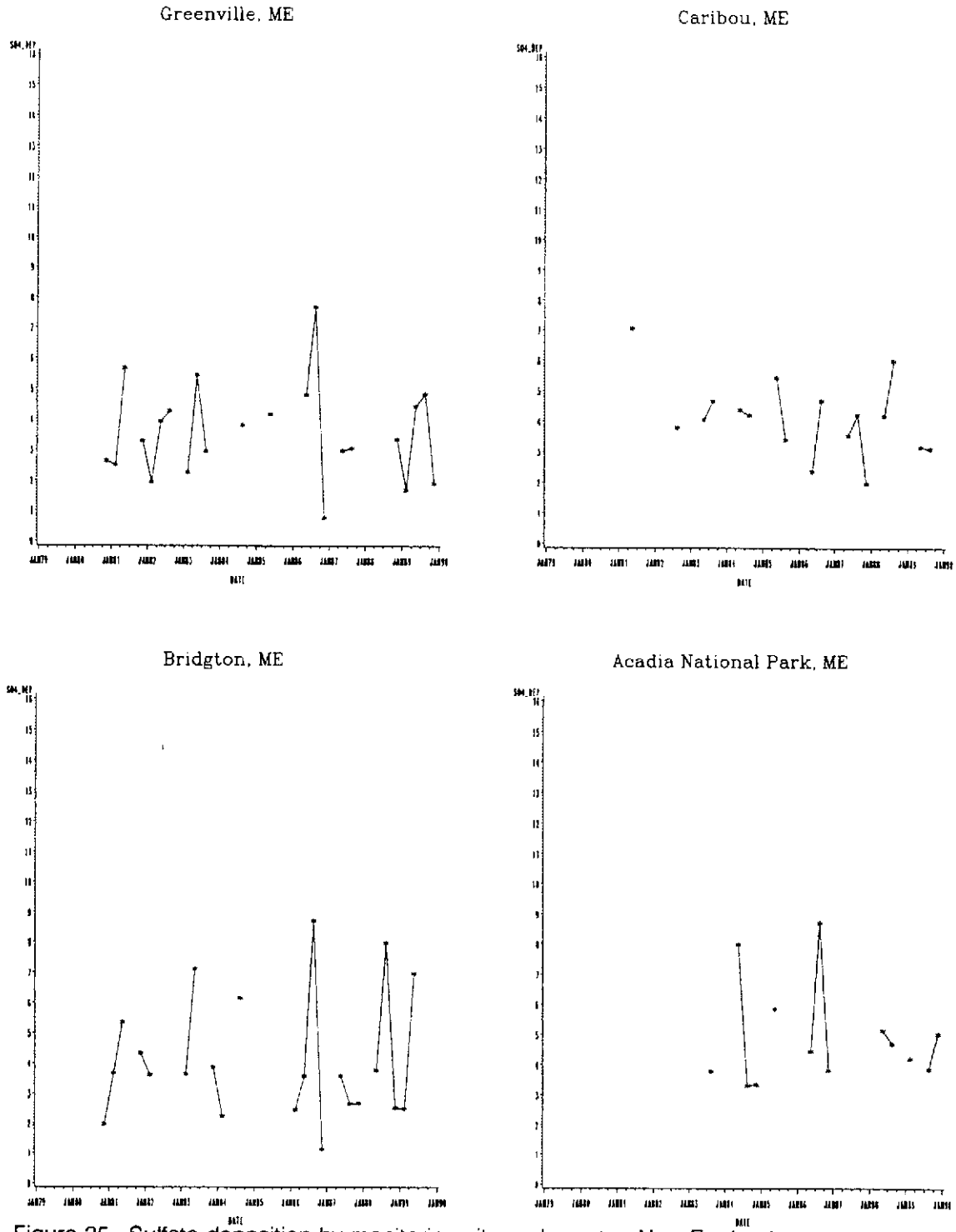
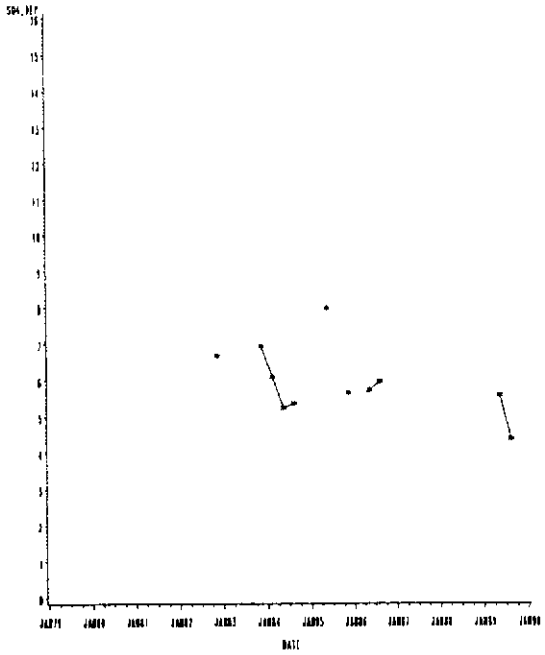


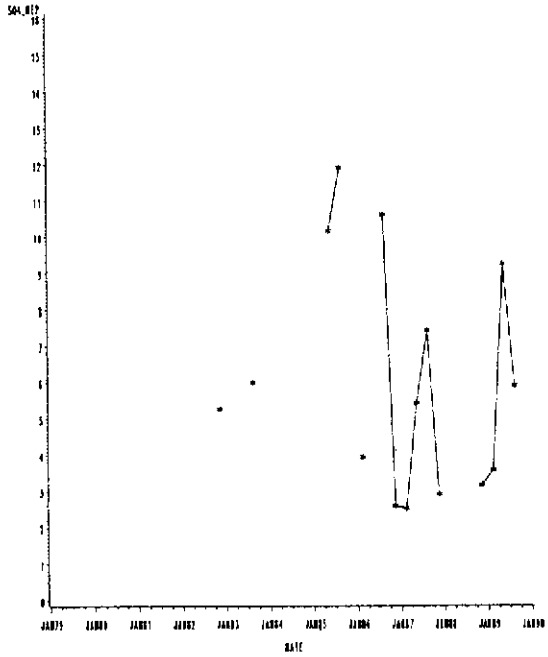
Figure 25.--Sulfate deposition by monitoring site and quarter, New England.

Sulfate Deposition (kg/ha) By Quarter

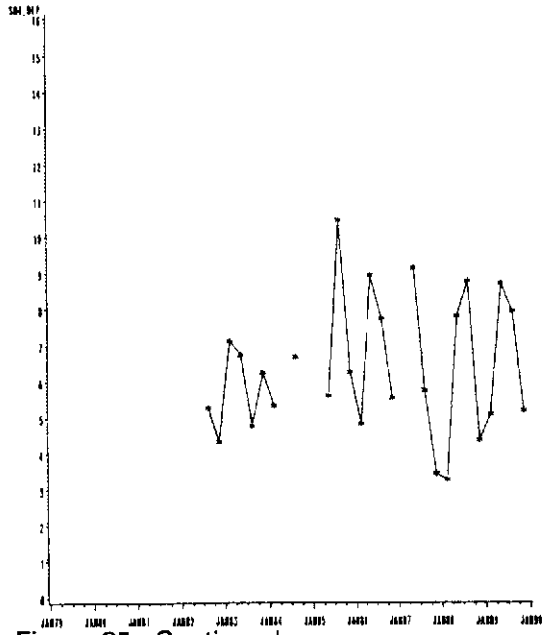
Cape Cod, MA



Quabbin Reservoir, MA



Waltham, MA



Hubbard Brook, NH

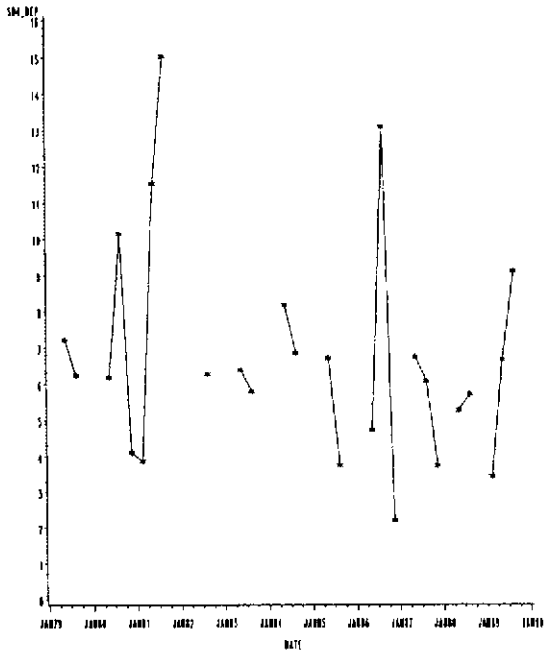
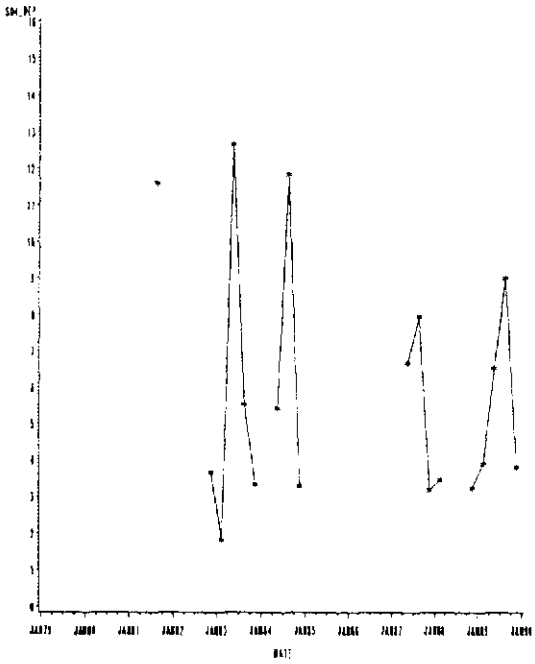


Figure 25.--Continued

Sulfate Deposition (kg/ha) By Quarter

Bennington, VT



Underhill, VT

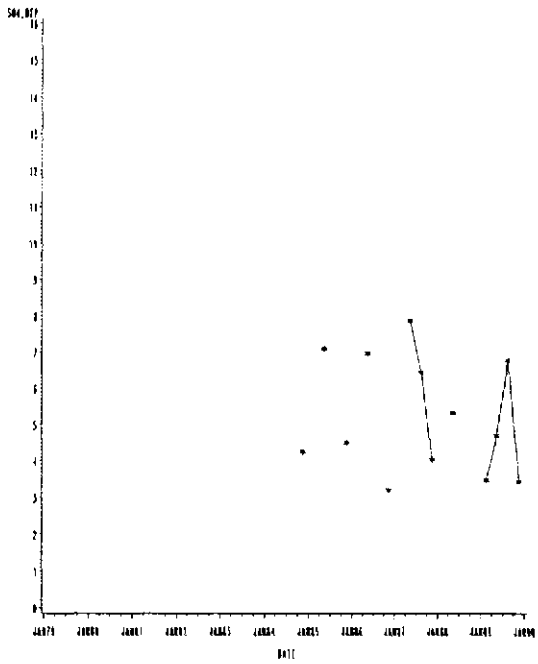


Figure 25.--Continued

Nitrate Deposition (kg/ha) By Quarter

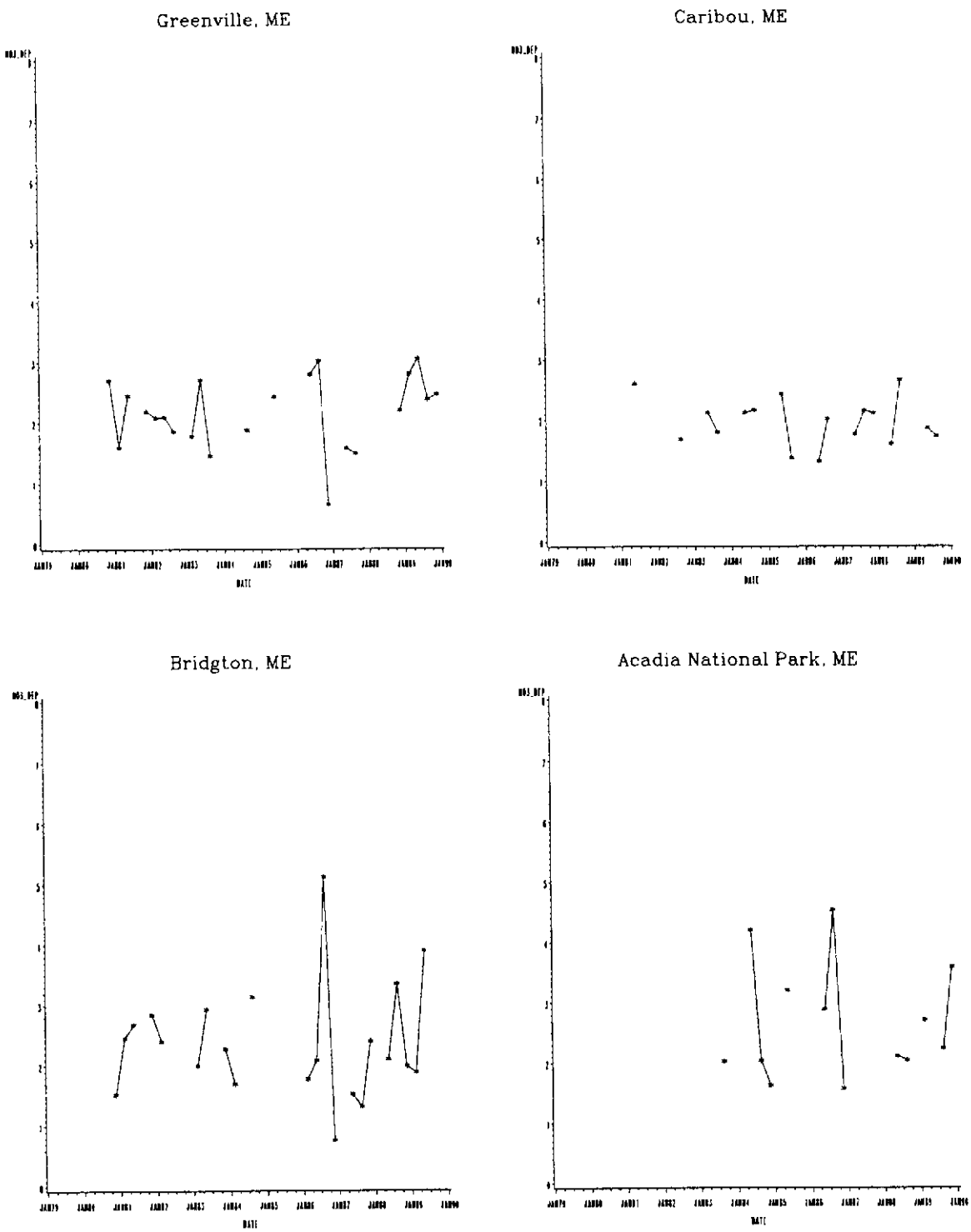
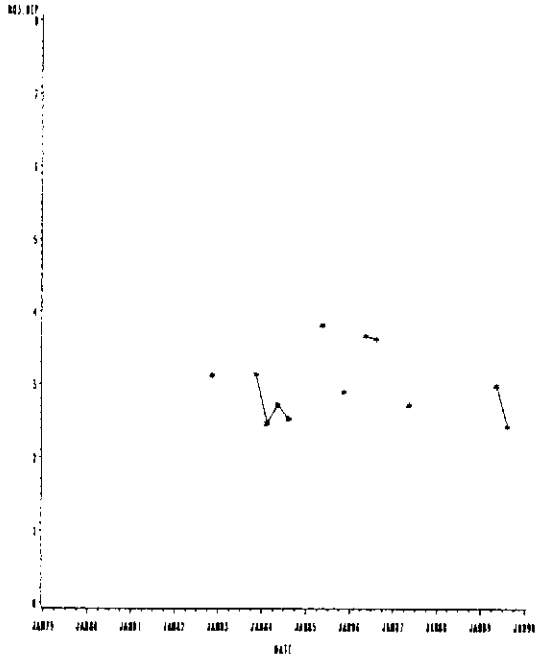


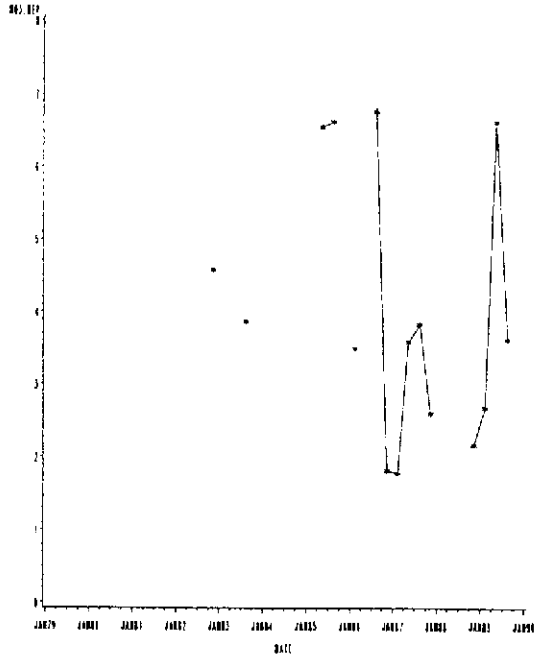
Figure 26.--Nitrate deposition by monitoring site and quarter, New England.

Nitrate Deposition (kg/ha) By Quarter

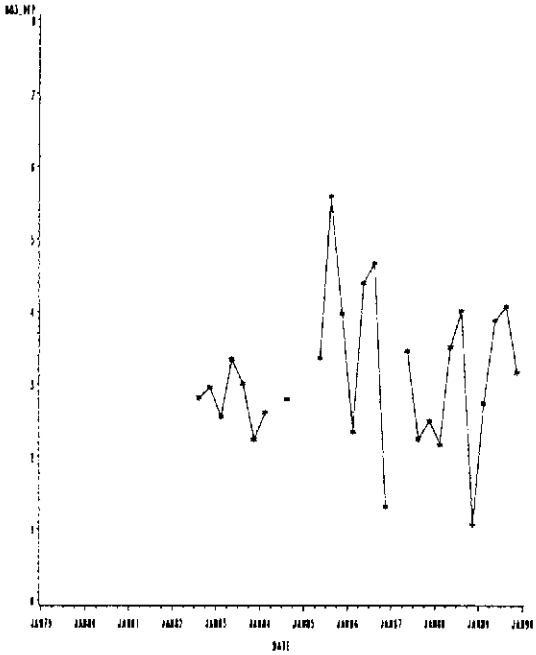
Cape Cod, MA



Quabbin Reservoir, MA



Waltham, MA



Hubbard Brook, NH

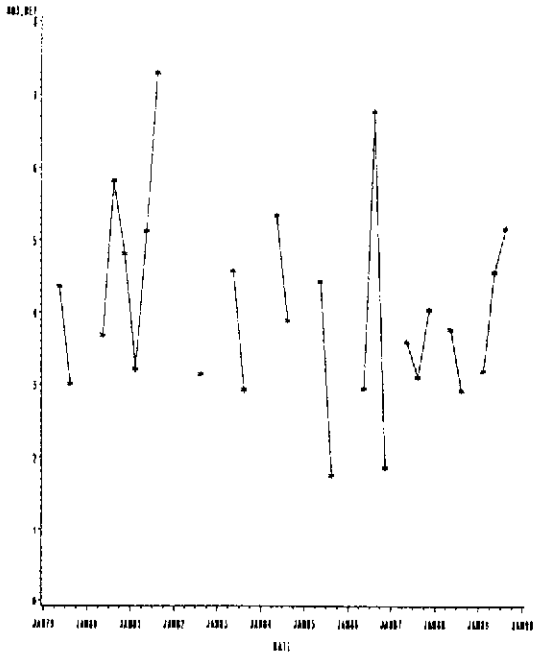
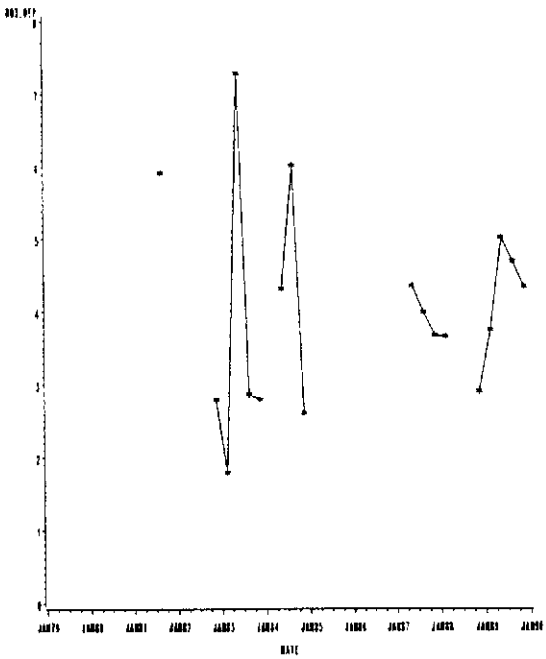


Figure 26.--Continued

Nitrate Deposition (kg/ha) By Quarter

Bennington, VT



Underhill, VT

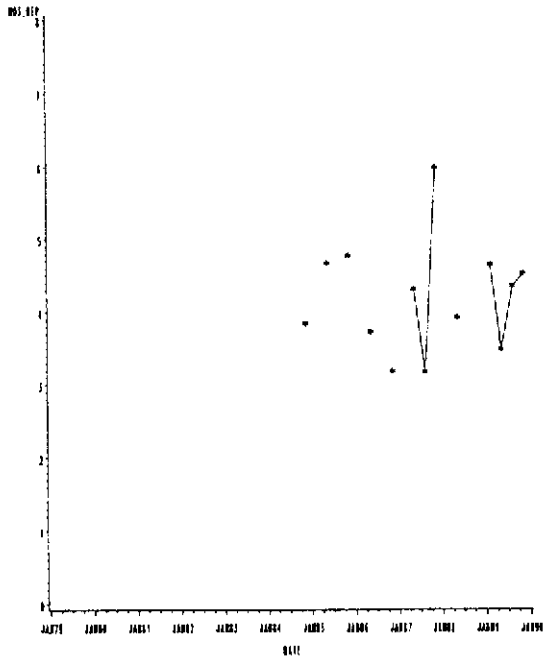


Figure 26.--Continued

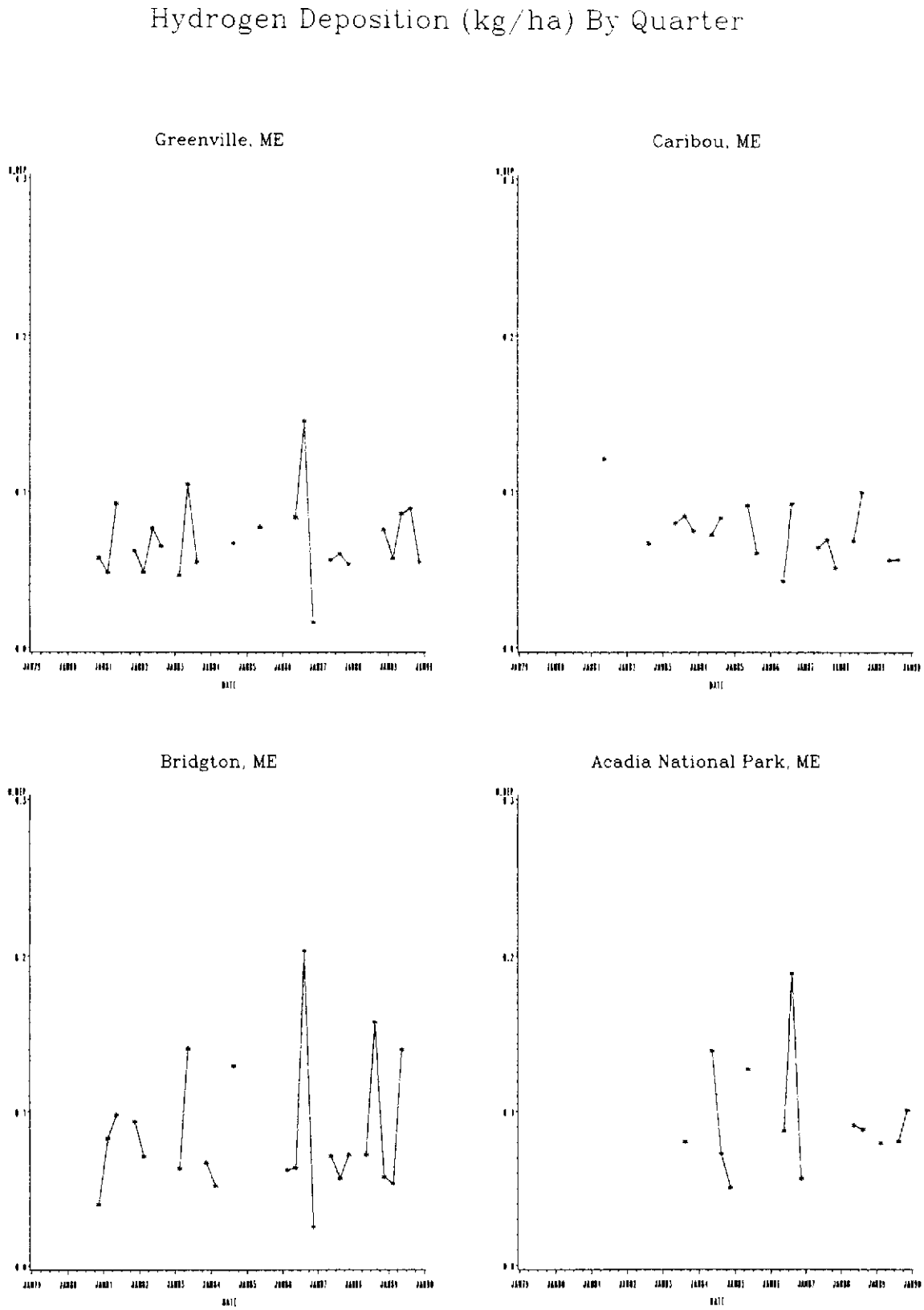
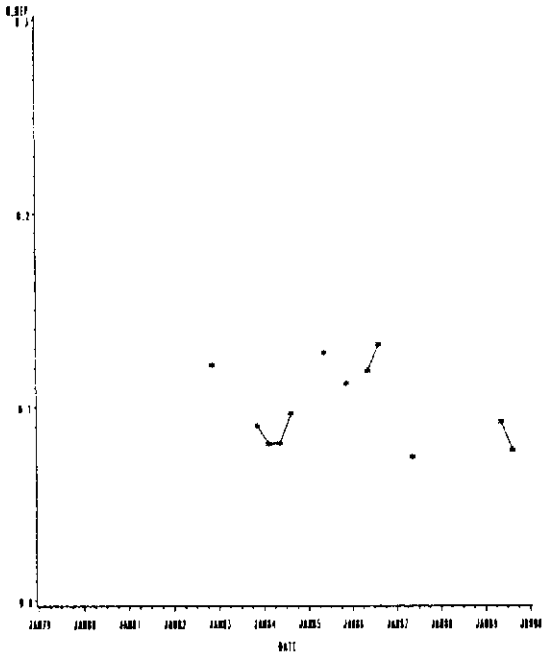


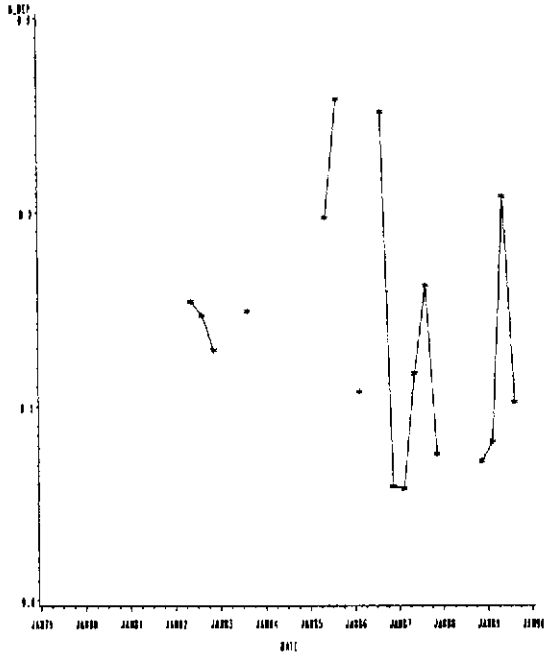
Figure 27.--Hydrogen deposition by monitoring site and quarter, New England.

Hydrogen Deposition (kg/ha) By Quarter

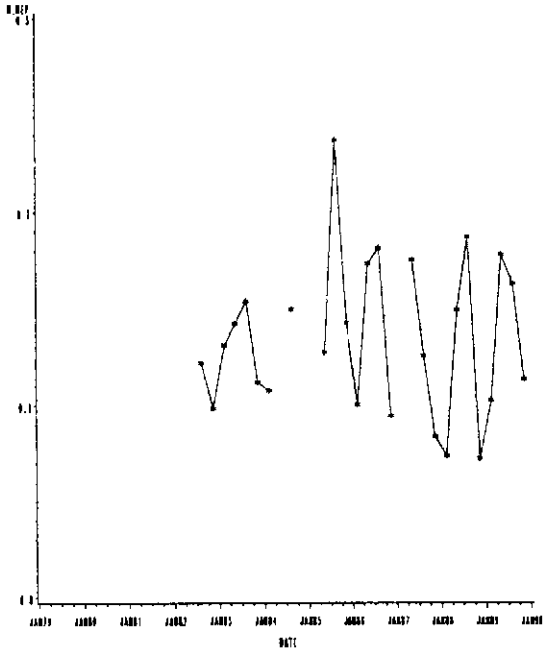
Cape Cod, MA



Quabbin Reservoir, MA



Waltham, MA



Hubbard Brook, NH

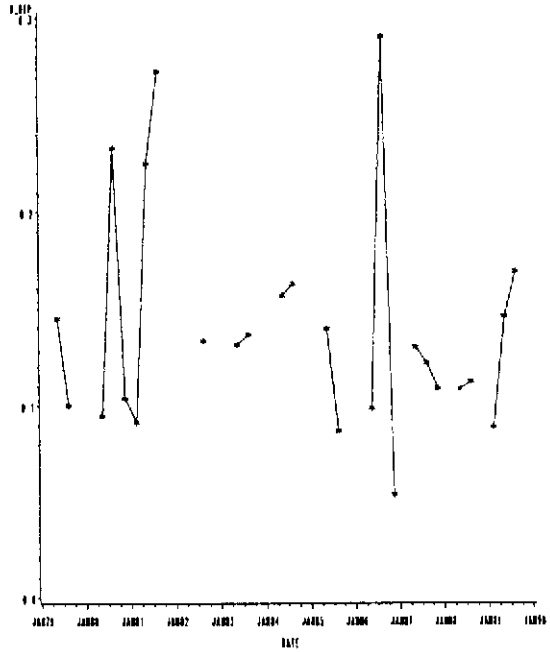


Figure 27.--Continued

Hydrogen Deposition (kg/ha) By Quarter

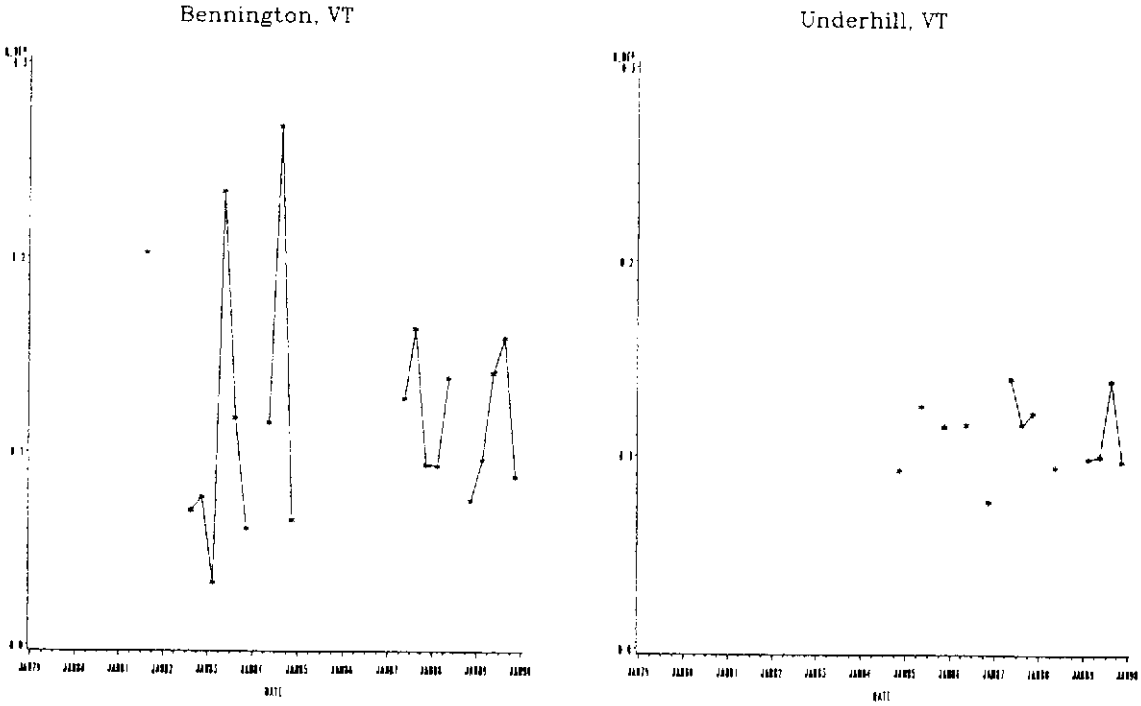


Figure 27.--Continued

Dry deposition. There are three dry deposition monitoring sites in New England (Fig. 24). The sites at Hubbard Brook and at Ashland, Maine, are part of the National Dry Deposition Network (NDDN) and began monitoring activities in December 1988. The site at Howland Forest, Maine, became active in October 1987, and is part of the National Oceanic and Atmospheric Administration network. All three sites are in rural locations.

Data from the Howland Forest site were unavailable for this report. For the two NDDN sites, Edgerton et al. (1990) reported annual averages for gas (HNO_3 and SO_2) and particulate (sulfate, nitrate, and ammonium) species. The values, in micrograms/m^3, were:

Item	Hubbard Brook	Ashland
Sulfate	3.1	2.7
Nitrate	0.27	0.28
Ammonium	0.88	0.69
HNO_3	0.93	0.71
SO_2	2.8	2.4

For each species listed, values are among the four lowest for all 41 NDDN sites east of the Mississippi River.

While NDDN has not yet finalized the methodology for computing deposition amounts, Edgerton et al. (1990) obtained a range of annual dry deposition estimates by making certain gross assumptions about various parameters which enter the dry-deposition calculations. When dry-deposition rates are combined with the 1989 annual wet-deposition totals from nearby sites, one finds that total deposition of both sulfate and nitrate probably was composed primarily of wet deposition at the two dry-deposition monitoring sites. At Hubbard Brook in 1989, wet deposition accounted for 78 to 87 percent of total sulfate deposition and 75 to 86 percent of total nitrate deposition. For the Ashland/Caribou area, wet deposition accounted for 60 to 75 percent of total sulfate and 64 to 78 percent of total nitrate deposition. The reader is cautioned that these percentages are rough estimates.

Global Climate Change

The issue of global climate change is controversial and as yet unresolved. Evidence suggests the possibility that increasing atmospheric concentrations of "greenhouse gases" might raise global average temperatures substantially (Peters 1990). If this occurs, changes in global climate will be associated with regional changes in average temperature, precipitation patterns, and other climatic attributes that affect trees. Distributions of species and forest composition would change. Widespread species are not at risk of extinction but loss of genetic variation could occur. Species with localized distributions are at risk of extinction.

Forest Health Monitoring

Forests have evolved under a myriad of stress factors, until recently of natural origin (for example, weather extremes, climatic change, and native insect and pathogen outbreaks). As a consequence, forest ecosystems are adaptive to stress.

The northeastern forests have been shaped to some extent by climatic change from the Wisconsin Glaciation that was more extreme than any suggested by present concerns about the "greenhouse effect". Nevertheless, over time, anthropogenic influences are creating potentials for change to which the forest would be unable to respond. Additionally, society's interest in the forest for both commodity and amenity resources demands that we be knowledgeable of changes in forests and where possible reduce detrimental human-caused forest stress (for example, "acid rain," tropospheric ozone, and greenhouse gases).

As mentioned earlier, Forest Health Monitoring (FHM) was initiated in New England as part of a broader program to track long-term trends in the health and productivity of forest ecosystems in the United States. An Executive Committee composed of senior USDA Forest Service personnel and New England State Foresters appointed a Technical Committee of Forest Service, State, and EPA personnel to develop, plan, and implement NEFHM. The Committee developed materials to implement its objectives, including a Work Plan, a field manual, data collection forms, and a training program for field personnel.

FHM is a long-term project that will characterize elements of forest condition and forest stress, quantify changes in forest condition, and evaluate any relationship between changes in forest condition and forest stress. The primary emphasis is detecting unexpected deviations from established baseline conditions or trends, and coordinating evaluation and research activities needed to explain observed deviations. The FHM Work Plan for New England specifies the following objectives:

1. Characterize the following forest conditions:

    a. Tree-growth rates
    b. Tree vigor
    c. Soil and site
    d. Stand composition
    e. Landscape characteristics

2. Characterize the following potential forest stressors:

    a. Major insects and pathogens
    b. Climate (long term) and weather (short term)
    c. Atmospheric pollution and deposition
    d. Other direct human activities (for example, changes in land use)

3. Quantify changes in forest conditions

4. Correlate changes in forest conditions with forest stresses

Sample Location Network

Data to support FHM in New England are to be collected from a network of 263 permanent sample locations across the six states (Table 1). The locations were identified using a grid developed by the EPA to ensure systematic coverage of the region. Specific locations were selected from a large sample of aerial photographic points that serve as the first phase of the USDA Forest Service's Forest Inventory (for example, Powell and Dickson 1984).

Each FHM sample location covers 1 acre within which vegetation measurements are taken on four, nested fixed-radius 1/24-acre plots. Each location will be visited annually at which time several measurements will be taken that provide information for assessing one or more proposed indicators of forest health. Not all measurements will be taken annually.

Indicators

The numerous measurements that will be taken will collectively quantify the conditions of the forest. An interpretation of these conditions and any changes in them will describe the health of the forest. The measurements have been aggregated into five indicator groups: growth, visual symptoms, soil nutrition, foliar nutrition, and landscape characterization.

Forest growth. This indicator group is similar to current activities within the existing FIA survey. In addition to quantifying periodic increment, mortality, and ingrowth through measurements of tree diameter and sample reconciliation, measurements will be taken to statistically control for site and stand-growth influences. The principal difference between these and FIA measurements will be the reduced periodicity.

Visual symptoms. These series of annual measurements will characterize crown conditions and specific damage to the entire tree. Foliage of the tree crown is the photosynthetic "factory" that supports tree growth. The tree crown is the portion of the tree in direct interaction with the atmosphere. By monitoring crown transparency, dieback, and discoloration, we hope to be able to detect conditions that would affect tree growth and mortality.

Symptoms of damage on trees that can be examined and monitored include those caused by insects, pathogens or parasites, animals, weather, or man. If sufficiently severe, such damage can affect the overall health of a tree.

Soil nutrition. The soil provides physical support to a tree and also serves as the principal source of its nutrients. If potential toxins are present in the soil, these elements can be translocated into the tree. Characterization of the soil profile, classification of the soil, and periodic (for example, + 10 years) chemical analysis of soil samples will provide information important to an assessment of forest health.

Foliar nutrition. The chemistry of tree foliage can serve as an early barometer of potential forest health problems. An imbalance in the

proportions of certain elements in the foliage may indicate a depletion or excess of minerals in the soil solution that is available to the tree.

Periodic chemical analysis of foliage samples should provide data to monitor these conditions. Considerable developmental research is needed before this indicator can be implemented across the full plot network.

Landscape characterization. Since the European settlement of New England, the principal agent of change in the region's forest has been human use of the land. This impact was first characterized by extensive forest clearing for agriculture and human uses, and then by reversion to forest as agricultural use was abandoned. The forests are now experiencing a second, if less extensive, episode of change for residential development. The mapping and measurement of land cover and land use on aerial photographs will provide data on human use of the New England forest over a large sample of the land area.

Reporting

Annual reports on FHM activities will contain summaries of data collected in that year as well as summaries of ancillary forest-stress data (for example, pest and pathogen surveys, atmospheric deposition and pollution statistics, and climate and weather statistics). These reports will be published by the Northeast Forest Experiment Station and Northeastern Area, State and Private Forestry in cooperation with the State Foresters and the EPA. Other more detailed reports will provide analysis and interpretation of change, and, once data become available, an analysis of the relationships between forest conditions and sources of stress that act upon the forest.

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Appendix

Reliability of the Estimates

The data in this report were collected on a carefully designed sample plots that represented forest conditions throughout New England. However, because not every tree nor every acre of land can be measured, we can present only estimates. The reliability of the estimating procedure can be judged by two important statistical measures: accuracy and precision. Among statisticians, accuracy refers to the success of estimating the true value, while precision refers to the variation among repeated samples. We are most interested in the accuracy of the survey, but only precision can be measured.

Although accuracy cannot be measured exactly, it can be checked. Preliminary estimates from individual state surveys were reviewed by local experts familiar with the forest resources of the New England States. If questions arose, the data were reviewed and re-analyzed, if necessary, to answer them. Also, great care was taken to keep all sources of procedural error to a minimum through careful training of both field and office personnel, frequent inspection of field and office work, and application of the most reliable survey methods.

Because of the care exercised in the survey process, estimates of precision afford a reasonable measure of the survey's adequacy. The precision of each estimate is described by its sampling error. Sampling errors are given with the row and column totals of each table in the Appendix. Errors for each table entry have been estimated and are available on request.

Here is an example of how the sampling error is used to indicate reliability. The estimate of total forest land acreage in New England is 32,401,000 acres (Table 5). Its sampling error is 0.3 percent, or 97,203 acres. This means that if there are no errors in the procedure, and we repeated the survey in the same way, the odds are 2 to 1 (66-percent probability) that the estimate would be between 32,303,797 and 32,498,203 acres (32,401,000 + 97,203). Similarly, the odds are 19 to 1 (95-percent probability) that the estimate would be within + 194,406 acres. It is worth noting that table totals have the smallest sampling errors and, therefore, are the most precise or reliable. Row and column totals are less precise and, generally, individual entries within a table are least precise.

Comparison to Other Survey Reports

The information presented in this report is similar to that published in Resource Bulletins for individual states (Table 2) and to those forest statistics published in support of the RPA Assessment (Waddell et al. 1989). However, information in this report is estimated solely from new ground or third survey plots. Information published in the state Resource Bulletins was combined estimates using data from both new ground and remeasured plots. Additionally, the algorithm used to classify stand size is different from that used for the New England Resource Bulletins, consequently, estimates of forest area by stand size may differ considerably.

Generally, there should be no significant difference between any two estimates of the same parameter when based on a large sample (i.e., table and row and column totals). For example, Powell and Dickson (1984) estimated there are 17,060,200 acres of timberland in Maine, + 0.3 percent (51,181 acres). In this report, we estimate Maine has 17,166,300 acres of timberland + 0.5 percent (85,832 acres). The 95-percent confidence limits of the two estimates overlap (16,957,839 to 17,162,561 from Powell and Dickson 1984 versus 16,994,637 to 17,337,963 from this report), and, therefore, are not significantly different.

Definition of Terms

Acceptable tree. (a) Live sawtimber trees that do not qualify as preferred trees but are not cull trees. (b) Live poletimber trees that prospectively will not qualify as preferred trees, but are not now or prospectively cull trees.

Accretion. The estimated net growth on growing-stock trees that are measured during the previous inventory, divided by the number of growing seasons between surveys. It does not include the growth on trees that were cut during the period, nor those trees that died.

Bog/marsh/swamp. Land that has less than 10.0 percent stocking with live trees; and which characteristically supports low, generally herbaceous or shrubby vegetation, and which is intermittently covered with water during all seasons; includes tidal areas that are covered with salty or brackish water during high tides.

Commercial species. Tree species presently or prospectively suitable for industrial wood products. Excludes species of typically small size, poor form, or inferior quality, such as hawthorn or sumac.

Cropland. Land that currently supports agricultural crops including silage and feed grains, bare farm fields resulting from cultivation or harvest, and maintained orchards.

Diameter at breast height (d.b.h.). The diameter outside bark of a standing tree measured at 4-1/2 feet above the ground.

Forest land. The total of timberland and all noncommercial forest land.

Forest type. A classification of forest land based on the species that form a plurality of live tree basal area stocking.

Forest-type group. A combination of forest types that share closely associated species or site requirements. The many forest types in the New England States were combined into the following major forest-type groups (the descriptions apply to forests in the New England States):

a. White pine--forests in which white pine, hemlock, or red pine make up the plurality of the stocking, singly or in combination; common associates include red spruce, maple, and yellow-poplar.

b. Spruce-fir--forests in which red spruce, northern white-cedar, balsam fir, white spruce, black spruce, or tamarack, singly or in combination, make up a plurality of the stocking; common associates include yellow birch and red maple.

c. Loblolly-shortleaf pine--forest in which loblolly, shortleaf or other southern yellow pines (except longleaf or slash pine), singly or in combination, comprise a plurality of the stocking; common associates include hickory and maple.

d. Oak-pine--forest in which northern red oak or white ash, singly or in combination, make up a plurality of the stocking but where pines or eastern redcedar contribute 25 to 50 percent of the stocking; hemlock, maple, sweet birch, and yellow-poplar are associates.

e. Oak-hickory--forests in which upland oaks, red maple (when associated with central hardwoods), or hawthorn, singly or in combination, make up a plurality of the stocking and in which white pine makes up less than 25 percent of the stocking; common associates include hard pines, hemlock, maple, birch, hickory, and yellow-poplar.

f. Oak-gum-cypress--forests in which tupelo, blackgum, sweetgum, oak, or southern cypress, singly or in combination, make up a plurality of the stocking; common associates include hickory, maple, yellow-poplar, and beech.

g. Elm-ash-red maple--forests in which black ash, elm, red maple (when growing on wet sites), willow, or green ash, singly or in combination, make up a plurality of the stocking; common associates include sugar maple, hickory, yellow-poplar, and black cherry.

h. Northern hardwoods--forests in which sugar maple, beech, yellow birch, red maple (when associated with northern hardwoods), pin cherry, or black cherry, singly or in combination, make up a plurality of the stocking; common associates include hard pines, hemlock, hickory, ash, and yellow-poplar.

i. Aspen-birch--forests in which aspen, paper birch, or gray birch, singly or in combination, make up a plurality of the stocking.

Gross growth. The sum of accretion and ingrowth.

Growing-stock trees. Live trees of commercial species classified as sawtimber, poletimber, saplings, or seedlings; that is, all live trees of commercial species except rough and rotten trees.

Hardwoods. Dicotyledonous trees, usually broad-leaved and deciduous.

Idle farmland. Former cropland or pasture that has not been tended within the last 2 years and has less than 10.0 percent stocking with live trees (established seedlings or larger trees), regardless of species.

Improved pasture. Land that is currently used and maintained for grazing (not including grazed cropland).

Ingrowth. The estimated net volume of growing-stock trees that became 5.0 inches d.b.h. or larger during the period between inventories, divided by the number of growing seasons between surveys.

Land area. (a) Bureau of Census: The area of dry land and land temporarily or partly covered by water, such as marshes, swamps, and river flood plains; streams, sloughs, estuaries, and canals less than 1/8 statute mile wide; and lakes, reservoirs, and ponds less than 40 acres in area. (b) Forest Inventory and Analysis: same as (a) except that the minimum width of streams, etc. is 120 feet, and the minimum size of lakes, etc. is 1 acre.

Mining and waste land. Surface mining, gravel pits, dumps.

Mortality. The estimated net volume of growing-stock trees at the previous inventory that died from natural causes before the current inventory, divided by the number of growing seasons between surveys.

Multiple family housing. Multiple individual residential units or attached units (e.g., apartment buildings, condominiums) and immediately adjacent managed land.

Net change. The difference between the current and previous inventory estimates of growing-stock volume, divided by the number of growing seasons between surveys. Components of net change are ingrowth plus accretion, minus mortality, minus cull increment, minus removals.

Net growth. The change, resulting from natural causes, in growing-stock volume during the period between surveys, divided by the number of growing seasons. Components of net growth are ingrowth plus accretion, minus mortality, minus cull increment.

Noncensus water. Streams/rivers between 120 feet and 1/8 mile in width, and bodies of water between 1 and 40 acres in size. The Bureau of the Census classifies such water as land.

Noncommercial forest land. Reserved timberland, Christmas tree plantations, other forest land, and other reserved forest land.

Noncommercial species. Tree species of typically small size, poor form, or inferior quality that normally do not develop into trees suitable for industrial wood products.

Nonforest land. Land that has never supported forests, or land formerly forested but now in nonforest use such as cropland, pasture, residential areas, or highways.

Nonstocked area. A stand-size class of forest land that is stocked with less than 10 percent of minimum full stocking with all live trees.

Other farmland. All nonforest land on a farm excluding cropland, pasture, and idle farmland; includes farm lanes, stock pens, and farmsteads.

Other forest land. Forest land that is incapable of producing 20 cubic feet per acre per year of industrial wood under natural conditions, because of adverse site conditions (formerly known as unproductive forest land).

Poletimber stand. A stand-size class of forest land that is stocked with at least 10 percent of minimum full stocking with all live trees with half or more of such stocking in poletimber or sawtimber trees or both, and in which the stocking of poletimber exceeds that of sawtimber.

Poletimber trees. Live trees of commercial species meeting regional specifications of soundness and form and at least 5.0 inches in d.b.h., but smaller than sawtimber trees.

Removals. The net growing-stock volume harvested or killed in logging, cultural operations (such as timber stand improvement) or land clearing, and also the net growing-stock volume neither harvested nor killed but growing on land that was reclassified from timberland to noncommercial forest land or nonforest land during the period between surveys. This volume is divided by the number of growing seasons.

Productive reserved timberland. Forest land sufficiently productive to qualify as timberland, but withdrawn from timber utilization through statute or administrative designation; land exclusively used for Christmas tree production (formerly known as productive reserved forest land).

Rights-of-way. Highways, pipelines, powerlines, canals.

Sampling error. A measure of the reliability of an estimate, expressed as a percentage of the estimate. The sampling errors given in this report correspond to one standard deviation and are calculated as the square root of the variance, divided by the estimate, and multiplied by 100.

Saplings. Live trees 1.0 inch through 4.9 inches d.b.h.

Sapling-seedling stand. A stand-size class of forest land that is stocked with at least 10 percent of minimum full stocking with all live trees with half or more of such stocking in saplings or seedlings or both.

Sawtimber stand. A stand-size class of forest land that is stocked with at least 10 percent of minimum full stocking with all live trees with half or more of such stocking in poletimber or sawtimber trees or both, and in which the stocking of sawtimber is at least equal to that of poletimber.

Sawtimber trees. Live trees of commercial species at least 9.0 inches d.b.h. for softwoods or 11.0 inches for hardwoods, containing at least one 12-foot sawlog or two noncontiguous 8-foot sawlogs, and meeting regional specifications for freedom from defect.

Seedlings. Live trees less than 1.0-inch d.b.h. and at least 1 foot tall.

Single-family housing. House sheltering one family and immediately adjacent managed land.

Softwoods. Coniferous trees, usually evergreen and having needles or scalelike leaves.

Stand. A group of forest trees growing on forest land.

Stocking. The degree of occupancy of land by trees, measured by basal area and/or number of trees in a stand compared to the basal area and/or number of trees required to fully use the growth potential of the land (or the stocking standard). In the Eastern United States this standard is 75 square feet of basal area per acre for trees 5.0 inches d.b.h. and larger, or its equivalent in numbers of trees per acre for seedlings and saplings.

Two categories of stocking are used in this report: all live trees and growing-stock trees. The relationships between the classes and the percentage of the stocking standard are: nonstocked = 0 to 9, poorly stocked = 10 to 59, moderately stocked = 60 to 99, fully stocked = 100 to 129, and overstocked = 130 to 160.

Timberland. Forest land producing or capable of producing crops of industrial wood (more than 20 cubic feet per acre per year) and not withdrawn from timber utilization. Formerly known as commercial forest land.

Trees. Woody plants that have well-developed stems and are usually more than 12 feet tall at maturity.

Urban forestland. Forest land completely surrounded by or nearly surrounded by urban development (not parks), whether commercial, industrial, or residential.

Common and Scientific Names of Tree Species of New England

Common Name	Scientific name[1]
CONIFEROUS SPECIES	
Balsam fir	*Abies balsamea*
Atlantic white-cedar	*Chamaecyparis thyoides*
Eastern redcedar	*Juniperus virginiana*
Larch (introduced)	*Larix* sp.
Tamarack (native)	*L. laricina*
Norway spruce	*Picea abies*
White spruce	*P. glauca*
Black spruce	*P. mariana*
Red spruce	*P. rubens*
Jack pine	*Pinus banksiana*
Red pine	*P. resinosa*
Pitch pine	*P. rigida*
Eastern white pine	*P. strobus*
Scotch pine	*P. sylvestris*
Northern white-cedar	*Thuja occidentalis*
Eastern hemlock	*Tsuga canadensis*
DECIDUOUS SPECIES	
Boxelder	*Acer negundo*
Striped maple	*A. pensylvanicum*
Red maple	*A. rubrum*
Silver maple	*A. saccharinum*
Sugar maple	*A. saccharum*
Mountain maple	*A. spicatum*
Tree-of-heaven, ailanthus	*Ailanthus altissima*
Serviceberry	*Amelanchier* sp.
Yellow birch	*Betula alleghaniensis*
Sweet birch	*B. lenta*
Paper birch	*B. papyrifera*
Gray birch	*B. populifolia*
American hornbeam, musclewood	*Carpinus caroliniana*
Hickory	*Carya* sp.
Bitternut hickory	*C. cordiformis*
Pignut hickory	*C. glabra*
Shagbark hickory	*C. ovata*
Mockernut hickory	*C. tomentosa*
American chestnut	*Castanea dentata*
Catalpa	*Catalpa* sp.
Hackberry	*Celtis occidentalis*
Flowering dogwood	*Cornus florida*
Hawthorn	*Crataegus* sp.
American beech	*Fagus grandifolia*

Common Name	Scientific name[1]
White ash	*Fraxinus americana*
Black ash	*F. nigra*
Green ash	*F. pennsylvanica*
Honeylocust	*Gleditsia triacanthos*
Butternut	*Juglans cinerea*
Black walnut	*J. nigra*
Tulip-poplar, yellow-poplar	*Liriodendron tulipifera*
Apple species	*Malus* sp.
Red mulberry	*Morus rubra*
Blackgum	*Nyssa sylvatica*
Eastern hophornbeam, ironwood	*Ostrya virginiana*
Sycamore	*Platanus occidentalis*
Balsam poplar	*Populus balsamifera*
Eastern cottonwood	*P. deltoides*
Bigtooth aspen	*P. grandidentata*
Quaking aspen	*P. tremuloides*
Cherry, plum	*Prunus* sp.
Pin cherry	*P. pensylvanica*
Black cherry	*P. serotina*
Chokecherry	*P. virginiana*
White oak	*Quercus alba*
Swamp white oak	*Q. bicolor*
Scarlet oak	*Q. coccinea*
Bear oak, scrub oak	*Q. ilicifolia*
Swamp chestnut oak	*Q. michauxii*
Pin oak	*Q. palustris*
Chestnut oak	*Q. prinus*
Northern red oak	*Q. rubra*
Post oak	*Q. stellata*
Black oak	*Q. velutina*
Black locust	*Robinia psuedoacacia*
Willow	*Salix* sp.
Black willow	*S. nigra*
Sassafras	*Sassafras albidum*
American mountain-ash	*Sorbus americana*
European mountain-ash	*S. aucuparia*
Basswood	*Tilia* sp.
American basswood	*T. americana*
Elm	*Ulmus* sp.
Winged elm	*U. alata*
American elm	*U. americana*
Slippery elm	*U. rubra*

[1]According to Little (1979).

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Table 4.--Land area by land class and state[a], New England, 1980-85

(In thousands of acres)

Land class	States				All states	SE
	Maine	New Hampshire	Vermont	S. New England		
Timberland	17,166.3	4,812.0	4,421.1	5,163.0	31,562.4	.4
Noncommercial forest land						
Productive reserved	279.1	102.5	89.1	73.3	544.0	15.8
Unproductive forest land	281.2	72.7	33.3	128.4	515.6	10.6
Urban forest land	2.1	.0	.0	65.8	67.9	39.8
Total noncommercial forest	562.3	175.2	122.4	267.5	1127.4	8.8
Total forest land	17,728.7	4,987.2	4,543.5	5,430.4	32,689.8	.3
Cropland	644.2	145.8	462.3	418.1	1,670.4	5.5
Improved pasture	190.4	81.1	373.0	207.2	851.8	8.8
Idle farmland	230.6	54.6	98.2	76.1	459.4	12.5
Other farmland	20.5	6.7	45.2	37.6	110.0	25.8
Total farmland	1,085.7	288.2	978.8	739.0	3,091.7	3.5
Bog/marsh/swamp	179.3	46.1	21.9	177.7	425.1	12.9
Rights-of-way	274.0	63.7	157.8	395.2	890.7	8.8
Mining and waste land	47.4	5.9	20.7	34.4	108.5	25.1
Maintained recreation site	27.2	33.4	13.8	138.3	212.8	19.5
Industrial,commercial land	27.7	14.4	23.4	289.8	355.4	15.9
Multiple family housing	19.6	14.1	7.1	78.4	119.1	26.0
Single family housing	228.4	225.9	110.5	1,108.7	1,673.6	5.9
Other land	88.8	24.0	26.8	300.9	440.5	13.8
Noncensus water	127.5	52.7	30.4	48.9	259.4	16.7
Total nonfarm nonforest	1,020.0	480.2	412.4	2,572.3	4,484.9	2.8
Total land area	19,834.3	5,755.6	5,934.7	8,741.8	40,266.4	.0
SE	.0	.0	.0	.0	.0	

[a] Reserved and unproductive forest lands in this table have been adjusted to match published data for New Hampshire and Vermont. These acres do not contribute to the the estimates in the following tables.

Table 5.--Forest area by forest-type group and land class, New England, 1980-85

(In thousands of acres)

Forest-type group	Land class				All forest land	SE
	Timberland	Productive-reserved	Unproductive	Urban forest		
White pine	4,536.8	7.8	19.3	1.0	4,564.9	3.6
Spruce/fir	9,252.8	186.1	272.0	1.0	9,711.8	2.2
Hard pine	161.4	17.4	20.1	8.7	207.7	16.4
Oak/pine	1,141.2	.0	12.5	25.0	1,178.7	7.8
Oak/hickory	3,049.4	31.8	20.9	12.0	3,114.2	3.9
Oak/gum/cypress	15.1	.0	.0	.0	15.1	72.8
Elm/ash/red maple	896.5	19.2	94.0	.0	1,009.7	8.4
Northern hardwoods	10,473.3	48.5	36.9	10.4	10,569.1	2.2
Aspen/birch	2,035.8	41.5	4.5	9.7	2,091.6	6.2
All groups	31,562.4	352.4	480.1	67.9	32,462.8	.3
SE	.4	15.8	10.6	39.8	.3	

Table 6.--Forest area by forest-type group and stand-size class, New England, 1980-85

(In thousands of acres)

Forest-type group	Stand-size class				All classes	SE
	Saw-timber	Pole-timber	Sapling and seedling	Non-stocked		
White pine	3,160.4	961.2	443.3	.0	4,564.9	3.6
Spruce/fir	4,039.8	3,753.1	1,907.6	11.4	9,711.8	2.2
Hard pine	84.4	72.3	51.0	.0	207.7	16.4
Oak/pine	658.5	427.5	92.6	.0	1,178.7	7.8
Oak/hickory	1,294.1	1,437.5	379.8	2.9	3,114.2	3.9
Oak/gum/cypress	15.1	.0	.0	.0	15.1	72.8
Elm/ash/red maple	292.4	451.0	254.7	11.6	1,009.7	8.4
Northern hardwoods	5,155.5	3,842.5	1,556.5	14.6	10,569.1	2.2
Aspen/birch	246.4	1,103.9	741.3	.0	2,091.6	6.2
All groups	14,946.6	12,049.1	5,426.7	40.4	32,462.8	.3
SE	1.7	2.1	3.4	39.9	.3	

Table 7.--Number of all trees on forest land by expanded species and tree-size class, All forest-type groups, New England, 1980-85

(In thousands of trees)

Species	Tree-size class					All classes	SE
	Seedling/ saplings	Poletimber	Sawtimber	All 5.0"+	Dead 5.0"+		
Balsam fir	28,744,602	844,048	152,874	996,922	129,827	29,871,351	3.4
Atlantic white-cedar	0	148	27	175	0	175	86.2
Eastern redcedar	52,554	8,449	987	9,437	853	62,844	33.2
Larch (introduced)	0	59	0	59	0	59	100.0
Tamarack (native)	174,218	15,509	6,954	22,463	1,970	198,651	21.7
Norway spruce	9,655	1,043	28	1,071	0	10,727	84.8
White spruce	539,244	78,581	24,718	103,299	3,930	646,474	10.0
Black spruce	1,246,072	81,367	11,853	93,220	5,961	1,345,253	17.1
Red spruce	7,260,599	578,665	223,928	802,593	47,972	8,111,164	5.4
Jack pine	5,880	121	65	186	0	6,065	97.0
Red pine	36,118	3,897	8,918	12,814	254	49,187	27.8
Pitch pine	72,728	19,692	8,127	27,819	2,332	102,879	19.5
White pine	1,969,965	219,478	193,764	413,242	17,368	2,400,575	5.8
Scotch pine	23,694	2,451	1,813	4,264	942	28,901	88.9
Northern white-cedar	3,780,539	243,728	122,653	366,382	24,694	4,171,615	9.0
Eastern hemlock	2,862,474	239,481	143,695	383,177	8,593	3,254,244	6.1
All softwoods	46,778,342	2,336,720	900,404	3,237,124	244,697	50,260,163	2.7
Boxelder	10,160	451	40	491	0	10,651	91.1
Striped maple	10,664,046	37,094	131	37,225	3,310	10,704,580	4.6
Red maple	16,931,295	753,176	120,640	873,816	18,881	17,823,992	3.1
Silver maple	57,340	2,617	1,027	3,645	0	60,985	46.2
Sugar maple	17,433,551	304,760	99,952	404,713	6,033	17,844,297	5.0
Mountain maple	5,957,371	617	0	617	46	5,958,034	6.6
Tree-of-heaven	26,813	691	29	721	294	27,828	76.4
Serviceberry	890,228	1,323	0	1,323	36	891,588	15.2
Yellow birch	6,804,092	202,819	64,217	267,036	11,762	7,082,890	5.9
Sweet birch	879,233	52,205	8,754	60,959	1,949	942,141	11.2
Paper birch	5,050,699	343,037	34,198	377,235	15,138	5,443,072	5.5
Gray birch	1,728,095	52,491	515	53,007	7,941	1,789,043	9.1
American hornbeam	508,393	1,338	22	1,360	161	509,914	17.8
Hickory species	258,977	8,820	1,467	10,287	824	270,088	14.9
Bitternut hickory	12,419	2,047	132	2,179	0	14,598	42.3
Pignut hickory	40,996	6,417	1,589	8,006	429	49,431	32.8
Shagbark hickory	104,960	6,028	1,371	7,400	139	112,499	21.7
Mockernut hickory	6,910	928	44	972	0	7,882	53.7
American chestnut	260,089	158	0	158	0	260,247	16.6
Catalpa species	0	0	38	38	0	38	100.0
Hackberry	0	59	0	59	0	59	100.0
Flowering dogwood	215,065	718	0	718	123	215,906	26.3
Hawthorn species	168,745	180	0	180	0	168,925	19.4
Beech	8,155,672	220,699	57,408	278,107	7,428	8,441,207	4.7
White ash	3,950,106	90,300	22,528	112,829	3,810	4,066,745	6.2

Table 7.-continued

(In thousands of trees)

Species	Tree-size class					ALL classes	SE
	Seedling/ saplings	Poletimber	Sawtimber	All 5.0"+	Dead 5.0"+		
Black ash	747,504	31,762	4,041	35,803	4,843	788,150	12.4
Green ash	214,092	4,083	459	4,541	46	218,679	23.3
Honeylocust	0	0	62	62	0	62	100.0
Butternut	36,898	942	597	1,539	53	38,490	66.6
Black walnut	0	28	0	28	0	28	100.0
Tulip-poplar	5,023	479	1,085	1,564	0	6,587	36.1
Apple species	136,517	8,532	397	8,928	1,215	146,661	18.6
Red mulberry	0	44	0	44	0	44	100.0
Blackgum	105,333	2,694	509	3,204	40	108,577	24.6
Eastern hophornbeam	1,136,820	29,533	663	30,195	1,811	1,168,826	9.5
American sycamore	1,426	0	60	60	0	1,486	96.0
Balsam poplar	614,670	13,056	3,059	16,115	949	631,734	27.6
Eastern cottonwood	20,297	473	176	649	0	20,946	56.4
Bigtooth aspen	404,811	45,695	9,503	55,197	2,494	462,502	15.2
Quaking aspen	2,787,043	155,685	24,121	179,806	10,369	2,977,219	11.7
Prunus species	392,123	707	0	707	104	392,935	32.2
Pin cherry	2,254,269	6,800	58	6,857	1,323	2,262,450	10.3
Black cherry	3,234,241	40,836	7,195	48,031	3,382	3,285,655	7.0
Choke cherry	1,453,407	339	19	358	0	1,453,765	16.3
White oak	1,101,118	52,863	11,755	64,618	11,338	1,177,074	9.1
Swamp white oak	4,824	1,248	84	1,332	13	6,169	48.0
Scarlet oak	295,950	32,233	7,370	39,603	1,533	337,087	18.8
Bear oak	751,040	0	0	0	0	751,040	28.8
Swamp chestnut oak	0	0	28	28	0	28	100.0
Pin oak	0	262	122	385	15	400	41.0
Chestnut oak	136,266	8,249	1,756	10,005	1,318	147,589	25.6
Northern red oak	2,619,145	154,107	56,280	210,387	7,309	2,836,841	9.1
Post oak	0	70	0	70	0	70	100.0
Black oak	1,063,825	52,381	13,787	66,169	4,203	1,134,196	15.8
Black locust	47,477	1,243	527	1,770	154	49,401	78.4
Willow species	1,018,703	1,325	73	1,399	177	1,020,279	17.4
Black willow	10,157	114	205	319	0	10,476	61.7
Sassafras	379,016	2,179	199	2,378	53	381,447	14.0
American mountain-ash	411,654	3,114	152	3,266	667	415,587	18.7
European mountain-ash	1,603	0	0	0	0	1,603	100.0
Basswood species	51,451	976	581	1,557	0	53,009	26.2
American basswood	131,847	6,425	1,839	8,264	279	140,391	22.5
Elm species	38,969	757	153	910	501	40,380	33.1
American elm	278,493	11,271	2,469	13,740	2,540	294,773	21.8
Slippery elm	60,368	678	221	899	263	61,530	35.7
Unknown	567,433	1,655	504	2,160	233	569,826	17.4
All hardwoods	102,629,072	2,761,816	564,216	3,326,032	135,533	106,090,636	1.8
All species	149,407,413	5,098,536	1,464,620	6,563,156	380,229	156,350,798	1.4
SE	1.5	.9	1.1	.8	2.7	1.4	

Table 8.--Number of all trees on forest land by expanded species and tree-size class, White pine forest-type group, New England, 1980-85

(In thousands of trees)

Species	Tree-size class					All classes	SE
	Seedling/ saplings	Poletimber	Sawtimber	All 5.0"+	Dead 5.0"+		
Balsam fir	2,292,621	43,928	6,596	50,524	8,354	2,351,499	11.7
Eastern redcedar	2,139	766	68	833	109	3,081	70.6
Tamarack (native)	0	763	386	1,149	852	2,001	39.3
White spruce	31,112	2,511	1,351	3,861	547	35,521	41.3
Black spruce	1,960	905	64	969	0	2,929	69.2
Red spruce	362,630	35,711	14,162	49,872	3,193	415,696	15.6
Jack pine	5,880	121	65	186	0	6,065	97.0
Red pine	22,099	3,185	6,638	9,823	64	31,986	39.4
Pitch pine	0	3,179	2,045	5,223	800	6,023	31.1
White pine	869,575	136,705	133,535	270,240	9,420	1,149,235	9.6
Scotch pine	23,694	2,412	1,751	4,163	942	28,800	89.2
Northern white-cedar	81,967	8,979	2,360	11,340	569	93,877	26.0
Eastern hemlock	1,307,638	106,581	73,639	180,219	2,842	1,490,699	9.6
All softwoods	5,001,316	345,745	242,659	588,404	27,693	5,617,413	7.6
Striped maple	418,783	313	0	313	0	419,096	19.1
Red maple	2,586,837	111,863	15,176	127,039	2,483	2,716,359	9.5
Silver maple	4,171	0	0	0	0	4,171	70.8
Sugar maple	1,104,149	12,004	2,727	14,730	391	1,119,271	18.0
Mountain maple	163,993	0	0	0	0	163,993	51.5
Serviceberry	151,331	0	0	0	0	151,331	31.2
Yellow birch	595,744	13,999	2,161	16,160	470	612,373	28.0
Sweet birch	159,308	8,091	1,421	9,512	334	169,154	30.8
Paper birch	508,575	31,166	3,298	34,464	1,063	544,102	15.9
Gray birch	345,247	15,756	69	15,825	2,233	363,306	14.6
American hornbeam	89,345	558	0	558	0	89,904	31.7
Hickory species	23,685	600	56	655	25	24,366	54.2
Bitternut hickory	4,291	0	17	17	0	4,309	72.8
Pignut hickory	2,620	0	39	39	0	2,659	98.5
Shagbark hickory	22,198	180	21	201	0	22,399	38.0
Mockernut hickory	0	34	0	34	0	34	100.0
American chestnut	33,678	0	0	0	0	33,678	41.1
Flowering dogwood	28,975	0	0	0	0	28,975	62.1
Hawthorn species	45,553	87	0	87	0	45,641	34.6
Beech	466,284	13,226	2,965	16,191	626	483,101	13.7
White ash	719,454	8,067	2,069	10,136	156	729,747	17.4
Black ash	37,980	1,667	182	1,850	74	39,903	58.9
Green ash	100,731	1,491	198	1,689	0	102,420	42.3
Butternut	1,442	0	38	38	0	1,481	97.4
Tulip-poplar	0	0	110	110	0	110	86.5

Table 8.-continued

(In thousands of trees)

Species	Tree-size class					All classes	SE
	Seedling/ saplings	Poletimber	Sawtimber	All 5.0"+	Dead 5.0"+		
Apple species	20,258	1,709	140	1,849	429	22,537	48.6
Blackgum	5,539	151	0	151	0	5,690	49.4
Eastern hophornbeam	138,511	4,111	40	4,151	375	143,037	19.5
American sycamore	0	0	25	25	0	25	100.0
Balsam poplar	1,474	550	199	749	33	2,256	68.6
Bigtooth aspen	77,192	5,225	996	6,221	230	83,643	29.7
Quaking aspen	320,428	15,454	1,356	16,810	433	337,672	17.9
Prunus species	13,957	0	0	0	0	13,957	53.5
Pin cherry	273,483	673	41	714	151	274,348	21.4
Black cherry	497,999	8,106	1,185	9,291	201	507,492	13.3
Choke cherry	151,074	66	0	66	0	151,140	24.7
White oak	158,701	6,820	1,398	8,218	825	167,744	23.0
Swamp white oak	1,490	0	0	0	0	1,490	100.0
Scarlet oak	37,979	3,041	663	3,704	9	41,692	53.2
Bear oak	14,192	0	0	0	0	14,192	58.4
Pin oak	0	65	0	65	0	65	100.0
Chestnut oak	16,716	654	92	746	99	17,561	65.2
Northern red oak	642,251	19,625	6,151	25,776	407	668,434	12.1
Black oak	130,291	6,755	1,748	8,503	140	138,935	22.7
Black locust	0	247	0	247	0	247	100.0
Willow species	95,845	0	28	28	0	95,873	39.8
Black willow	0	114	19	133	0	133	100.0
Sassafras	8,128	0	0	0	0	8,128	62.4
American mountain-ash	11,840	55	0	55	0	11,895	82.0
Basswood species	8,045	134	29	163	0	8,208	58.6
American basswood	0	388	257	645	19	664	46.0
Elm species	9,352	165	27	191	0	9,543	59.3
American elm	55,964	2,415	538	2,954	144	59,062	31.8
Slippery elm	8,459	0	53	53	0	8,512	99.4
Unknown	131,171	352	43	395	0	131,567	45.6
All hardwoods	10,444,717	295,979	45,577	341,556	11,351	10,797,625	6.0
All species	15,446,033	641,724	288,237	929,960	39,044	16,415,038	5.3
SE	5.5	4.3	4.1	4.0	10.2	5.3	

Table 9.--Number of all trees on forest land by expanded species and tree-size class, Spruce/fir forest-type group, New England, 1980-85

(In thousands of trees)

Species	Tree-size class					All classes	SE
	Seedling/ saplings	Poletimber	Sawtimber	All 5.0"+	Dead 5.0"+		
Balsam fir	18,619,939	631,162	111,179	742,340	100,134	19,462,413	5.0
Eastern redcedar	2,853	274	0	274	0	3,127	91.7
Larch (introduced)	0	59	0	59	0	59	100.0
Tamarack (native)	159,582	13,050	5,371	18,421	856	178,860	23.9
Norway spruce	8,034	1,043	28	1,071	0	9,105	98.3
White spruce	373,879	61,744	20,240	81,985	2,555	458,418	12.3
Black spruce	1,203,468	78,056	11,603	89,659	5,360	1,298,486	17.7
Red spruce	5,137,699	431,680	168,350	600,030	29,101	5,766,830	7.4
Red pine	3,941	148	492	641	82	4,664	60.6
Pitch pine	0	0	14	14	0	14	100.0
White pine	128,763	11,681	12,433	24,114	629	153,506	15.8
Scotch pine	0	0	15	15	0	15	100.0
Northern white-cedar	3,260,234	212,247	113,222	325,469	21,989	3,607,692	10.2
Eastern hemlock	464,276	33,221	17,717	50,938	621	515,835	20.5
All softwoods	29,362,668	1,474,366	460,664	1,935,030	161,326	31,459,024	4.3
Boxelder	0	33	0	33	0	33	100.0
Striped maple	1,750,586	5,507	74	5,580	339	1,756,506	11.2
Red maple	4,972,600	108,698	15,023	123,721	2,494	5,098,816	6.4
Silver maple	29,367	0	37	37	0	29,405	89.1
Sugar maple	1,617,069	16,005	5,846	21,852	396	1,639,317	17.8
Mountain maple	2,412,314	261	0	261	0	2,412,575	10.9
Tree-of-heaven	6,294	0	0	0	0	6,294	73.8
Serviceberry	57,806	0	0	0	0	57,806	27.1
Yellow birch	2,086,701	44,612	12,544	57,156	2,093	2,145,951	8.8
Sweet birch	0	164	32	197	0	197	85.2
Paper birch	1,962,163	109,927	9,027	118,954	6,324	2,087,442	9.5
Gray birch	189,847	9,944	178	10,122	895	200,865	19.1
American hornbeam	640	44	0	44	0	684	100.0
Hawthorn species	15,573	0	0	0	0	15,573	80.7
Beech	246,597	6,352	1,403	7,755	544	254,896	16.7
White ash	246,967	5,414	691	6,105	227	253,300	20.3
Black ash	425,809	16,093	1,610	17,703	3,948	447,461	17.1
Green ash	27,849	118	0	118	0	27,967	44.0
Butternut	25,109	0	36	36	0	25,145	99.9
Apple species	15,123	1,140	60	1,200	34	16,357	68.0
Eastern hophornbeam	45,189	1,631	145	1,776	0	46,965	45.3
Balsam poplar	295,083	3,775	959	4,735	50	299,867	40.8
Eastern cottonwood	0	65	33	98	0	98	100.0
Bigtooth aspen	74,491	3,997	1,671	5,669	332	80,491	41.9
Quaking aspen	460,489	34,061	7,447	41,508	3,326	505,322	14.7

Table 9.-continued

(In thousands of trees)

Species	Tree-size class					All classes	SE
	Seedling/ saplings	Poletimber	Sawtimber	All 5.0"+	Dead 5.0"+		
Prunus species	220,820	447	0	447	0	221,267	51.8
Pin cherry	476,425	1,263	0	1,263	420	478,107	17.2
Black cherry	317,731	3,696	116	3,811	109	321,652	27.7
Choke cherry	226,669	202	0	202	0	226,871	33.2
White oak	1,107	0	0	0	0	1,107	100.0
Northern red oak	21,961	722	287	1,009	0	22,970	29.8
Black oak	1,107	274	0	274	0	1,381	100.0
Willow species	246,403	964	0	964	177	247,544	20.8
Black willow	2,198	0	0	0	0	2,198	100.0
American mountain-ash	287,145	1,473	75	1,548	667	289,360	24.8
American basswood	21,765	489	14	503	33	22,301	82.4
Elm species	6,436	0	0	0	0	6,436	100.0
American elm	17,165	458	263	721	203	18,089	42.7
Slippery elm	19,271	108	48	157	0	19,427	78.3
Unknown	205,744	330	95	425	0	206,169	30.7
All hardwoods	19,035,616	378,270	57,715	435,986	22,613	19,494,214	4.5
All species	48,398,283	1,852,636	518,379	2,371,016	183,939	50,953,238	3.6
SE	3.7	2.8	3.0	2.6	4.7	3.6	

Table 10.--Number of all trees on forest land by expanded species and tree-size class, Oak/hickory forest-type group, New England, 1980-85

(In thousands of trees)

Species	Tree-size class					All classes	SE
	Seedling/ saplings	Poletimber	Sawtimber	All 5.0"+	Dead 5.0"+		
Balsam fir	134,156	2,908	428	3,337	375	137,868	33.8
Eastern redcedar	8,004	1,083	113	1,195	239	9,439	56.0
Tamarack (native)	4,314	0	46	46	189	4,551	95.0
Norway spruce	1,622	0	0	0	0	1,622	100.0
White spruce	1,652	28	33	62	28	1,743	98.1
Red spruce	23,761	2,398	859	3,257	106	27,125	30.9
Red pine	1,585	0	303	303	62	1,949	58.7
Pitch pine	21,587	639	292	931	65	22,583	40.6
White pine	269,234	16,337	6,428	22,765	1,727	293,726	12.6
Scotch pine	0	0	17	17	0	17	100.0
Northern white-cedar	16,514	49	74	123	0	16,638	70.5
Eastern hemlock	72,447	11,388	5,333	16,721	1,441	90,610	18.5
All softwoods	554,877	34,831	13,927	48,759	4,234	607,870	12.3
Boxelder	10,160	224	40	264	0	10,424	93.0
Striped maple	192,356	203	0	203	0	192,559	25.8
Red maple	1,958,446	89,320	10,329	99,648	2,716	2,060,811	8.0
Sugar maple	515,916	10,068	1,382	11,450	581	527,948	19.0
Mountain maple	19,812	0	0	0	0	19,812	40.8
Tree-of-heaven	20,519	619	29	649	294	21,461	96.7
Serviceberry	266,852	63	0	63	36	266,952	33.3
Yellow birch	237,663	5,252	954	6,206	501	244,369	21.1
Sweet birch	397,458	17,080	2,585	19,665	760	417,883	17.6
Paper birch	290,544	12,899	963	13,862	1,178	305,584	24.1
Gray birch	254,276	1,544	14	1,559	539	256,373	23.9
American hornbeam	247,188	30	0	30	0	247,218	28.9
Hickory species	124,930	4,863	890	5,753	632	131,315	18.6
Bitternut hickory	3,948	1,234	66	1,300	0	5,248	79.5
Pignut hickory	27,280	4,541	1,174	5,715	429	33,424	44.6
Shagbark hickory	51,752	3,787	880	4,667	139	56,558	32.6
Mockernut hickory	2,760	554	44	597	0	3,357	83.2
American chestnut	204,085	158	0	158	0	204,243	19.2
Catalpa species	0	0	38	38	0	38	100.0
Hackberry	0	59	0	59	0	59	100.0
Flowering dogwood	111,798	573	0	573	123	112,495	35.3
Hawthorn species	23,999	93	0	93	0	24,091	40.7
Beech	477,952	15,431	2,578	18,009	155	496,117	19.0
White ash	398,111	9,214	1,563	10,777	592	409,479	15.7
Black ash	47,374	653	47	700	26	48,100	53.8
Green ash	4,382	148	0	148	0	4,530	62.8
Butternut	1,203	205	214	419	0	1,621	76.0

Table 10.-continued

(In thousands of trees)

Species	Tree-size class					All classes	SE
	Seedling/ saplings	Poletimber	Sawtimber	All 5.0"+	Dead 5.0"+		
Tulip-poplar	2,586	419	903	1,322	0	3,908	41.7
Apple species	29,889	1,495	35	1,531	77	31,497	41.0
Blackgum	51,643	1,534	233	1,767	0	53,409	31.9
Eastern hophornbeam	335,562	3,447	91	3,538	31	339,130	21.0
American sycamore	1,426	0	0	0	0	1,426	100.0
Balsam poplar	0	0	137	137	0	137	72.9
Eastern cottonwood	0	0	9	9	0	9	100.0
Bigtooth aspen	49,331	3,439	566	4,005	385	53,721	32.9
Quaking aspen	61,094	3,632	172	3,804	629	65,527	23.7
Prunus species	8,545	0	0	0	0	8,545	100.0
Pin cherry	70,962	187	0	187	0	71,150	32.7
Black cherry	666,700	2,495	257	2,753	346	669,799	14.3
Choke cherry	325,696	38	19	57	0	325,753	41.6
White oak	621,877	34,011	8,365	42,375	9,163	673,415	10.9
Swamp white oak	1,413	248	27	275	0	1,688	84.5
Scarlet oak	200,288	25,205	6,173	31,378	1,447	233,114	23.3
Bear oak	382,877	0	0	0	0	382,877	41.1
Pin oak	0	198	122	320	0	320	46.9
Chestnut oak	105,924	7,416	1,582	8,998	1,140	116,062	30.6
Northern red oak	688,753	83,197	33,970	117,167	5,755	811,676	11.2
Black oak	608,251	34,825	10,186	45,010	3,554	656,816	19.2
Black locust	3,108	461	306	768	154	4,030	100.0
Willow species	2,620	0	0	0	0	2,620	100.0
Sassafras	283,364	1,737	90	1,827	53	285,243	16.2
American mountain-ash	6,613	0	0	0	0	6,613	70.9
Basswood species	1,451	45	28	74	0	1,525	95.2
American basswood	16,361	594	39	632	98	17,091	75.6
Elm species	1,137	0	0	0	78	1,215	93.8
American elm	22,706	795	247	1,041	256	24,003	35.4
Slippery elm	5,668	0	0	0	20	5,688	54.5
Unknown	36,820	587	0	587	43	37,450	47.1
All hardwoods	10,483,433	384,820	87,347	472,167	31,930	10,987,530	5.7
All species	11,038,310	419,652	101,274	520,926	36,164	11,595,400	5.6
SE	5.8	4.8	5.0	4.5	8.1	5.6	

Table 11.--Number of all trees on forest land by expanded species and tree-size class, Northern hardwoods forest-type group, New England, 1980-85

(In thousands of trees)

Species	Tree-size class					All classes	SE
	Seedling/ saplings	Poletimber	Sawtimber	All 5.0"+	Dead 5.0"+		
Balsam fir	5,295,653	120,678	30,391	151,070	15,644	5,462,367	7.3
Atlantic white-cedar	0	148	27	175	0	175	86.2
Eastern redcedar	4,284	651	50	701	0	4,985	49.4
Tamarack (native)	2,320	724	606	1,331	72	3,723	66.3
White spruce	73,136	8,407	1,579	9,986	488	83,610	19.6
Black spruce	21,165	1,151	186	1,336	117	22,618	53.5
Red spruce	1,427,999	87,337	35,237	122,574	11,085	1,561,659	7.4
Red pine	0	161	401	563	0	563	57.9
Pitch pine	0	90	88	178	67	245	66.0
White pine	314,100	20,381	15,409	35,790	3,438	353,328	17.8
Scotch pine	0	39	29	69	0	69	100.0
Northern white-cedar	199,551	11,134	4,481	15,616	1,071	216,239	28.4
Eastern hemlock	752,762	69,741	38,407	108,147	2,186	863,096	10.7
All softwoods	8,090,971	320,644	126,892	447,536	34,170	8,572,677	5.8
Striped maple	7,307,435	29,779	57	29,836	2,971	7,340,242	5.9
Red maple	4,798,945	302,468	59,055	361,523	5,610	5,166,078	6.4
Sugar maple	13,407,557	251,417	87,433	338,851	4,590	13,750,998	6.0
Mountain maple	2,690,308	355	0	355	46	2,690,709	10.0
Tree-of-heaven	0	72	0	72	0	72	100.0
Serviceberry	182,527	858	0	858	0	183,385	25.3
Yellow birch	3,640,823	126,434	46,517	172,950	7,900	3,821,673	8.9
Sweet birch	191,649	22,910	4,302	27,212	690	219,552	19.7
Paper birch	1,420,914	85,887	12,872	98,759	4,321	1,523,994	12.0
Gray birch	150,046	11,328	93	11,421	2,373	163,839	19.8
American hornbeam	78,870	502	22	524	161	79,555	25.9
Hickory species	38,957	2,413	427	2,840	168	41,965	33.5
Bitternut hickory	2,819	813	33	846	0	3,665	82.5
Pignut hickory	5,958	307	66	373	0	6,332	70.0
Shagbark hickory	26,493	1,684	384	2,068	0	28,561	48.0
Mockernut hickory	4,150	341	0	341	0	4,491	70.9
American chestnut	11,892	0	0	0	0	11,892	54.6
Flowering dogwood	25,855	145	0	145	0	26,001	63.9
Hawthorn species	69,068	0	0	0	0	69,068	34.0
Beech	6,544,621	175,689	49,307	224,996	6,104	6,775,721	5.6
White ash	1,635,676	51,196	15,753	66,949	2,335	1,704,960	8.2
Black ash	92,411	4,740	1,153	5,893	103	98,408	23.0
Green ash	27,917	589	190	779	46	28,742	45.7
Honeylocust	0	0	62	62	0	62	100.0
Apple species	30,261	2,359	81	2,439	635	33,336	38.0

Table 11.-continued

(In thousands of trees)

Species	Tree-size class					All classes	SE
	Seedling/ saplings	Poletimber	Sawtimber	All 5.0"+	Dead 5.0"+		
Butternut	9,144	519	224	744	36	9,924	48.7
Black walnut	0	28	0	28	0	28	100.0
Tulip-poplar	2,437	35	72	107	0	2,544	68.4
Blackgum	11,399	169	0	169	40	11,608	64.5
Eastern hophornbeam	509,500	18,364	387	18,751	1,238	529,490	14.1
American sycamore	0	0	35	35	0	35	100.0
Balsam poplar	107,777	227	95	321	93	108,191	50.5
Eastern cottonwood	13,363	0	17	17	0	13,380	78.3
Bigtooth aspen	119,519	6,359	2,661	9,020	328	128,867	38.4
Quaking aspen	731,921	20,528	4,205	24,733	1,727	758,382	32.9
Prunus species	56,405	49	0	49	0	56,454	49.5
Pin cherry	1,065,772	3,976	17	3,993	752	1,070,517	17.5
Black cherry	1,093,996	20,493	5,145	25,638	1,951	1,121,585	14.0
Choke cherry	413,377	33	0	33	0	413,410	37.8
White oak	75,661	2,563	452	3,015	493	79,168	40.4
Scarlet oak	0	171	69	240	0	240	86.0
Chestnut oak	12,700	132	82	214	0	12,914	52.8
Northern red oak	493,157	18,897	7,839	26,737	513	520,407	21.4
Black oak	26,057	1,053	440	1,494	383	27,934	38.3
Black locust	44,369	534	221	755	0	45,124	85.4
Willow species	91,689	0	2	2	0	91,691	38.6
Sassafras	35,040	154	38	193	0	35,233	54.2
American mountain-ash	76,684	927	77	1,004	0	77,689	31.7
Basswood species	26,536	688	404	1,091	0	27,627	35.4
American basswood	86,163	4,563	1,426	5,989	84	92,237	23.8
Elm species	7,902	47	0	47	0	7,949	58.4
American elm	71,661	2,905	538	3,443	780	75,884	64.4
Slippery elm	21,447	382	55	437	0	21,884	62.6
Unknown	117,128	72	337	409	125	117,661	31.1
All hardwoods	47,705,956	1,176,158	302,648	1,478,806	46,597	49,231,359	3.5
All species	55,796,927	1,496,802	429,540	1,926,342	80,767	57,804,036	3.3
SE	3.3	2.7	2.7	2.5	5.6	3.3	

Table 12.--Number of all trees on forest land by expanded species and tree-size class, Other forest-type groups, New England, 1980-85

(In thousands of trees)

Species	Tree-size class					All classes	SE
	Seedling/ saplings	Poletimber	Sawtimber	All 5.0"+	Dead 5.0"+		
Balsam fir	2,402,232	45,372	4,279	49,651	5,319	2,457,203	10.4
Eastern redcedar	35,274	5,676	757	6,433	505	42,212	46.8
Tamarack (native)	8,001	971	544	1,516	0	9,516	45.5
White spruce	59,465	5,891	1,515	7,405	312	67,182	36.4
Black spruce	19,478	1,256	0	1,256	484	21,219	58.6
Red spruce	308,509	21,539	5,320	26,860	4,486	339,855	15.1
Red pine	8,494	401	1,083	1,485	46	10,025	44.1
Pitch pine	51,140	15,784	5,688	21,472	1,400	74,013	25.6
White pine	388,293	34,374	25,959	60,333	2,154	450,780	12.6
Northern white-cedar	222,272	11,317	2,515	13,833	1,065	237,169	30.1
Eastern hemlock	265,351	18,551	8,600	27,151	1,503	294,004	15.9
All softwoods	3,768,510	161,133	56,262	217,394	17,273	4,003,178	8.4
Boxelder	0	194	0	194	0	194	100.0
Striped maple	994,886	1,291	0	1,291	0	996,177	19.0
Red maple	2,614,466	140,828	21,056	161,884	5,577	2,781,928	7.9
Silver maple	23,802	2,617	990	3,607	0	27,410	36.4
Sugar maple	788,859	15,266	2,563	17,829	75	806,763	14.4
Mountain maple	670,944	0	0	0	0	670,944	21.6
Serviceberry	231,712	401	0	401	0	232,113	34.6
Yellow birch	243,161	12,522	2,042	14,564	798	258,523	17.1
Sweet birch	130,818	3,959	413	4,373	165	135,355	30.2
Paper birch	868,502	103,157	8,038	111,195	2,252	981,949	11.8
Gray birch	788,678	13,918	162	14,080	1,901	804,660	16.7
American hornbeam	92,349	204	0	204	0	92,553	48.9
Hickory species	71,404	944	95	1,039	0	72,443	37.2
Bitternut hickory	1,360	0	16	16	0	1,376	98.8
Pignut hickory	5,137	1,569	309	1,878	0	7,016	58.5
Shagbark hickory	4,517	377	87	464	0	4,981	52.8
American chestnut	10,433	0	0	0	0	10,433	100.0
Flowering dogwood	48,436	0	0	0	0	48,436	75.3
Hawthorn species	14,552	0	0	0	0	14,552	33.5
Beech	420,217	10,001	1,154	11,155	0	431,372	17.5
White ash	949,899	16,408	2,453	18,861	500	969,259	16.5
Black ash	143,930	8,609	1,048	9,657	692	154,279	29.9
Green ash	53,212	1,736	71	1,807	0	55,019	39.5
Butternut	0	217	84	301	17	319	69.1
Tulip-poplar	0	25	0	25	0	25	100.0
Apple species	40,986	1,829	80	1,909	39	42,934	32.7
Red mulberry	0	44	0	44	0	44	100.0
Blackgum	36,752	840	277	1,117	0	37,870	53.2

Table 12.-continued

(In thousands of trees)

Species	Tree-size class					All classes	SE
	Seedling/ saplings	Poletimber	Sawtimber	All 5.0"+	Dead 5.0"+		
Eastern hophornbeam	108,058	1,979	0	1,979	167	110,204	24.7
Balsam poplar	210,337	8,504	1,669	10,173	774	221,284	50.8
Eastern cottonwood	6,934	408	117	526	0	7,460	73.3
Bigtooth aspen	84,278	26,675	3,608	30,282	1,220	115,780	18.7
Quaking aspen	1,213,112	82,010	10,941	92,950	4,254	1,310,316	17.6
Prunus species	92,397	211	0	211	104	92,712	48.0
Pin cherry	367,627	700	0	700	0	368,327	27.2
Black cherry	657,815	6,046	491	6,538	775	665,127	13.8
Choke cherry	336,590	0	0	0	0	336,590	24.6
White oak	243,771	9,469	1,540	11,010	857	255,638	25.2
Swamp white oak	1,921	999	57	1,056	13	2,991	71.7
Scarlet oak	57,683	3,815	465	4,281	77	62,041	42.0
Bear oak	353,970	0	0	0	0	353,970	43.3
Swamp chestnut oak	0	0	28	28	0	28	100.0
Pin oak	0	0	0	0	15	15	100.0
Chestnut oak	926	48	0	48	78	1,052	88.5
Northern red oak	773,022	31,665	8,033	39,698	634	813,355	25.3
Post oak	0	70	0	70	0	70	100.0
Black oak	298,118	9,474	1,413	10,887	125	309,131	41.6
Willow species	582,147	362	43	405	0	582,552	28.0
Black willow	7,958	0	187	187	0	8,145	74.6
Sassafras	52,485	288	70	359	0	52,843	38.7
American mountain-ash	29,371	659	0	659	0	30,030	46.6
European mountain-ash	1,603	0	0	0	0	1,603	100.0
Basswood species	15,419	109	120	229	0	15,648	54.2
American basswood	7,558	390	104	494	45	8,098	45.4
Elm species	14,142	545	126	671	423	15,236	60.7
American elm	110,997	4,699	883	5,581	1,157	117,736	30.7
Slippery elm	5,524	188	65	253	243	6,019	75.6
Unknown	76,570	314	29	343	65	76,979	35.3
All hardwoods	14,959,350	526,589	70,927	597,517	23,042	15,579,908	5.6
All species	18,727,860	687,722	127,189	814,911	40,315	19,583,086	5.3
SE	5.4	4.9	5.5	4.7	9.1	5.3	

Table 13.--Number of all live trees on forest land by species and diameter class, All forest-type groups, New England, 1980-85

(In thousands of trees)

Species	Diameter class (inches at breast height)									
	Seedlings	1.0-2.9	3.0-4.9	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9
Balsam fir	24,887,512	2,803,461	1,053,629	561,452	282,596	109,771	33,416	7,579	1,784	262
Tamarack	128,205	24,219	21,793	10,957	4,612	3,510	1,871	813	354	322
White spruce	359,744	85,680	93,821	50,228	28,353	14,784	6,328	2,308	739	334
Black spruce	1,010,646	142,707	92,719	59,471	21,896	8,776	1,970	940	114	24
Red spruce	6,084,644	751,173	424,782	352,041	226,624	121,432	59,039	26,794	9,773	4,266
Red pine	22,031	6,270	7,817	1,932	1,964	3,179	3,058	1,480	788	277
Pitch pine	36,833	20,982	14,913	11,344	8,348	4,262	2,221	1,045	318	155
White pine	1,406,861	399,939	163,164	131,446	88,031	62,999	47,367	30,413	21,036	13,048
Northern white-cedar	3,285,365	290,278	204,896	140,896	102,832	58,818	35,137	16,467	7,572	2,349
Hemlock	2,261,510	388,800	212,164	143,479	96,002	59,229	40,917	21,751	11,704	5,066
Other softwoods	47,248	33,687	10,848	7,677	4,536	1,986	789	105	39	0
Total all softwoods	39,530,597	4,947,198	2,300,547	1,470,924	865,796	448,747	232,113	109,695	54,221	26,103
Red maple	14,624,177	1,677,442	629,675	388,245	238,939	125,992	64,115	28,824	13,649	7,277
Sugar maple	16,406,670	784,149	242,732	139,354	103,514	61,892	40,116	24,344	13,340	8,326
Yellow birch	6,214,111	440,365	149,615	89,699	67,033	46,086	27,205	15,469	9,331	5,068
Sweet birch	741,669	89,618	47,946	25,986	17,923	8,296	4,759	2,166	1,289	416
Paper birch	4,312,318	474,182	264,198	175,769	111,354	55,913	21,130	8,244	2,852	1,136
Gray birch	1,303,334	280,637	144,124	44,297	7,115	1,079	336	106	64	9
Hickory	357,535	48,896	17,831	12,019	7,549	4,673	2,389	1,429	382	286
Beech	7,055,785	876,859	223,028	113,443	66,307	40,948	25,103	15,529	8,744	4,497
White ash	3,717,973	157,057	75,076	40,917	31,632	17,751	10,341	6,181	3,242	1,434
Black ash	642,800	72,773	31,931	17,836	9,392	4,534	2,345	1,057	349	155
Aspen	3,451,656	241,459	133,707	96,754	72,428	45,726	21,473	9,772	3,335	1,295
Black cherry	3,132,116	69,458	32,667	20,588	12,319	7,929	4,067	1,590	962	342
White oaks	1,127,867	57,169	57,173	32,374	18,839	11,218	6,412	3,147	2,025	897
Northern red oak	2,392,617	154,317	72,211	65,907	52,834	35,366	25,095	13,647	8,895	4,553
Other red oaks	2,013,475	60,750	36,590	37,447	29,086	18,344	10,130	6,005	2,373	1,171
Elm	316,395	47,193	14,243	6,079	4,517	2,109	1,168	838	331	280
Other hardwoods	25,670,593	1,177,362	265,546	82,978	24,770	8,712	3,769	2,248	1,370	987
Total all hardwoods	93,481,092	6,709,685	2,438,294	1,389,692	875,553	496,571	269,952	140,598	72,533	38,132
All species	133,011,689	11,656,883	4,738,840	2,860,616	1,741,349	945,318	502,065	250,294	126,754	64,235
SE	1.6	2.1	2.4	1.2	1.1	1.2	1.3	1.5	2.0	2.6

Table 13.-continued

(In thousands of trees)

Species	Diameter class (inches at breast height)					
	19.0-20.9	21.0-28.9	29.0+	Total 5.0+	All classes	SE
Balsam fir	46	16	0	996,922	29,741,524	3.4
Tamarack	59	26	0	22,522	196,740	21.9
White spruce	162	63	0	103,299	642,544	10.0
Black spruce	28	0	0	93,220	1,339,292	17.1
Red spruce	1,553	1,055	17	802,593	8,063,192	5.4
Red pine	104	32	0	12,814	48,933	27.9
Pitch pine	91	35	0	27,819	100,547	19.9
White pine	7,565	9,707	1,629	413,242	2,383,207	5.8
Northern white-cedar	1,299	975	37	366,382	4,146,921	9.1
Hemlock	2,429	2,497	101	383,177	3,245,651	6.1
Other softwoods	0	0	1	15,133	106,916	32.6
Total all softwoods	13,336	14,405	1,785	3,237,124	50,015,466	2.7
Red maple	3,133	3,186	456	873,816	17,805,111	3.1
Sugar maple	5,735	6,670	1,421	404,713	17,838,264	5.0
Yellow birch	2,729	4,052	363	267,036	7,071,128	5.9
Sweet birch	64	58	0	60,959	940,192	11.3
Paper birch	571	258	8	377,235	5,427,933	5.5
Gray birch	0	0	0	53,007	1,781,102	9.1
Hickory	109	0	8	28,845	453,106	10.9
Beech	1,831	1,666	38	278,107	8,433,779	4.7
White ash	497	712	121	112,829	4,062,935	6.2
Black ash	92	41	0	35,803	783,307	12.4
Aspen	620	328	37	251,768	4,078,589	10.0
Black cherry	183	50	0	48,031	3,282,273	7.0
White oaks	557	492	93	76,054	1,318,262	8.6
Northern red oak	1,669	2,138	284	210,387	2,829,532	9.1
Other red oaks	668	907	25	106,157	2,216,971	13.8
Elm	55	129	41	15,549	393,380	17.5
Other hardwoods	360	476	67	125,738	27,239,238	2.9
Total all hardwoods	18,874	21,163	2,963	3,326,032	105,955,103	1.8
All species	32,210	35,568	4,747	6,563,156	155,970,568	1.4
SE	3.4	3.3	7.8	.8	1.4	

Table 14.--Number of all live trees on forest land by species and diameter class, White pine forest-type group, New England, 1980-85

(In thousands of trees)

Species	Diameter class (inches at breast height)									
	Seedlings	1.0-2.9	3.0-4.9	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9
Balsam fir	2,006,958	214,979	70,684	30,964	12,964	5,060	1,314	221	0	0
Tamarack	0	0	0	672	91	192	100	23	36	35
White spruce	25,093	6,020	0	1,643	867	667	357	257	36	0
Black spruce	1,960	0	0	636	269	17	31	17	0	0
Red spruce	299,927	43,464	19,238	22,083	13,627	7,905	4,069	1,422	486	180
Red pine	14,283	1,489	6,327	1,456	1,729	2,372	2,242	1,046	666	199
Pitch pine	0	0	0	1,774	1,405	1,193	632	115	41	23
White pine	567,551	204,720	97,303	79,375	57,331	42,780	32,779	21,780	14,672	8,717
Northern white-cedar	62,274	12,660	7,033	4,940	4,039	1,184	903	193	79	0
Hemlock	1,041,170	168,309	98,159	60,177	46,404	29,211	20,242	11,994	6,440	2,972
Other softwoods	14,597	17,116	0	1,445	1,853	1,251	577	55	0	0
Total all softwoods	4,033,813	668,758	298,744	205,167	140,579	91,833	63,246	37,124	22,455	12,125
Red maple	2,226,678	261,331	98,828	62,959	33,077	15,827	9,025	3,336	1,301	770
Sugar maple	1,026,853	58,369	18,927	4,774	4,363	2,867	733	1,067	373	212
Yellow birch	552,956	33,787	9,000	7,297	4,039	2,662	955	658	324	131
Sweet birch	128,370	22,705	8,233	4,540	2,165	1,385	807	322	207	63
Paper birch	447,289	40,600	20,686	15,936	9,334	5,895	1,739	1,130	277	57
Gray birch	249,665	60,876	34,706	13,499	2,135	122	47	0	12	9
Hickory	44,280	7,034	1,481	543	271	0	20	75	0	21
Beech	392,826	60,429	13,029	6,035	5,429	1,762	1,531	713	382	168
White ash	682,526	28,136	8,793	4,446	2,403	1,218	688	791	326	97
Black ash	29,192	4,763	4,024	1,212	389	66	114	33	20	0
Aspen	351,476	25,341	22,277	10,179	6,647	4,401	1,257	859	234	128
Black cherry	470,769	17,858	9,373	3,606	2,633	1,866	855	151	139	22
White oaks	162,111	7,393	7,403	4,373	1,987	1,114	577	365	358	51
Northern red oak	590,194	38,902	13,156	10,309	6,748	2,568	3,028	1,491	850	429
Other red oaks	165,301	12,957	4,205	4,562	3,626	1,673	993	767	234	195
Elm	64,651	6,275	2,849	955	1,284	341	345	125	96	17
Other hardwoods	1,772,547	100,068	23,237	7,073	2,518	861	541	201	115	77
Total all hardwoods	9,357,684	786,826	300,207	162,299	89,050	44,629	23,256	12,084	5,248	2,446
All species	13,391,497	1,455,585	598,952	367,466	229,629	136,463	86,502	49,208	27,703	14,571
SE	5.9	6.3	7.1	4.6	4.5	4.5	4.5	4.8	5.3	6.6

Table 14.-continued

(In thousands of trees)

Species	Diameter class (inches at breast height)					
	19.0-20.9	21.0-28.9	29.0+	Total 5.0+	All classes	SE
Balsam fir	0	0	0	50,524	2,343,145	11.7
Tamarack	0	0	0	1,149	1,149	35.4
White spruce	34	0	0	3,861	34,974	41.8
Black spruce	0	0	0	969	2,929	69.2
Red spruce	51	49	0	49,872	412,502	15.7
Red pine	81	32	0	9,823	31,922	39.5
Pitch pine	28	13	0	5,223	5,223	31.4
White pine	5,025	6,697	1,084	270,240	1,139,815	9.6
Northern white-cedar	0	0	0	11,340	93,307	26.1
Hemlock	1,434	1,259	89	180,219	1,487,857	9.6
Other softwoods	0	0	0	5,183	36,895	71.8
Total all softwoods	6,653	8,050	1,173	588,404	5,589,720	7.7
Red maple	386	302	55	127,039	2,713,876	9.5
Sugar maple	92	204	45	14,730	1,118,880	18.0
Yellow birch	18	69	5	16,160	611,904	28.0
Sweet birch	0	23	0	9,512	168,821	30.9
Paper birch	68	27	0	34,464	543,039	15.9
Gray birch	0	0	0	15,825	361,072	14.7
Hickory	17	0	0	947	53,742	29.4
Beech	81	89	0	16,191	482,475	13.7
White ash	95	59	13	10,136	729,591	17.4
Black ash	15	0	0	1,850	39,829	59.0
Aspen	36	38	0	23,780	422,874	16.5
Black cherry	19	0	0	9,291	507,291	13.3
White oaks	37	76	25	8,964	185,872	22.0
Northern red oak	136	205	11	25,776	668,027	12.1
Other red oaks	39	168	15	12,273	194,735	20.5
Elm	18	17	0	3,198	76,973	27.7
Other hardwoods	0	34	0	11,419	1,907,272	10.3
Total all hardwoods	1,059	1,313	171	341,556	10,786,274	6.0
All species	7,711	9,363	1,344	929,960	16,375,994	5.3
SE	7.7	7.9	16.0	4.0	5.3	

Table 15.--Number of all live trees on forest land by species and diameter class, Spruce/fir forest-type group, New England, 1980-85

(In thousands of trees)

Species	Diameter class (inches at breast height)									
	Seedlings	1.0-2.9	3.0-4.9	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9
Balsam fir	16,038,760	1,839,963	741,216	417,140	214,022	80,313	24,361	5,144	1,188	127
Tamarack	122,156	19,948	17,478	9,181	3,928	2,794	1,282	678	278	267
White spruce	241,897	58,159	73,823	38,468	23,277	12,230	5,049	1,877	627	265
Black spruce	979,529	134,937	89,002	56,901	21,155	8,602	1,911	923	114	24
Red spruce	4,307,321	489,871	340,507	259,730	171,950	91,891	43,084	20,225	7,684	3,314
Red pine	3,941	0	0	148	0	143	129	163	37	21
Pitch pine	0	0	0	0	0	0	0	14	0	0
White pine	117,475	7,732	3,556	6,848	4,833	3,890	3,049	1,647	1,268	686
Northern white-cedar	2,866,582	222,877	170,774	120,833	91,414	53,889	32,580	15,393	6,968	2,147
Hemlock	397,971	42,194	24,111	19,613	13,608	8,326	5,161	1,985	1,312	355
Other softwoods	1,426	2,008	7,452	1,258	59	15	0	0	27	0
Total all softwoods	25,077,059	2,817,689	1,467,920	930,120	544,246	262,093	116,607	48,050	19,504	7,206
Red maple	4,560,719	319,886	91,995	56,074	34,128	18,496	8,453	3,569	1,695	656
Sugar maple	1,568,875	35,770	12,424	7,777	5,440	2,789	2,464	1,512	747	466
Yellow birch	1,922,380	145,748	18,573	19,495	13,915	11,201	5,686	2,914	1,756	1,138
Sweet birch	0	0	0	164	0	0	32	0	0	0
Paper birch	1,665,263	210,829	86,071	60,569	33,987	15,371	5,665	2,021	911	306
Gray birch	135,455	37,123	17,269	8,050	1,548	347	106	71	0	0
Beech	199,375	34,989	12,233	2,711	2,400	1,240	601	435	273	78
White ash	230,833	11,005	5,129	3,370	1,140	904	349	128	169	44
Black ash	379,973	32,079	13,757	9,038	5,105	1,950	866	461	119	58
Aspen	774,311	34,160	21,590	16,989	15,342	9,568	5,994	2,627	884	413
Black cherry	307,940	5,731	4,060	2,113	1,185	398	21	34	29	0
White oaks	1,107	0	0	0	0	0	0	0	0	0
Northern red oak	17,467	4,493	0	430	236	57	110	58	94	24
Other red oaks	1,107	0	0	109	164	0	0	0	0	0
Elm	37,026	5,845	0	380	186	0	30	191	31	33
Other hardwoods	5,743,715	289,101	40,204	11,500	1,983	419	211	179	97	23
Total all hardwoods	17,545,549	1,166,761	323,306	198,771	116,760	62,739	30,587	14,201	6,806	3,239
All species	42,622,607	3,984,450	1,791,226	1,128,892	661,006	324,832	147,194	62,251	26,309	10,445
SE	4.0	4.6	4.7	3.0	2.9	3.0	3.4	4.1	5.4	7.4

Table 15.-continued

(In thousands of trees)

Species	Diameter class (inches at breast height)					
	19.0-20.9	21.0-28.9	29.0+	Total 5.0+	All classes	SE
Balsam fir	29	16	0	742,340	19,362,279	5.0
Tamarack	59	13	0	18,480	178,063	24.0
White spruce	129	63	0	81,985	455,864	12.4
Black spruce	28	0	0	89,659	1,293,127	17.7
Red spruce	1,196	938	17	600,030	5,737,729	7.4
Red pine	0	0	0	641	4,582	61.6
Pitch pine	0	0	0	14	14	100.0
White pine	786	906	201	24,114	152,877	15.8
Northern white-cedar	1,261	948	37	325,469	3,585,704	10.2
Hemlock	209	363	5	50,938	515,214	20.5
Other softwoods	0	0	1	1,360	12,246	76.7
Total all softwoods	3,696	3,247	260	1,935,030	31,297,698	4.3
Red maple	334	313	3	123,721	5,096,321	6.4
Sugar maple	431	221	5	21,852	1,638,921	17.8
Yellow birch	459	561	29	57,156	2,143,857	8.9
Sweet birch	0	0	0	197	197	85.2
Paper birch	77	39	8	118,954	2,081,118	9.5
Gray birch	0	0	0	10,122	199,969	19.1
Beech	0	16	0	7,755	254,352	16.7
White ash	0	0	1	6,105	253,072	20.3
Black ash	77	29	0	17,703	443,512	17.2
Aspen	50	143	0	52,009	882,071	16.8
Black cherry	32	0	0	3,811	321,543	27.7
White oaks	0	0	0	0	1,107	100.0
Northern red oak	0	0	0	1,009	22,970	29.8
Other red oaks	0	0	0	274	1,381	100.0
Elm	18	8	0	877	43,749	41.7
Other hardwoods	0	26	0	14,439	6,087,460	6.7
Total all hardwoods	1,478	1,356	47	435,986	19,471,601	4.5
All species	5,175	4,603	307	2,371,016	50,769,299	3.6
SE	9.5	9.3	29.6	2.6	3.6	

Table 16.--Number of all live trees on forest land by species and diameter class, Oak/hickory forest-type group, New England, 1980-85

(In thousands of trees)

Species	Diameter class (inches at breast height)									
	Seedlings	1.0-2.9	3.0-4.9	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9
Balsam fir	106,615	26,710	831	1,889	1,019	428	0	0	0	0
Tamarack	0	0	4,314	0	0	23	23	0	0	0
White spruce	1,652	0	0	28	0	0	33	0	0	0
Red spruce	19,135	3,100	1,527	1,747	651	578	151	56	0	37
Red pine	1,585	0	0	0	0	87	137	68	11	0
Pitch pine	16,577	1,790	3,220	229	409	195	39	44	0	14
White pine	201,870	51,844	15,521	11,979	4,359	2,848	1,770	464	585	374
Northern white-cedar	8,982	6,025	1,506	0	49	37	0	37	0	0
Hemlock	54,678	14,075	3,693	6,959	4,429	2,533	1,458	729	317	214
Other softwoods	6,351	3,274	0	697	386	108	0	22	0	0
Total all softwoods	417,446	106,819	30,613	23,529	11,302	6,837	3,612	1,421	913	639
Red maple	1,594,282	275,568	88,596	49,930	26,480	12,910	5,557	2,515	1,138	663
Sugar maple	454,466	54,043	7,408	5,878	3,017	1,173	501	431	200	96
Yellow birch	215,167	17,018	5,477	2,492	1,784	975	469	361	67	11
Sweet birch	349,396	29,197	18,864	8,715	6,090	2,275	1,358	588	469	161
Paper birch	254,471	28,336	7,737	6,370	4,220	2,309	566	308	88	0
Gray birch	223,715	24,234	6,327	1,243	301	0	14	0	0	0
Hickory	166,720	32,323	11,628	7,361	4,474	3,143	1,597	984	196	223
Beech	388,067	70,479	19,407	9,165	4,285	1,981	1,324	618	335	174
White ash	375,791	16,377	5,943	4,071	3,148	1,995	808	423	175	108
Black ash	46,994	0	380	179	284	189	47	0	0	0
Aspen	93,183	12,023	5,220	3,930	2,126	1,015	708	167	0	0
Black cherry	653,258	10,065	3,377	1,681	570	244	81	69	68	39
White oaks	665,727	28,533	34,953	19,282	13,811	8,581	4,849	2,463	1,334	605
Northern red oak	616,429	45,995	26,329	32,227	29,234	21,737	14,965	8,258	5,506	2,640
Other red oaks	1,137,485	26,482	27,449	24,877	21,178	14,172	8,057	4,485	1,854	857
Elm	15,991	12,058	1,462	379	280	135	141	70	0	17
Other hardwoods	2,156,843	88,907	33,251	8,112	2,908	1,901	567	491	473	198
Total all hardwoods	9,407,983	771,640	303,810	185,893	124,192	74,735	41,611	22,232	11,905	5,793
All species	9,825,429	878,459	334,422	209,422	135,495	81,572	45,223	23,653	12,817	6,431
SE	6.1	7.5	8.3	5.3	5.1	5.5	5.3	6.0	6.9	8.5

Table 16.-continued

(In thousands of trees)

Species	Diameter class (inches at breast height)					
	19.0-20.9	21.0-28.9	29.0+	Total 5.0+	All classes	SE
Balsam fir	0	0	0	3,337	137,493	33.9
Tamarack	0	0	0	46	4,361	98.9
White spruce	0	0	0	62	1,714	98.1
Red spruce	37	0	0	3,257	27,018	31.0
Red pine	0	0	0	303	1,887	60.1
Pitch pine	0	0	0	931	22,518	40.8
White pine	193	179	14	22,765	291,999	12.7
Northern white-cedar	0	0	0	123	16,638	70.5
Hemlock	43	39	0	16,721	89,168	18.7
Other softwoods	0	0	0	1,213	10,838	50.3
Total all softwoods	273	219	14	48,759	603,636	12.4
Red maple	218	216	21	99,648	2,058,095	8.0
Sugar maple	104	41	9	11,450	527,367	19.0
Yellow birch	37	9	0	6,206	243,869	21.1
Sweet birch	9	0	0	19,665	417,123	17.6
Paper birch	0	0	0	13,862	304,406	24.1
Gray birch	0	0	0	1,559	255,835	23.9
Hickory	53	0	0	18,032	228,703	14.9
Beech	66	61	0	18,009	495,962	19.0
White ash	14	33	0	10,777	408,887	15.7
Black ash	0	0	0	700	48,074	53.8
Aspen	0	5	4	7,955	118,380	20.5
Black cherry	0	0	0	2,753	669,453	14.3
White oaks	403	269	49	51,648	780,862	10.5
Northern red oak	995	1,378	228	117,167	805,921	11.2
Other red oaks	545	673	9	76,709	1,268,126	19.0
Elm	19	0	0	1,041	30,552	35.2
Other hardwoods	128	172	36	14,986	2,293,986	9.8
Total all hardwoods	2,593	2,857	357	472,167	10,955,600	5.7
All species	2,866	3,076	370	520,926	11,559,236	5.6
SE	11.7	10.7	23.1	4.5	5.6	

Table 17.--Number of all live trees on forest land by species and diameter class, Northern hardwoods forest-type groups, New England, 1980-85

(In thousands of trees)

Species	Diameter class (inches at breast height)									
	Seedlings	1.0-2.9	3.0-4.9	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9
Balsam fir	4,657,736	488,967	148,950	77,029	43,649	20,702	7,049	1,980	537	106
Tamarack	2,320	0	0	319	405	243	285	63	14	0
White spruce	36,982	16,155	19,999	5,810	2,597	961	418	123	25	52
Black spruce	19,663	0	1,502	988	162	157	29	0	0	0
Red spruce	1,208,905	163,226	55,868	54,282	33,054	17,675	10,415	4,564	1,529	735
Red pine	0	0	0	0	161	158	132	89	0	0
Pitch pine	0	0	0	0	90	50	0	27	11	0
White pine	235,336	60,372	18,391	12,182	8,199	5,119	3,409	2,276	1,839	1,278
Northern white-cedar	169,006	24,808	5,737	6,724	4,410	2,122	1,116	585	391	201
Hemlock	571,568	117,605	63,590	44,513	25,228	15,552	12,119	5,606	2,841	1,106
Other softwoods	3,253	1,031	0	800	39	65	29	0	12	0
Total all softwoods	6,904,770	872,164	314,036	202,648	117,996	62,805	35,002	15,313	7,198	3,479
Red maple	4,102,607	483,767	212,570	146,081	98,888	57,498	29,724	14,635	7,088	4,124
Sugar maple	12,648,018	563,450	196,088	112,098	86,209	53,111	35,137	20,870	11,709	7,360
Yellow birch	3,320,149	217,361	103,313	53,214	43,920	29,300	19,043	11,006	6,940	3,632
Sweet birch	146,561	24,239	20,848	10,362	8,509	4,039	2,253	1,214	590	155
Paper birch	1,283,011	80,339	57,564	36,239	31,561	18,087	8,149	2,940	811	483
Gray birch	111,140	25,815	13,091	9,183	1,747	398	81	0	12	0
Hickory	73,276	5,102	0	3,286	1,436	835	557	210	84	25
Beech	5,750,168	623,129	171,323	88,055	52,181	35,453	21,153	13,439	7,664	3,911
White ash	1,535,542	61,053	39,081	20,621	19,112	11,463	7,347	4,138	2,251	1,089
Black ash	70,184	20,736	1,490	2,298	1,422	1,020	568	335	180	58
Aspen	918,304	39,396	14,879	11,282	8,810	7,021	3,475	2,295	828	125
Black cherry	1,068,130	19,539	6,326	9,633	6,289	4,571	2,847	1,210	625	282
White oaks	78,998	8,517	845	1,667	786	242	107	67	96	142
Northern red oak	459,645	22,006	11,506	8,738	5,872	4,287	2,821	1,914	1,446	920
Other red oaks	19,316	6,741	0	470	580	175	165	96	93	59
Elm	95,125	5,020	865	1,449	1,498	387	211	208	83	65
Other hardwoods	12,294,333	546,611	128,833	47,618	13,113	4,041	1,603	879	458	489
Total all hardwoods	43,974,510	2,752,822	978,624	562,295	381,933	231,929	135,241	75,457	40,960	22,919
All species	50,879,281	3,624,986	1,292,660	764,943	499,930	294,734	170,242	90,770	48,159	26,398
SE	3.5	4.2	5.1	3.1	2.9	2.9	3.0	3.3	3.7	4.3

Table 17.-continued

(In thousands of trees)

Species	Diameter class (inches at breast height)					
	19.0-20.9	21.0-28.9	29.0+	Total 5.0+	All classes	SE
Balsam fir	17	0	0	151,070	5,446,723	7.3
Tamarack	0	0	0	1,331	3,651	67.4
White spruce	0	0	0	9,986	83,122	19.7
Black spruce	0	0	0	1,336	22,501	53.7
Red spruce	251	68	0	122,574	1,550,573	7.5
Red pine	23	0	0	563	563	57.9
Pitch pine	0	0	0	178	178	82.6
White pine	547	766	173	35,790	349,890	18.0
Northern white-cedar	39	26	0	15,616	215,167	28.5
Hemlock	590	585	7	108,147	860,909	10.7
Other softwoods	0	0	0	945	5,229	46.8
Total all softwoods	1,467	1,446	181	447,536	8,538,507	5.8
Red maple	1,705	1,545	234	361,523	5,160,468	6.4
Sugar maple	5,007	6,031	1,319	338,851	13,746,408	6.0
Yellow birch	2,198	3,369	329	172,950	3,813,773	9.0
Sweet birch	55	35	0	27,212	218,861	19.8
Paper birch	366	124	0	98,759	1,519,674	12.0
Gray birch	0	0	0	11,421	161,467	19.8
Hickory	25	0	8	6,468	84,846	24.4
Beech	1,668	1,433	38	224,996	6,769,617	5.6
White ash	273	554	100	66,949	1,702,625	8.3
Black ash	0	12	0	5,893	98,304	23.0
Aspen	207	48	0	34,092	1,006,671	26.8
Black cherry	132	50	0	25,638	1,119,633	14.0
White oaks	63	59	0	3,229	91,590	36.6
Northern red oak	311	413	14	26,737	519,893	21.4
Other red oaks	35	60	0	1,733	27,790	38.5
Elm	0	26	0	3,927	104,937	48.6
Other hardwoods	132	67	26	68,425	13,038,203	4.8
Total all hardwoods	12,176	13,827	2,068	1,478,806	49,184,762	3.5
All species	13,644	15,273	2,249	1,926,342	57,723,269	3.3
SE	5.3	5.0	11.6	2.5	3.3	

Table 18.--Number of all live trees on forest land by species and diameter class, Other forest-type groups, New England, 1980-85

(In thousands of trees)

Species	Diameter class (inches at breast height)									
	Seedlings	1.0-2.9	3.0-4.9	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9
Balsam fir	2,077,443	232,841	91,948	34,429	10,943	3,267	691	233	58	29
Tamarack	3,729	4,271	0	784	187	257	181	48	26	21
White spruce	54,119	5,345	0	4,279	1,612	925	470	52	51	17
Black spruce	9,493	7,771	2,214	945	310	0	0	0	0	0
Red spruce	249,355	51,513	7,642	14,198	7,341	3,382	1,319	527	75	0
Red pine	2,223	4,780	1,490	327	74	419	419	114	75	57
Pitch pine	20,256	19,192	11,693	9,341	6,443	2,825	1,550	845	266	118
White pine	284,629	75,271	28,393	21,063	13,311	8,362	6,361	4,245	2,672	1,992
Northern white-cedar	178,520	23,907	19,845	8,398	2,919	1,586	537	259	134	0
Hemlock	196,123	46,616	22,612	12,218	6,333	3,607	1,937	1,437	794	420
Other softwoods	21,620	10,258	3,397	3,477	2,199	548	182	27	0	0
Total all softwoods	3,097,509	481,767	189,234	109,460	51,673	25,178	13,646	7,787	4,151	2,653
Red maple	2,139,890	336,890	137,686	73,200	46,365	21,262	11,355	4,768	2,427	1,064
Sugar maple	708,457	72,516	7,885	8,829	4,484	1,953	1,279	464	312	192
Yellow birch	203,459	26,451	13,252	7,200	3,375	1,947	1,052	529	244	156
Sweet birch	117,342	13,476	0	2,204	1,159	596	310	43	23	37
Paper birch	662,285	114,077	92,140	56,655	32,251	14,251	5,011	1,845	765	291
Gray birch	583,359	132,589	72,731	12,321	1,384	213	87	35	40	0
Hickory	73,260	4,437	4,722	828	1,367	695	214	159	102	17
Beech	325,349	87,833	7,036	7,477	2,013	511	493	323	89	166
White ash	893,282	40,487	16,129	8,409	5,829	2,170	1,149	701	320	96
Black ash	116,456	15,194	12,279	5,108	2,192	1,310	749	228	31	39
Aspen	1,314,381	130,538	69,741	54,374	39,502	23,721	10,039	3,824	1,389	628
Black cherry	632,019	16,265	9,531	3,554	1,642	850	264	127	101	0
White oaks	219,922	12,725	13,971	7,051	2,255	1,281	879	252	236	99
Northern red oak	708,881	42,921	21,221	14,204	10,744	6,717	4,170	1,926	998	540
Other red oaks	690,266	14,569	4,936	7,428	3,537	2,324	915	657	192	60
Elm	103,602	17,995	9,066	2,916	1,269	1,247	441	244	120	149
Other hardwoods	3,703,154	152,674	40,021	8,675	4,248	1,489	847	499	227	201
Total all hardwoods	13,195,367	1,231,637	532,346	280,433	163,617	82,539	39,257	16,624	7,614	3,735
All species	16,292,876	1,713,404	721,580	389,893	215,289	107,717	52,903	24,411	11,765	6,389
SE	5.7	7.2	7.5	5.2	5.2	5.4	5.9	6.4	7.6	9.5

Table 18.-continued

(In thousands of trees)

Species	Diameter class (inches at breast height)					
	19.0-20.9	21.0-28.9	29.0+	Total 5.0+	All classes	SE
Balsam fir	0	0	0	49,651	2,451,883	10.4
Tamarack	0	12	0	1,516	9,516	45.5
White spruce	0	0	0	7,405	66,870	36.5
Black spruce	0	0	0	1,256	20,734	59.9
Red spruce	18	0	0	26,860	335,369	15.1
Red pine	0	0	0	1,485	9,979	44.3
Pitch pine	63	21	0	21,472	72,613	26.0
White pine	1,012	1,158	157	60,333	448,626	12.6
Northern white-cedar	0	0	0	13,833	236,105	30.2
Hemlock	153	251	0	27,151	292,502	15.9
Other softwoods	0	0	0	6,433	41,707	47.2
Total all softwoods	1,247	1,443	157	217,394	3,985,905	8.4
Red maple	490	809	143	161,884	2,776,350	7.9
Sugar maple	100	173	42	17,829	806,688	14.4
Yellow birch	17	44	0	14,564	257,725	17.1
Sweet birch	0	0	0	4,373	135,190	30.2
Paper birch	60	67	0	111,195	979,697	11.8
Gray birch	0	0	0	14,080	802,759	16.8
Hickory	14	0	0	3,397	85,815	32.0
Beech	16	67	0	11,155	431,372	17.5
White ash	115	65	7	18,861	968,759	16.5
Black ash	0	0	0	9,657	153,587	29.9
Aspen	327	94	33	133,932	1,648,593	16.3
Black cherry	0	0	0	6,538	664,353	13.8
White oaks	53	88	18	12,213	258,831	24.9
Northern red oak	226	141	30	39,698	812,721	25.4
Other red oaks	49	6	0	15,168	724,939	28.1
Elm	0	77	41	6,505	137,169	27.4
Other hardwoods	100	177	5	16,468	3,912,317	9.3
Total all hardwoods	1,568	1,810	319	597,517	15,556,866	5.7
All species	2,815	3,253	476	814,911	19,542,771	5.3
SE	12.0	12.4	21.9	4.7	5.3	

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The USDA Forest Service along with various cooperators has initiated Forest Health Monitoring (FHM) in New England to assess the condition and stressors of the region's forests, to analyze changes in these data over time, and to identify any relationships between forest condition and stressors. A major component of FHM in New England is 263 permanent plots located across the region on which growth efficiency, foliar condition and nutrition, soil nutrition, and landscape characteristics will be measured and reported annually. This publication describes the forest resources of New England and discusses major influences--insects and pathogens, climate and weather, and atmospheric deposition and pollution.

Headquarters of the Northeastern Forest Experiment Station is in Radnor, Pennsylvania. Field laboratories are maintained at:

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