The Timber Resources of New Jersey

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NORTHEASTERN FOREST EXPERIMENT STATION
FOREST SERVICE, U. S. DEPARTMENT OF AGRICULTURE
6816 MARKET STREET, UPPER DARBY, PA. 19082
WARREN T. DOOLITTLE, DIRECTOR

FOREWORD

Under the authority of the McSweeney-McNary Forest Research Act of May 22, 1928, and subsequent amendments, the Forest Service, U.S. Department of Agriculture, conducts a series of continuing forest surveys of all states to provide up-to-date information about the forest resources of the Nation.

The first forest survey of New Jersey was made in 1955 by the Northeastern Forest Experiment Station. A resurvey was made in 1971 with excellent help and cooperation of the New Jersey Department of Environmental Protection, Bureau of Forestry. Aerial photographs used for this survey were also supplied by the Department.

The resurvey of the State was directed by Carl E. Mayer, leader of the Forest Survey Project. He was assisted by John R. Peters, who supervised the field crews; Joseph E. Barnard and David R. Dickson, who applied the general sampling procedures used by the Forest Survey to meet the specific requirements for the New Jersey inventory; James T. Bones, who, with the cooperation of the Bureau of Forestry, collected and compiled data on timber-products output and plant residues; Teresa M. Bowers, who assisted in computing data for the sampling design and the tables in this report; and Carmela M. Hyland, who assisted with administrative services for the field crews and typed the manuscript and tables.

The authors and Joseph E. Barnard checked the consistency of the previous inventory with the new inventory. They made frequent use of the TRAS model in this phase of the data analysis and in the 30-year projections of timber volume.

Cover Photo

New Jersey Department of Conservation and Economic Development

The highest elevation in New Jersey—1,803 feet above sea level, is marked by High Point Monument, in Sussex County. The area in the foreground has been defoliated by the gypsy moth.

PHOTO CREDITS. Most of the photographs in this report were provided by New Jersey Department of Conservation and Economic Development. The photos of wood products on page 32 were provided by Rutgers, the State University of New Jersey.

The Timber Resources of New Jersey

by Roland H. Ferguson
and Carl E. Mayer

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The Authors

ROLAND H. FERGUSON, research forester, received his bachelor of science degree in forestry at Oregon State College in 1931, and joined the USDA Forest Service in 1934. After working in the southern pine and Douglas-fir regions, he came to the Northeastern Forest Experiment Station in 1945. He has participated in various aspects of the Forest Survey and since 1957 has been a resource analyst in the Experiment Station's Forest Survey unit.

CARL E. MAYER is the forest survey project leader at the Northeastern Forest Experiment Station. He received his bachelor's degree in forestry from Iowa State University in 1943. After military service as an officer in the U.S. Marine Corps, he spent 12 years in Forest Survey at the Pacific Northwest Experiment Station in Portland, Oregon. He transferred to the Northeastern Station in 1958 and since that time has directed the Forest Survey of the 14-state Northeastern area.

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Highlights of the Findings

DURING the 16 years between the initial forest survey in 1955 and the resurvey in 1971, there have been many significant changes in forest area and timber volumes. Here are some of the important findings of the most recent survey:

- Commercial forest land totaled 1,856,800 acres, a 12-percent decrease since 1956.
- About 75 percent of the commercial forest land was fully stocked with growing-stock trees; only 8 percent of the commercial forest land was poorly stocked.
- Growing-stock volume increased 10 percent to 1,470 million cubic feet; however, softwood volume decreased almost 7 percent.
- Hardwoods made up more than 80 percent of the growing-stock volume. Oaks alone made up almost 50 percent.
- Sawtimber trees accounted for slightly more than one-half (783 million cubic feet) of the total volume.
- Sawtimber volume increased about 6 percent to 3,070 million board feet; softwood sawtimber volume increased about 5 percent.
- Pitch pine, beech, and yellow-poplar increased more than 50 percent in sawtimber volume; other pines, select red oaks, and sweetgum decreased more than 15 percent.
- Annual net growth for 1971 was about 25 million cubic feet of growing stock, including 45 million board feet of sawtimber.
- Timber removals in 1971 were 16 million cubic feet of growing stock, including 34 million board feet of sawtimber.
- Total softwood growing-stock volume cut between surveys was more than 20 percent greater than net growth.
- Projections of future timber supply show that, if present trends of removals continue, by 2002 the total inventory volume would increase about 26 percent; however, the volume of softwood growing stock would decrease about 18 percent.

The Resurvey

THE FIRST forest survey of the timber resources of New Jersey was made in 1955. The second forest survey of the State, 16 years later, shows that a number of significant changes have taken place.

This report summarizes the present timber-resource situation and the changes that have taken place since the initial survey. It presents the inventory, annual net growth, and timber removals in more detail than was possible for the initial survey. Trends in the timber supply, including a discussion of timber availability, are pointed out, and projections of future timber-supply are made.

Comparisons of volume estimates given in this report with those in the first report were made after putting the initial survey estimates on the same basis as the resurvey. The initial growing-stock volume (1 January 1956) after such revision, was almost 8 percent greater than reported in *The Timber Resources of New Jersey* (*12*), due mainly to differences in volume tables.

In the resurvey, 50 percent of the initial field plots were remeasured to provide estimates of average annual net timber growth, average annual timber removals, land-use change, and to update the initial forest-inventory estimates. To develop an independent second estimate, new field plots were established and measured. These two samples yielded independent estimates, which were weighted and combined to give the current estimates of forest area and timber volume reported in this publication. A more detailed discussion of the design and sampling procedure can be found in the appendix.

Sampling errors, which indicate the reliability of the estimates, are shown for most of the state totals and subtotals of the new estimates. Sampling errors for less than state totals of commercial forest land range from 5 percent (for the 280,000 acres of commercial forest land in Burlington County) to about 20 percent (for the 32,000 acres in Mercer County). Sampling errors for growing-stock volume in these two counties are 13 percent and 31 percent respectively.

Definitions of forest survey terms and the discussion about reliability of the estimates are presented in the appendix. Users of these timber-resource data are strongly urged to read these definitions and explanations carefully.

Timber-Resource Trends

Forty percent (1,856,800 acres) of New Jersey's land area is covered by some kind of forest, from small seedlings to mature trees. Less than 2 percent of the forest area is classified as noncommercial, and this is about equally divided between productive-reserved and unproductive forest land. New Jersey's forests provide raw material for many timber products; they offer opportunities for outdoor recreation; and they protect a vast supply of pure underground water.

Many definitions, procedures, and methods have been changed since the first forest survey of New Jersey as the result of improved forest-inventory and data-processing techniques. The initial survey estimates had to be put on a basis comparable to the resurvey estimates in order to analyze actual trends between surveys. However, the reported 1956 estimates are still valid for the procedures, definitions, and volume tables that were used at that time, and therefore should not be discounted. Trends in commercial forest-land area, growing-stock volume, and sawtimber volume, after adjustments of the 1956 data to the resurvey standards, are presented:

Change in area and volume, 1956-72

	1956	1972	Change (units)	Change (percent)
Commercial forest land: (*thousand acres*)	2,120.0	1,856.3	−263.7	−12.4
Growing-stock volume: (*million cubic feet*)				
Softwoods	276.5	258.0	−18.5	−6.7
Hardwoods	1,060.7	1,212.3	+151.6	+14.3
Total	1,337.2	1,470.3	+133.1	+10.0
Sawtimber volume: (*million board feet*)				
Softwoods	543.0	572.0	+29.0	+5.3
Hardwoods	2,354.0	2,498.2	+54.2	+6.1
Total	2,897.0	3,070.2	+83.2	+6.0

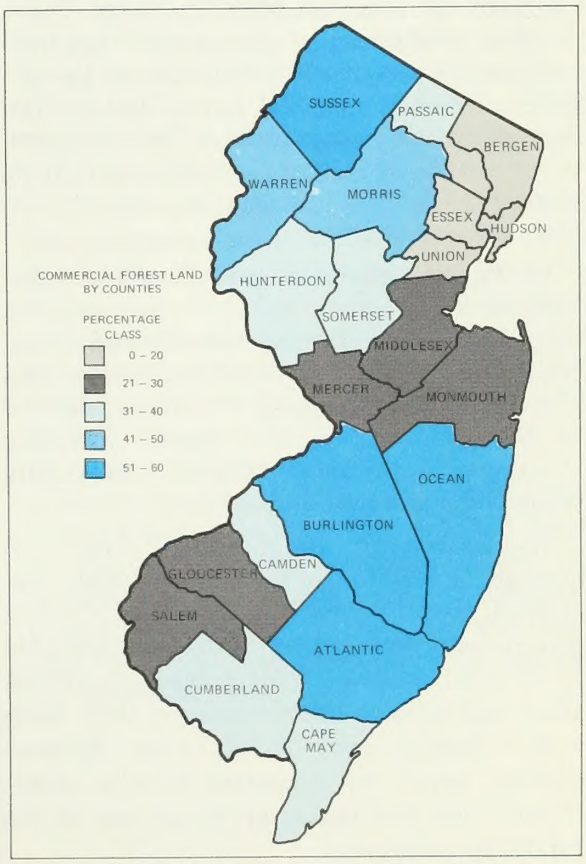
A Decrease in Forest Area

Land-use changes between the two forest surveys resulted in a 12-percent decrease in commercial forest land. Commercial forest land now makes up 38 percent of the land area. The acreage decreased by more than a quarter-million acres to 1,857,000 acres of commercial forest land; however, 2,613,000 acres (54 percent of the land area) still have some tree cover.

About one-fourth of the decrease in commercial forest land was attributable to the change from forest to nonforest land in four highly urbanized counties in the northeastern part of the State—Bergen, Essex, Hudson, and Union. A current study by James T. Bones and George H. Pierson—Opportunities for wood recovery during land-clearing operations in New Jersey—shows a further loss of 164,000 acres of commercial forest land due to land clearing in the remainder of the State. More than three-fifths of the forest land clearing in the southern counties between 1955 and 1971 took place in Burlington, Monmouth, and Ocean counties, and nearly half of the land clearing in the northern counties took place in Morris and Middlesex counties.

The most forested and the least forested counties (exclusive of the four urban counties) are in the central part of the State. Ocean County has 60 percent of its land area in forest and Mercer County has only 22 percent (fig. 1). Most of the counties in New Jersey have less than 100,000 acres of commercial forest land. Only six counties—Sussex and Morris in the north and Ocean, Burlington, Atlantic, and Cumberland in the south—have more than that.

Figure 1.—Commercial forest-land area by counties.



Noncommercial forest land in the State—71,600 acres—is about equally divided between productive-reserved and nonproductive forest land and makes up about 2 percent of the total land area. Largest acreages of productive-reserved forest land (reserved from timber cutting) are in Morris and Sussex Counties and account for two-thirds of the total reserved. The largest acreages of forest land classified as nonproductive for timber are in Monmouth, Ocean, and Burlington Counties—a total of 29,500 acres for the three counties.

Public-owned commercial forest land in 1972 (318,900 acres) is 25 percent greater than the acreage reported in 1956. More than three-fourths of the public-owned forest land is owned by the State of New Jersey, mostly in the ten state forests throughout the State. The Wharton State Forest (over 150 square miles in area) accounts for about 40 percent of the state-owned forest land.

Privately owned commercial forest land estimates are based upon a canvass of forest landowners in New Jersey that was conducted concurrently with the resurvey of the State. Further breakdowns of these ownerships indicate that 24 percent—375,900 acres—of the privately owned commercial forest land in New Jersey is held by corporations. These corporations include real-estate development firms, corporate farms, public utilities, and in a few cases, forest industries.

Of the individually owned commercial forest land (965,500 acres), individual farmers own only 6 percent, while professionals and executives own 37 percent, and retired persons own 17 percent. The remaining 40 percent is owned by a varied assortment of people—including housewives, laborers, skilled tradesmen, white-collar workers, and so forth.

Farmer-owned commercial forest-land acreage, including incorporated farms, decreased greatly between surveys. Farmers owned more than 320,000 acres of commercial forest land in 1956. This acreage decreased about one-third to 108,200 acres in 1972. Individual farmers own 56,200 acres, whereas acreage owned by corporate farmers totals 52,000 acres and makes up 48 percent of the total farm ownership.

Commercial forest-land ownership	*Thousand acres*
Individually owned:	
Farmers	56.2
Professionals and executives	363.6
Retired people	163.0
Other individuals	382.7
Total individually owned	965.5
Corporate, including forest industry	375.9
Other, including associations, clubs, etc.	196.5
Public owned	318.9
All ownerships	1,856.8

More than 90 percent of the commercial forest land is medium- to well-stocked with growing-stock trees. This is about the same as it was on the initial survey. At the extremes of the percentages of stocking, about 5 percent of the forest area is overstocked (for optimum growth) and about 3 percent is nonstocked. This situation is not as favorable as it might suggest. Only 15 percent of the commercial forest area is more than 10 percent stocked with desirable trees (trees that have no serious quality defects and that are of relatively high vigor).

Sawtimber stands in New Jersey continued to make up the same proportion (25 percent) of the total commercial forest land. These stands totaled 464,000 acres in 1972 and averaged 4,200 board feet per acre. Poletimber stands covered 388,000 acres and averaged 1,150 cubic feet per acre. Acreage in sapling-seedling stands increased 30 percent between surveys to 1 million acres and now make up more than one-half of the commercial forest area.

The seven major forest types in New Jersey that are discussed below are made up of many local forest types (see appendix for precise definitions of the seven forest types). In the resurvey of the State, 24 local forest types are recognized. The forest types were classified on the basis of plurality of stocking of key indicator species. Changes in area, causes for change, and current acreages are given for each major type.

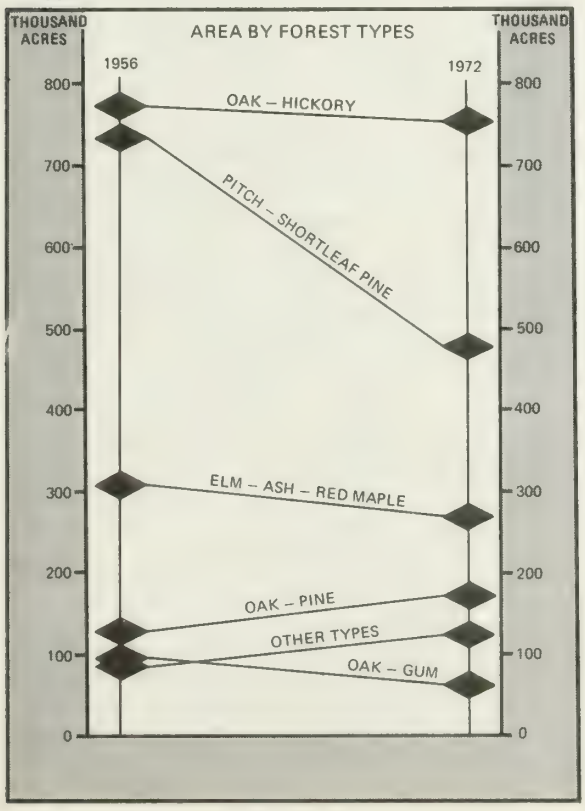
White pine-hemlock.—This is the least extensive forest type in New Jersey (20,000 acres) and is found only in the two northernmost counties—Sussex and Passaic. The area of timber stands where white pine predomi-

nates is about equal to the area of timber stands where hemlock predominates.

Pitch-shortleaf pine.—One-fourth of the commercial forest land in the State consists of this major forest type. The area decreased 35 percent between surveys, from 732,000 acres to 478,000 acres (fig. 2). Although most of the area in this type was classified as the local pitch pine forest type, some 30,000 acres were in two other local types where shortleaf pine or Virginia pine predominates, and 47,000 acres were in the local type where eastern redcedar predominates. The eastern redcedar type was found in Mercer and Middlesex Counties and other counties to the north. The pitch-shortleaf pine types were found mostly in Monmouth County and other counties to the south.

During the period between surveys, timber removals of yellow pines were more than double the average annual net growth. Consequently, the pine component of many stands became less than 50 percent of the total stocking. Some of these stands are now classified as *oak-pine* and some are now a hardwood type. Other pine stands were lost due to land-use changes.

Figure 2.—Changes in forest area by forest types.



Oak-pine.—This type is found in all counties throughout the State. Yellow pine (pitch, shortleaf, and Virginia) in this type make up 25 to 49 percent of the total stocking. The area increased by about one-third since 1956 to 172,000 acres. It now makes up almost 10 percent of the total commercial forest area.

Oak-hickory.—Forty percent of the commercial forest area is in this most extensive forest type. It is found in every county in New Jersey and totals 754,000 acres. There was little change in area of this forest type between surveys. The major type is a composite of six local types that have some kind of an oak mixture and two other local types. The local sweetgum—yellow-poplar forest type makes up more than a tenth of the total for this major type.

Oak-gum.—Total area of this major forest type decreased about one-third between surveys. Most of the type is made up of the local Atlantic white-cedar type—50,000 acres out of the 60,000 acre total—and is found almost exclusively in the southern half of the State. The other 10,000 acres are mostly in the black-gum-red maple local forest type.

Elm-ash-red maple.—This major type name now designates those stands that were classified as the swamp hardwoods type in the initial survey. The area in this type decreased more than 10 percent between surveys. It consists almost entirely of the black ash-elm-red maple local forest type. Less than 5 percent of the 268,000-acre total is in the only other local type—river birch-sycamore.

Maple-beech-birch.—Like the white pine-hemlock type, this forest type is found mostly in two northwestern counties—Sussex and Warren. The area in this type almost doubled between surveys to 104,000 acres, and makes up a little more than 5 percent of the commercial forest-land area.

Softwood Volume Decreased; Hardwood Volume Increased

Total growing-stock volume increased about 10 percent between surveys to 1,470 million cubic feet in 1972. The ratio of softwood to hardwood changed: the volume of softwoods decreased about 7 percent to 258 million cubic feet, and hardwoods increased about 15 percent to 1,212 million cubic feet. Red oaks, the predominate species group in the State, increased about 17 percent between surveys and made up one-third (403 million cubic feet) of the hardwood growing-stock volume in 1972 (fig. 3). All softwood species except pitch pine decreased in volume. The decrease in softwood growing-stock volume was due not only to greater volume being cut than being replaced by net growth, but also to considerable land-clearing within the softwood types in southern New Jersey.

Significant changes also appeared in the distribution of growing-stock volume by tree-diameter classes. Volumes by tree-diameter (dbh) class show a large increase in the 6-, 8-, and 10-inch classes (fig. 4). Most of the increases were in the hardwood species. Hardwood volume in these three classes increased 26 percent, but the corresponding softwood volume decreased 12 percent. The net increase for all species in the three classes averaged 15 percent.

Figure 3.—Changes in growing-stock volume by species.

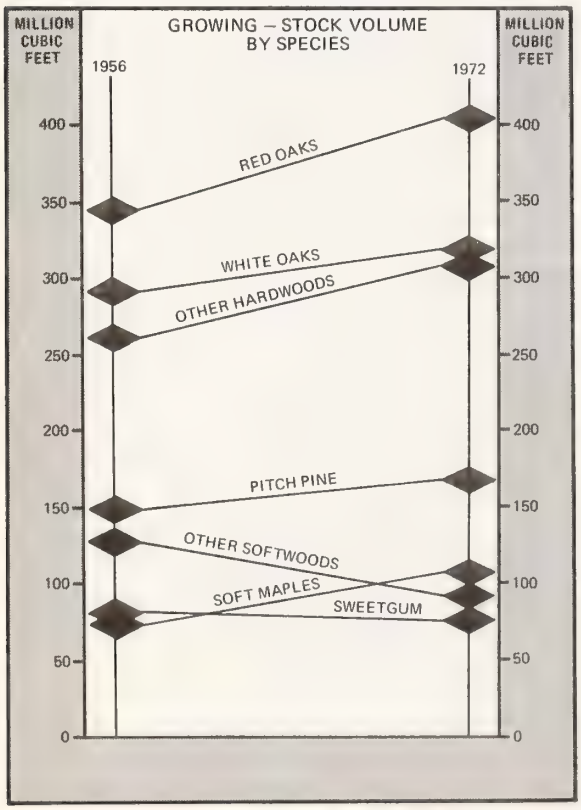
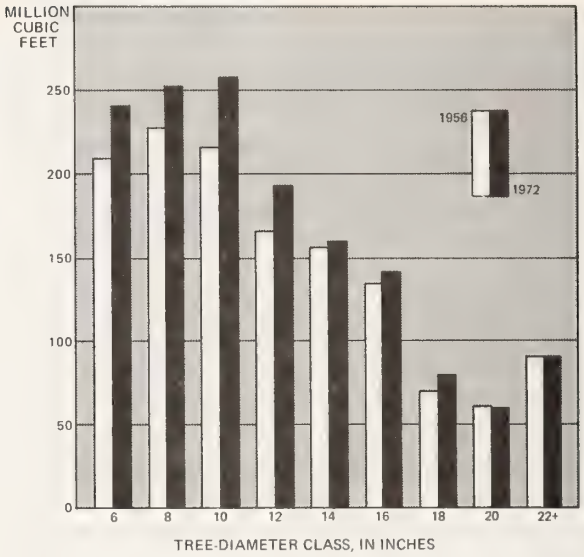


Figure 4.—Growing-stock volume by diameter classes, 1956 and 1962.



Softwood species growing-stock volume made up 18 percent of the total in 1972. Softwood volume was made up of about two-thirds pitch pine (167 million cubic feet) and one-third other softwoods (91 million cubic feet). Hardwood species made up 82 percent of the total volume, and oaks alone (721 million cubic feet or about 60 percent of the hardwood volume) accounted for almost one-half of the total growing-stock volume. Next most prominent species were the soft (red) maples (107 million cubic feet) that made up about 9 percent of the hardwood volume.

The volume of growing stock is about equally divided between the northern and southern halves of the State, even though there is a greater acreage of commercial forest land in the southern half (nine counties). Timber stands in the northern counties average about 976 cubic feet per acre and in the

southern counties average about two-thirds as much (683 cubic feet per acre). In the northern counties, softwoods make up less than 5 percent of the growing-stock volume, and in the nine southern counties softwoods make up almost 30 percent.

Included in the growing-stock volume for 1972 is 3,070 million board feet of sawtimber. The volume of sawtimber increased almost 6 percent between surveys, and the rates of increase for both softwoods and hardwoods were about the same. Softwood volume (572 million board feet) made up almost 19 percent of the total sawtimber volume.

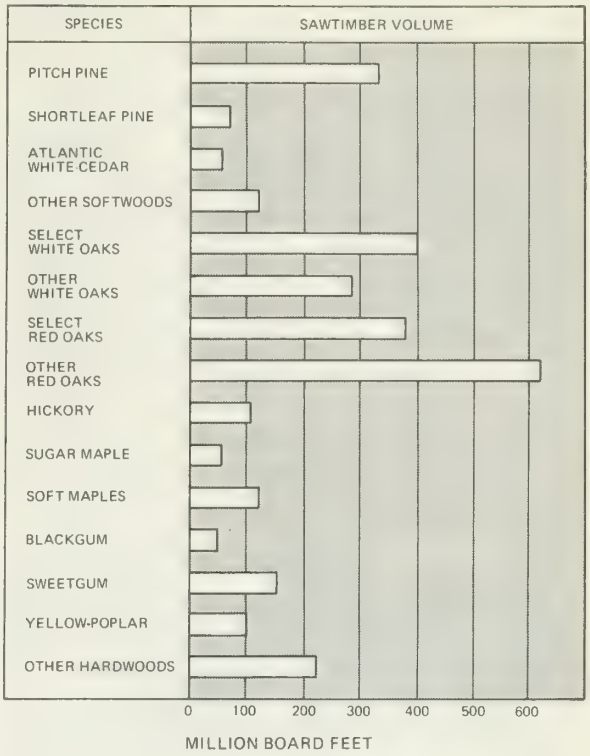
Most species increased in board-foot volume of sawtimber. Two species—pitch pine and yellow-poplar—increased in board-foot volume by more than 50 percent to 333 million board feet and 102 million board feet, respectively. Other softwood species and two hardwood species—northern red oak and sweetgum—decreased more than 15 percent in sawtimber volume.

All species of oak accounted for 55 percent (1,685 million board feet) of the total sawtimber volume. Five of the 15 species or species groups in New Jersey (pitch pine and four groups of oaks) had more than ¼ billion board feet each (fig. 5). The group of other red oaks had more than ½ billion board feet.

In the northern half of the State, the average volume per acre was 2,155 board feet. This is 59 percent greater than the average of 1,356 board feet per acre in the nine southern counties. Softwoods made up about 4 percent of the board-foot volume in the northern counties and 32 percent in the southern counties. Three counties—Burlington, Morris, and Sussex—had more than 300 million board feet each of sawtimber, and their timber stands averaged 1,690 board feet per acre.

Quality of sawtimber trees in New Jersey generally declined. The volume in standard-lumber log-grade 1 for all hardwood species combined made up 10 percent of the total hardwood volume in 1956. By 1972, the volume of hardwoods in grade 1 had dropped to an average of 7 percent of the total. Percentages in grade 1 by species ranged from 4 percent for the white oaks to 33 percent for yellow-poplar. More than 30 percent of the total hardwood sawtimber volume was classified as construction-log quality.

Figure 5.—Net volume of sawtimber by species.



Net Growth Exceeded Timber Removals

Total net growth of growing stock for the 16-year period between surveys was 371 million cubic feet, and the total removals during the same period were only 230 million cubic feet. The growing-stock volume had a net increase of 141 million cubic feet. The average annual net change in growing-stock volume for all species was 8.8 million cubic feet, but softwood volume decreased 1.2 million cubic feet per year while hardwood volume increased 10.0 million.

Sawtimber volume increased 173 million board feet between surveys. Sawtimber removals during the period were much less than net growth and resulted in an average annual net increase of 11.0 million board feet. Removals were about three-fourths as great as the net growth for combined species, but some species had a greater volume of removals than growth. Removals for all softwood species except pitch pine were four times greater than net growth.

Two hardwood species—northern red oak and sweetgum—had greater removals of sawtimber volume than net growth by a ratio of about 2 to 1.

Volume of Ingrowth Was Large

The average annual change in growing-stock volume and sawtimber volume is the composite of several components: growth on initial volume (accretion), ingrowth, change from a merchantable tree to a rough or rotten tree (cull-tree increment), mortality, and timber removal. An unusual change in one or more of the components could account for an unusual difference in the average annual change. For example, sweetgum in New Jersey had a high mortality rate that resulted in a negative average annual change for that species.

For most species, ingrowth is one of the most important components of average annual change in volume. In New Jersey, it is more than three-fourths as large as the growth on the initial volume. The reason for this is the young age of New Jersey's forests. One-half of the forest area is in sapling-seedling stands. The volume of ingrowth trees (growing-stock trees that were less than 5.0 inches dbh on the initial survey and that grew to 5.0 inches dbh and larger) made up about 44 percent (16.5 million cubic feet) of the average gross growth of growing stock (37.7 million cubic feet).

Mortality of growing-stock trees and cull-tree increment together (14.5 million cubic feet) reduced the average gross growth by 38 percent. These two components for the softwood species group reduced the gross growth of softwoods by 26 percent, while those for the hardwood species group reduced the gross growth of hardwoods by 41 percent.

The volume for each of the components of average annual net change in growing-stock for the period, 1956-71, is:

	Thousand cubic feet	*Percent of gross growth*
Survivor growth of growing stock	21,154	56
Volume and growth of trees that became poletimber	+16,507	+44
Average annual gross growth	37,661	100
Cull-tree increment	−3,561	−9
Growing-stock tree mortality	−10,900	−29
Average annual net growth	23,200	62
Average annual removals	−14,400	−39
Average annual net change	8,800	23

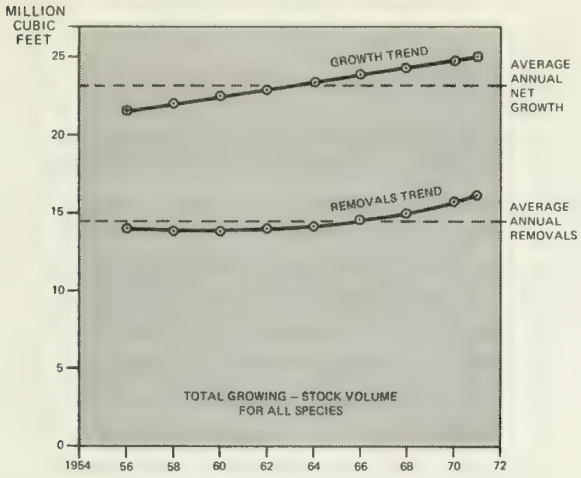
Sawtimber ingrowth, the volume of growing-stock trees that grew into the sawtimber-size class, was about 80 percent of the survivor growth. Survivor growth (44 million board feet) made up 55 percent of the gross growth (80 million board feet) and ingrowth (36 million board feet) made up 45 percent. The volume of sawtimber trees that died and those that became nongrowing stock reduced the volume of the average annual gross growth of sawtimber more than 45 percent. The average annual net growth of 42 million board feet exceeded the average annual removals of 31 million board feet and resulted in an average annual change of 11 million board feet.

Ratios of Removals to Growth are nearly Constant for Total Growing-Stock Volume

Annual net growth for 1971 was 24.9 million cubic feet, an increase of almost 16 percent over the net growth of 21.5 million cubic feet for 1956. Timber removals for 1956 were 13.9 million cubic feet, and for 1971 they were 16.0 million cubic feet or an increase of 15 percent. Timber removals of growing-stock volume in 1971 as a percent of net growth was 64 percent, almost the same as it was in 1956 (fig. 6).

The growth-removals relationship for softwood growing-stock volume is quite different than that for hardwoods. The net growth for softwoods in 1971 was 5.1 million cubic feet; and expressed as an annual rate based on the

Figure 6.—Average annual growth and removals and trends in net growth and removals, 1956-71.

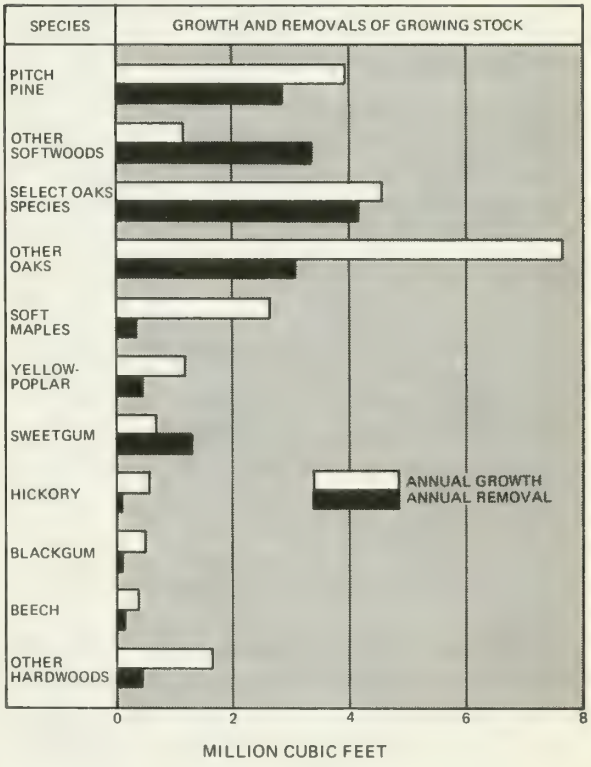


inventory volume, it was 2.0 percent. Softwood removals in 1971 (6.2 million cubic feet) exceeded growth by more than 20 percent. The net growth for hardwoods in 1971 was 19.8 million cubic feet. Hardwood growing-stock volume had a growth rate of 1.6 percent. The hardwood removals in 1971 (9.8 million cubic feet) was just one-half of the net growth.

Pitch pine was the only softwood species that had a greater volume of net growth (4.0 million cubic feet) than timber removals in 1971. As a group, the oaks' volume of net growth (12.2 million cubic feet) exceeded timber removals by 70 percent; however, northern red oak timber removals (3.2 million cubic feet) exceeded its net growth by 75 percent. The only other hardwood species for which timber removals (1.3 million cubic feet) greatly exceeded net growth was sweetgum. Its removals were almost double (85 percent) the net growth (fig. 7).

Total net growth of sawtimber volume in 1971 was 45 million board feet, and sawtimber volume removals totaled 34 million board feet. The removals in 1971 as a percent of net growth (75 percent) were about the same as in 1956 (72 percent). Like growing stock, the sawtimber removals and net growth differed considerably for the softwood and hardwood species groups. Removals of softwood sawtimber volume in 1971 (12 million board feet) were 14 percent less than the net growth of 14 million board feet. Removals of hardwood sawtimber volume (22 million board feet) were 29 percent less than the net growth of 31 million board feet.

Figure 7.—Net growth and removals of growing stock by species, 1971.



Timber-Products Output

The timber-products output estimates for 1970 (tables 33, 34, and 35) should not be confused with the estimates of timber removals for 1971 (tables 29 and 30). More than just the year is different. Timber-products output is that portion of total timber removals that was used for products. In addition to timber removed for products, such as sawlogs and pulpwood bolts, timber removals include logging residues and other removals such as in land-clearing.

Data for timber-products were obtained from a field canvass of all known primary-wood manufacturers that operated in New Jersey in 1970. Utilization studies were conducted concurrent with logging operations within the State. Data from both sources were utilized to analyze the 1970 timber harvest and output of timber products.

The production of timber products in New Jersey from all sources totaled 11.4 million cubic feet in 1970, a decrease of 26 percent from the total output of 15.5 million cubic feet in 1955. The sources of the 1970 timber-products output and their volumes are:

	Million cubic feet	*Percent*
Growing-stock volume		
Softwoods	3.3	29
Hardwoods	5.6	49
Total growing stock	8.9	78
Other sources	1.6	14
Total roundwood volume	10.5	92
Plant byproducts	.9	8
Total, all sources	11.4	100

Other sources in the above tabualtion include utilized volume from trees less than 5.0 inches dbh, nongrowing-stock trees on commercial forest land, and trees from nonforest land such as fence rows.

In 1970 softwoods made up 35 percent of the total output volume and 38 percent of the roundwood output (4.0 million cubic feet). Hardwoods made up 65 percent of the total output volume and 62 percent of the roundwood output (6.5 million cubic feet). Compared to 1955, softwood output from roundwood decreased by almost 50 percent while the corresponding hardwood output decreased by about 8 percent.

Changes in roundwood production between 1955 and 1970 by products and species groups were very pronounced. Total sawlog volume of roundwood production decreased by one-third to 2.1 million cubic feet, due to a 75 percent decrease in the softwood sawlog production. Total pulpwood production decreased about 45 percent to 3.7 million cubic feet. Softwood pulpwood production decreased about 40 percent, and hardwoods decreased about 60 percent. Piling and veneer logs were the only timber products that increased in volume, but together (0.5 million cubic feet) they made up only 5 percent of the total roundwood production. The changes in industrial roundwood production are shown in greater detail in the report, *The Timber Industries of New Jersey and Delaware* (*2*). The 1970 roundwood production in New Jersey from all sources and by products is:

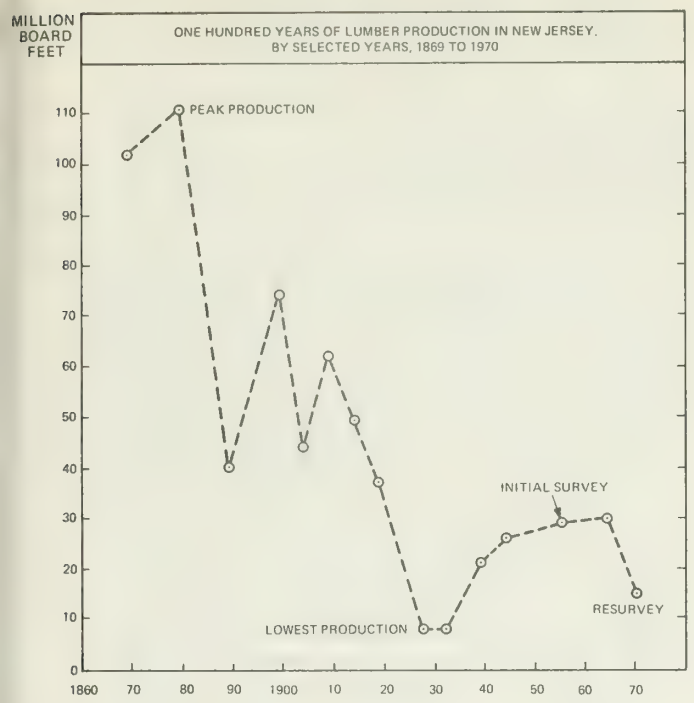
	Million cubic feet	*Percent*
Sawlogs	2.1	20
Veneer logs	.2	2
Pulpwood bolts	3.7	35
Piling	.3	3
Other industrial	1.0	10
Fuelwood	3.2	30
Total	10.5	100

Lumber and Sawlogs

Historically, lumber production in New Jersey has fluctuated widely. It reached a record high or 111 million board feet in 1879, but 10 years later the production dropped to 40 million board feet. From another peak production of 62 million board feet in 1909, an all-time low of 8 million board feet was reached in 1928 and again in 1932 (*5*). Production rose to 30 million board feet in 1964 *(9)* and dropped sharply to 15 million board feet in 1970 (fig. 8).

The big drop in lumber production in recent years is attributable to the large decrease of sawlogs brought in from other states. Sawlogs from neighboring states (12 million board feet) in 1955 made up 41 percent of the vol-

Figure 8.—100 years of lumber production, 1869-1970.



ume sawed by sawmills in New Jersey. Sawlogs from out-of-state in 1970 (1.5 million board feet) made up only 10 percent of the volume sawed.

There were about 150 active sawmills in the State in 1955, and they produced a total of 29 million board feet of lumber. Now there are about one-third that number (45 commercial sawmills); they sawed 15 million board feet of lumber in 1970. About 85 percent (11.7 million board feet) of the total sawlog production in 1970 (13.8 million board feet) was from the hardwood species group, principally oak. At the time of the initial survey in 1955, hardwoods made up about 60 percent of the total production.

Pulpwood

Pulpwood bolts (46.5 thousand cords) made up more than one-third of the total volume of roundwood produced in 1970. In 1955, pulpwood bolts (84.6 thousand cords) made up almost half of the total roundwood volume produced. The 1970 pulpwood production from roundwood was 45 percent less than what it was in 1955. And in addition to the 3.7 million cubic feet of roundwood pulpwood produced in 1970, there were 74 thousand cubic feet of pulpwood equivalent that came from plant by-products.

Most of the pulpwood that was harvested from the softwood species—3.1 out of 3.7 million cubic feet—came from three counties: Burlington (1.2), Camden (0.6), and Gloucester (0.6). The remaining 0.7 million cubic feet of softwood pulpwood came from three other southern counties. Relationships of New Jersey's pulpwood production to that for other states are given in *Pulpwood production in the Northeast, 1970* (*3*).

Three pulpmills that use wood chips were operating in the State in 1970, but they were not dependent upon pulpwood cut from timber stands. Most of the pulp was produced from waste paper, cardboard, and other fiber products. Woodpulp made up only a small part of the total pulp produced. The pulp production from these mills was used in the manufacture of roofing paper and insulation board.

Other Products

Veneer logs and bolts, piles, poles, posts, fuelwood, and miscellaneous products (total of 4.7 million cubic feet) accounted for 45 percent of the timber products output from roundwood for 1970. These products (5.6 million cubic feet) made up 36 percent of the roundwood output in 1955.

The 1970 outputs of roundwood volume for these other products (in cubic feet and percent) and percent from the hardwood species are:

	Million cubic feet	*Percent*	*Percent hardwood*
Veneer logs	0.2	4	100
Piling	.3	6	87
Poles	.4	9	100
Posts	—	—	0
Fuelwood	3.2	68	100
Miscellaneous	.6	13	12
Total	4.7	100	87

Fuelwood output (3.2 million cubic feet) made up more than two-thirds of the above 4.7 million cubic feet and 31 percent of the total roundwood volume. About 80 percent of the roundwood came from growing stock and 20 percent came from other sources such as

trees less than 5.0 inches dbh and trees from nonforest land. In addition to the roundwood output, another 0.8 million cubic feet of fuelwood came from plant byproducts.

Economic Importance of the Timber Resource

New Jersey is a highly urbanized state: 11 of its 21 counties are included in the U.S. Bureau of the Census's Standard Metropolitan Statistical Areas. The State also has the highest density of population in the Nation, with 953 persons per square mile (*10*). Still it has large areas of farmland under cultivation (about 500,000 acres)—more than 10 percent of its land area (*6*)—and commercial forest land makes up 38 percent of the total (just under 2 million acres). Timber products do not make as important a contribution to the State's economy as they do in most eastern states.

According to the U.S. Bureau of the Census, the manufacturing industry in New Jersey accounted for about 45 percent (0.9 million employees) of the State's employment of 2.0 million employees and 50 percent ($1.5 billion) of the State's payroll of $3.0 billion, in the first quarter of 1969 (*8*). But timber-based industries made up a very small part of the manufacturing industries. Of the 14,740 manufacturing establishments in New Jersey that had a total of 831,000 employees in 1967, only 1,067 establishments with about 47,000 employees (5 percent of the total) were in the timber-based industries.

The timber-based industries, SIC-24, -25, -26 (Standard Industrial Classification by the U.S. Bureau of the Census), employed a net total of 42,800 persons, excluding 3,900 workers in the metal furniture and fixture industry sub-groups (SIC-26). The lumber and wood products industry (SIC-24) employed 4,700 workers; the furniture and fixtures industry (SIC-25, wood only) employed 5,900 workers; and the paper and allied products industry (SIC-26) employed 32,200*(7)*.

Value added by manufacturing is indicative of the relative economic importance of a manufacturing industry. Value added is the difference between the cost of goods and services purchased by a manufacturer and the value of the products sold. The U.S. Bureau of the Census reported that in New Jersey, the value added by manufacturing in 1967 totaled $12,738 million. The value added by the timber-based industries exceeded $600 million, about 5 percent of the State total.

The lumber and wood products industry created $48 million value added; the furniture and fixtures industry (excluding $42 million in the metal furniture and fixtures industry subgroups) created $64 million value added; and the paper and allied products industry created $452 million value added, a net total for the three timber-based industries of $564 million in value added.

How Much Timber Could be Harvested?

The objectives of the Forest Survey in New Jersey were to estimate the volume, condition, composition, timber growth and removals, and trends between surveys, and to analyze the timber-resource situation. No attempt has been made to determine the volume of timber in New Jersey that may be bought or sold; but ownership data were gathered in the forest survey, and a study of private commercial forest-land ownership is under way that may provide some answers to the question of availability of privately owned timber.

The total net growth of growing stock in 1971 was 24.9 million cubic feet. Growing-stock removals totaled only 16.0 million cubic feet, or a favorable difference of 8.9 million cubic feet between growth and removals. This difference is often thought of as the volume of additional timber that is available for harvest each year without detriment to the growing-stock base. But the actual volume that is available for harvest statewide is usually much less than this difference for several reasons.

Ownership is one reason. The bulk of the

annual net growth (20.6 million cubic feet)is in the farmer and miscellaneous private ownerships. Many of these owners may be unwilling to sell timber under any circumstances. Others may be unwilling to sell at current market prices, or they may set conditions on removals that would make harvesting unprofitable. The ownership study by the Northeastern Station revealed that 16 percent of the State's privately owned commercial forest land is owned by people who plan to harvest timber within the next 10 years. Another 35 percent is owned by those who are indefinite about future harvests, and the remaining 49 percent is owned by those who never intend to harvest timber.

Based on the answers from the ownership study, a maxium of 788,700 acres, or 51 percent, of the privately owned commercial forest land may be considered available for timber harvesting. However, only 26 percent of the privately owned commercial forest land—398,900 acres—is owned by people who have harvested timber in the past. Considering the low percentage of forest land held by owners who have harvested timber and the high proportion of forest land held by owners with indefinite future timber harvesting plans, a more realistic estimate would be about 50 percent of the commercial forest land, or not more than 770,000 acres.

About 64 percent of the estimated 63,650 owners have owned their land for 10 years or longer. Forty-seven percent of the owners indicated that the primay reason for owning forest land was that it was part of their residence. Twenty-eight percent of the owners (who own 38 percent of the commercial forest land) gave land investment as the most important reason for owning forest land. About 1 percent of the owners (owning less than 2 percent of the commercial forest land) gave timber production as their major reason for owning forest land.

Economics is another reason why all the growth may not be available for harvest. Log markets are disappearing, and there are relatively few primary log-processors left. Areas with too little volume per acre and too far from markets cannot be harvested profitably. On other areas, the timber may be too small to be marketable; or the timber may be predominantly of a species or quality that is unsalable.

Species composition is another reason why actual volume that may be harvested is much less than the growth. The volume of northern red oak, sweetgum, and all softwood species except pitch pine decreased between surveys due to a greater volume of removals than net growth. Such overcutting cannot continue indefinitely without reducing the inventory volume of these species to a point where the stands will not be worth harvesting.

The tables in the appendix provide a guide for those who wish to locate timber supplies. They do not answer the question of whether the timber is available for sale. The tables can only serve to point out areas where timber may be available, and that may warrant further investigation by the prospective buyer.

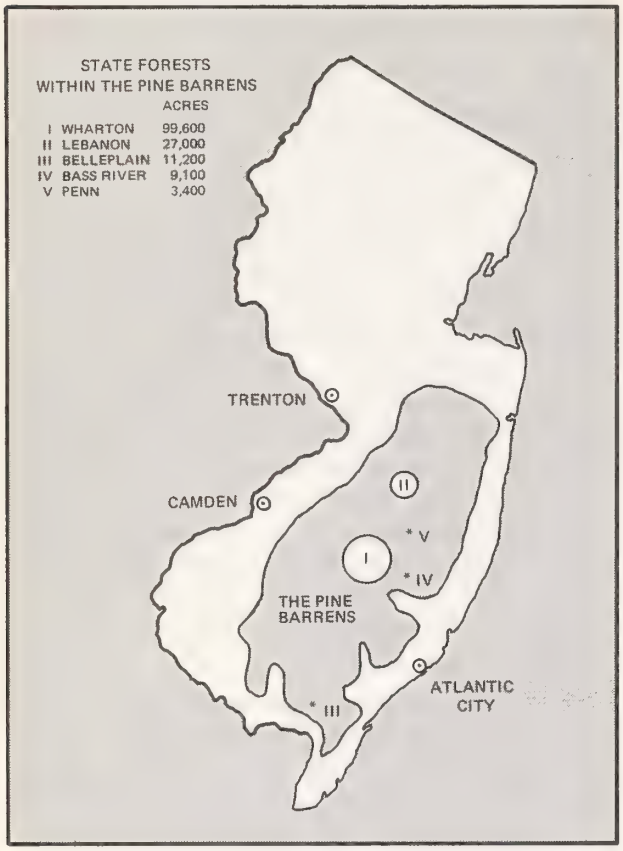
Other Values of the Timber Resource

Although the timber resource in New Jersey is important for wood products, it has considerable value for other uses—potable water supplies, recreation, and wildlife management.

In southeastern New Jersey is an extensive wildland area—the Pine Barrens—of about 1.1 million acres (fig. 9). The borders of the Pine Barrens lie only 25 miles from Philadelphia, and 35 miles from New York City. The area is almost entirely forested, has but few widely spread settlements, lacks industrialization, and is free from upland agricultural development (*1*). Recommendations were made as early as 1895 to preserve a large part of the Pine Barrens for water supply, recreational, forestry, and scientific purposes.

The Wharton State Forest (99,600 acres) is a multiple-use area occupying portions of three counties—Atlantic, Burlington, and Camden—and is part of the Pine Barrens. It was purchased by the State in 1954 to preserve a potential water supply (underground water), to preserve historic features, and to provide recreational land and water for public enjoyment, in addition to management for forest products. This forest contains a great untapped source of good water, possibly enough to satisfy the increasing demands in southern New Jersey for a century or more (New Jer-

Figure 9.—The Pine Barrens cover about one-fifth of the State.



sey Department of Conservation and Economic Development).

Lebanon, Penn, Bass River, and Belleplain State Forests (a total of 50,700 acres) are also located within the Pine Barrens. These forests were acquired by the State, beginning in 1908, for the benefit and enjoyment of the public as well as for timber production, wildlife management, and conservation of water supplies.

The value of developed water supplies from the watersheds in New Jersey has recently been estimated to be more than $200 per acre per year, based upon the assumption that water on protected areas is worth one-tenth of its market price when impounded, piped, and treated.

Outdoor recreational values in New Jersey are high, and the forests contribute considerably to those values (fig. 10). The 10 state forests with a gross area of 175,500 acres, including some of the finest North Jersey mountain country and large areas of the Pine Barrens, provide year-around recreational use. Seven state forests have campsites developed for family camping, 6 provide opportunities for fishing, 8 have improved picnic areas, and all 10 have hiking trails and hunting areas.

Twenty-four state parks (gross area of 47,800 acres) have been established to provide facilities for outdoor recreation, to preserve the native flora and fauna, and to preserve areas of historic importance. Most of them are forest parks and wildlife sanctuaries where hunting is prohibited. But fishing is available in all but 4 of the parks. Improved campsites are available in 8 parks and hiking trails are located in 11.

People use the state forests and parks for hiking, horseback or bike riding, motoring,

Figure 10.—State forests, parks, and recreation campsites can provide accommodations for 1,058 individual trailers or campers.

boating, camping, swimming, picnicking, bird-watching, identifying or admiring wild flowers, and hunting or fishing where permitted. For the 12-month period ended June 30, 1972, the Bureau of Parks reported that attendance in the forests and parks was 4.1 million, and that the income realized from these two sources was almost $1.3 million.

About 127,800 acres of prime wetlands, uplands, and water areas in 40 units were acquired as fish and wildlife management areas. These management areas are available to all citizens for hunting, fishing, birding, hiking, or just outdoor appreciation. Also, about 30,000 acres in four National Wildlife Refuges are located in New Jersey. Many thousands of additional acres of lands in state forests and parks are being managed for the benefit of all wildlife—game and nongame alike.

Much of the privately owned forest land in New Jersey receives use similar to that already described for state-owned forests, parks, and game management areas. There are tracts owned by Boy Scouts, Girl Scouts, church groups, gunning clubs, and other groups where recreation is the primary use. Many forest-land owners retain their ownership partly because they wish to own some land and partly because it provides a place for their own private recreation.

Seventeen state forests and parks have campgrounds with 376 campsites in the northern counties and 682 campsites in the southern counties (*4*). In 1972, the fees totaled about $17,000 per week when all available campsites were occupied (fig. 10). In addition to camping facilities on state-owned land, there are 135 privately owned campgrounds in the State; only 15 of these are in the northern counties. The greatest concentration of campgrounds is in Cape May County—a total of 35 campgrounds. Most of the private and public campgrounds in the State are in or adjacent to wooded areas where they benefit from the trees, and the choice campsites are nestled among the forest trees. The total number of camper-days spent in privately owned campgrounds at an average price of $4.00 per day yields a gross income of about $6.5 million per year.

Monetary returns to the forest-land owner, both public and private, for camping, hunting, fishing, and other recreational use are considerable, as are the water and forest-product values. Intangible products of the forests—such as their natural beauty and the reduction of air and water pollutants by the forests—must also be considered when placing a value on forest lands.

Timber-Supply Outlook

The change in the timber-resource situation in New Jersey from 1956 to 1972 has been described. Briefly stated, timber removals of softwood growing stock exceeded net growth during the period between surveys, and the softwood inventory volume decreased 7 percent. Hardwood growing-stock removals, however, were less than net growth; and the hardwood inventory volume increased 15 percent. Total growing-stock inventory volume of the combined species groups increased 10 percent.

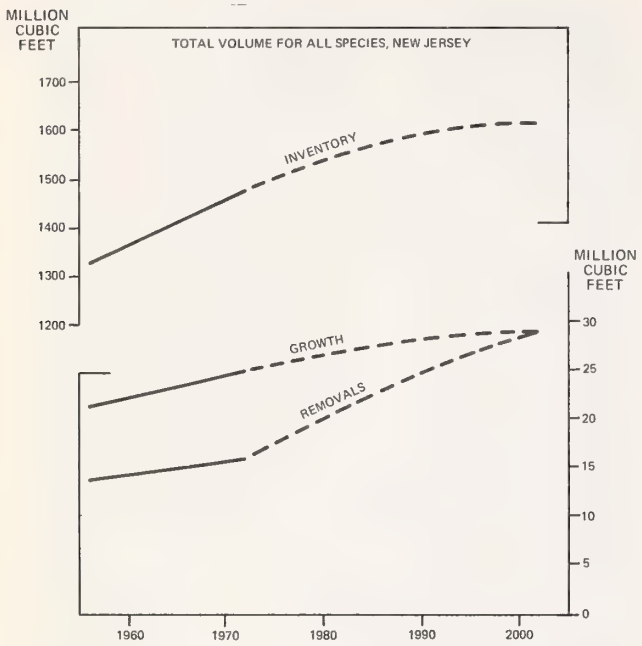
An important question to be answered about the timber supply in New Jersey is: What might be the supply situation in 30 years? In answer to this question, two separate 30-year supply forecasts, based upon different basic assumptions, are presented below.

Both 30-year projections, however, have three assumptions in common: (1) the total area of commercial forest land in New Jersey has stabilized at 1.8 million acres, and no further significant changes in land use is expected; (2) the diameter-growth rates by species groups based upon the average annual growth between surveys will continue the same; and (3) trends in forestry programs of the Department of Environmental Protection will continue at the same rate as in the past.

First Projection: Growth Equals Removals in 2002

The first projection is based on the objective that the annual net growth and removals of growing-stock volume will be brought into

Figure 11.—First projection: Growth equals removals in 2002.



balance in 30 years. Net annual growth for 1972 was 24.9 million cubic feet, and removals totaled 16.0 million cubic feet. They would come into balance at 29.0 million cubic feet in 2002 (fig. 11). Timber available for cutting during the 30-year period is assumed to be that amount that will bring net annual growth and timber removals of the present inventory into balance at the end of 30 years. From the table of projected volumes of timber removals and corresponding annual net growth for softwoods and hardwoods (table 37), the following tabulation shows for specified years the annual growth and available cut, in millions of cubic feet:

	ALL SPECIES		*SOFTWOODS ONLY*	
Year	*Annual growth*	*Available cut*	*Annual growth*	*Available cut*
1972	24.9	16.0	5.1	6.2
1982	27.0	20.9	4.8	5.7
1992	28.4	25.3	4.5	4.9
2002	29.0	29.0	4.2	4.2

Under this projection, the inventory volume of growing stock would increase from 1,470 million cubic feet in 1972 to 1,603 million cubic feet in 2002. However, this increase would take place entirely within the hardwood species group. The hardwood inventory volume would increase 12 percent to 1,364 million cubic feet, but the softwood inventory volume would decrease 7 percent to 239 million cubic feet. In order for annual net growth and annual removals to come into balance at the end of the 30-year period, timber cutting of hardwoods must increase from present levels.

Second Projection: Removals Follow 1955-71 Trend

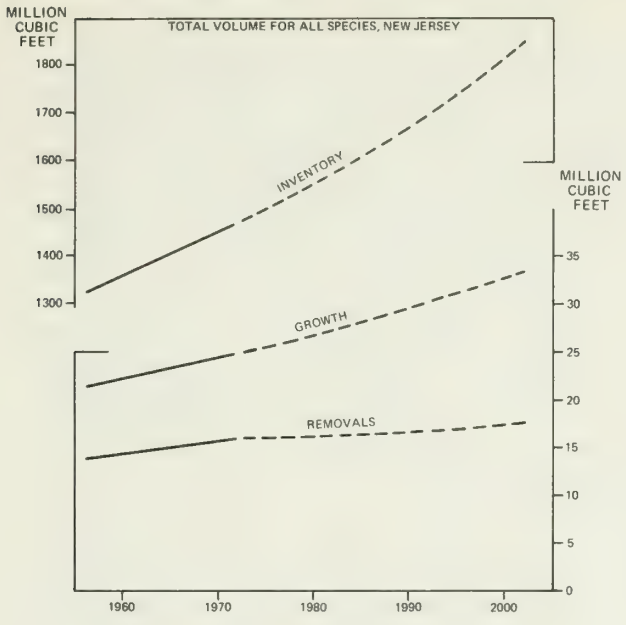
The second projection is based on the assumption that the trend of past timber removals (1955-71) will continue through the next 30 years. Growing-stock removals rates for softwoods are considerably different from those for hardwoods. Softwood growing-stock removals in 1956 were 6.4 million cubic feet and in 1971 they were 6.2 million cubic feet, a decrease of about 3 percent. Hardwood growing-stock removals during the same period increased from 7.4 to 9.8 million cubic feet, an increase of more than 30 percent.

Current timber removals in New Jersey (16.0 million cubic feet of all species) were about 65 percent of net growth in 1971 (24.9 million cubic feet). Under the present trend projections, total removals of growing-stock volume would increase to 17.7 million cubic feet in 2002. Annual net growth would increase to 33.7 million cubic feet. Therefore, timber removals would be about 53 percent of net growth. During the 30-year period, the total growing-stock inventory volume would increase from 1,470 million to 1,851 million cubic feet (fig. 12).

The combined inventory volume of softwoods and hardwoods would increase about 26 percent in the 30-year period. Softwoods made up 17.5 percent of the 1972 inventory volume and will decrease to 12.5 percent of the inventory volume in 2002 if present trends continue.

During the 30-year period, annual timber removals of all species will increase slightly more than 10 percent, and annual net growth will increase about 35 percent. However, since softwood growing-stock volume in New Jersey

Figure 12.—Second projection: Removals continue present trends.



is being overcut, the present trends projections show that softwood growing-stock volume removals in 2001 will be about 18 percent less than what they were in 1971 and that hardwood removals will be about 28 percent more.

Based on the answers from the ownership study, a maximum of 789,000 acres of privately owned commercial forest land may be considered available for timber harvesting as of 1972. Trend of removals to 2002 based upon trend between surveys (as shown in fig. 12) would be the same, regardless of whether or not the results of the ownership study are considered. The growth and inventory volume trends, as shown in the figure, include volumes on privately owned commercial forest land regardless of the availability. The volume of growth on land available for timber harvesting would be approximately the same as the volume of removals. There probably would be no increase in inventory volume that would be available for cutting during the next 30 years, unless there are changes in demands, markets, and owners' intentions.

Management Opportunities

If present trends of annual net growth and timber removals continue, softwood removals will continue to be greater than growth, and the resultant growing-stock volume of softwoods in 30 years will decrease more than 10 percent. One of the timber-management objectives might be to increase the annual rate of net growth for softwood growing stock, which was less than 2.0 percent of the inventory in 1972.

Four measures to improve species composition, timber quality, and tree size—(1) protection of the timber resource, (2) timber-stand improvement, (3) postponement of harvest cuts in young stands, and (4) harvest cuttings and related treatments—were described in detail by Webster and Stoltenberg in the previous timber resource report (*12*).

Protection of the timber resource continues to be important. Wildfires, gypsy moths and other insects, and poor composition from past cutting, grazing, or other abuse are largely responsible for the low growth rates of softwoods and hardwoods in New Jersey. In the pine forest type—with advice and assistance of New Jersey Bureau of Forestry foresters—woodland owners may use prescribed or controlled burning to reduce fuels and make fires easier to control and less destructive.

Severe, reepated wildfires in the Pine Barrens keep large areas of forest land in seedling-sapling stands and reduce the area of the most valuable forest type—the Atlantic white-cedar. During the past 10 years, there has been an average of 1,516 forest fires; and they have burned more than 31,000 acres each year.

The gypsy moth is the most serious pest of trees in New Jersey. Gypsy-moth caterpillars feed on leaves of forest, shade, and fruit trees. No trees appear to be immune to them. Scientists state that gypsy moth research and control is a high-priority program because of the large number of trees killed or damaged by

the pest each year. The extent of defoliation varies greatly by species. For example, oaks are often completely defoliated, while intermingled yellow-poplars may escape defoliation. In the Newark watershed alone, more than 1,000,000 oaks, 9,000 eastern hemlocks, and 8,000 white pines were killed in 1971 as the direct result of a 3-year gypsy moth infestation.

DDT was used to control or eradicate the gypsy moths until 1963. Since then, an insecticide called carbaryl (which is low in toxicity to humans, birds, other warm-blooded animals, and fish) has been used. A variety of nonchemical methods for combating the moth are being tested—several species of parasites, and disease-producing micro-organisms, and sterilization of male moths.

Forest protection against fire, insects, and disease is considered a public responsibility. Protection programs are carried out by the State on forest land irrespective of ownership. Owners of privately owned forest land have to decide and carry out—possibly through agents—harvesting, timber-stand improvement, or regeneration measures.

More than 80 percent of the commercial forest land is in private ownership, and most of the private holdings are too small to justify employing a professional forester. The Bureau of Forestry in the Department of Environmental Protection offers forestry services to all landowners interested in managing their forest land. A State-employed forester will meet with the landowner, examine the woodlot with him, and specify a forest-management plan that may include harvest cuttings, tree planting, and stand improvement. Requests for this service can be made directly to the Bureau of Forestry or through County Agricultural Agents and Soil Conservation Service district supervisors.

The oak-hickory forest type in the northern counties and the pitch pine type in the southern counties make up about two-thirds of the commercial forest land in New Jersey. The oak-hickory is one of the 37 major forest types in the United States for which biologically feasible silvicultural systems and supporting information have been summarized for the timber-resource managers by the U.S. Forest Service in U.S. Department of Agriculture Handbook 445 (*11*).

The New Jersey Bureau of Forestry has acquired much information on managing the oak-hickory forest type in the State—partly through experience and partly through research by the Bureau and Station. Because oaks, sweetgum, and especially yellow-poplar are less tolerant of shade than such associated species as the maples, sweet birth, and blackgum, some form of even-aged management is needed—although canopy holes can be as small as 1 acre.

When forest openings in the pitch pine forest type are created by fires, windthrow, or other major disturbance, the pines seed in on the open land. After 20 to 30 years, the pine stands (in those openings) are invaded by hardwoods, which are more tolerant of shade than the pines, and which compete so strongly with pine reproduction for light and moisture that few pine seedlings are able to survive. Thus, mature stands of pine commonly contain a dense understory of young hardwoods.

Except on the best sites, the silvicultural objective for timber production in the pitch pine and oak-pine types usually is to increase the pine and diminish the hardwood components. Pine is favored over the hardwoods because of the greater demand for pine lumber and pulpwood. Pines grow satisfactorily and produce moderate amounts of wood even on light, infertile soils, whereas on such sites the hardwoods are of poor quality, grow slower, and produce lower yields. To obtain maximum pine stocking in future stands, harvest cuttings must be accompanied by methods of hardwood control, such as prescribed fire, use of herbicides, or mechanical site preparation.

The eastern white pine forest type and the northern hardwood type are found only in the northwestern counties in the State. Growth characteristics of eastern white pine indicate that it can best be grown under even-aged stand conditions, although there is considerable leeway in choosing regeneration methods. White pine has been successfully regenerated by a wide variety of methods, including clearcutting in blocks and strips, and by seed-tree, shelterwood, and group selection cuttings. Sin-

gle-tree selection cutting has not proved satisfactory.

The northern hardwood forest type occurs rarely in New Jersey. These stands are often composed of sugar maple, beech, sweet birch, and hemlock in varying mixtures. It is the only New Jersey forest type where the selection system (harvesting of trees singly or in very small groups) provides conditions suitable for maintaining the present composition.

Research by the Bureau and Station, and experience, has provided a large amount of information directly applicable to managing the several forest types found in New Jersey. Much of this information, including that for shortleaf pine and Atlantic white-cedar, has been presented in their publications. Bureau foresters can provide landowners with current information on management techniques applicable to each stand to meet its owner's objectives.

Management of forest land for other than timber is also a possibility. The value of the forests in relation to family camping has already been described. There is an excellent potential for fees from people who seek permission to use nature trails designed and built by the woodland owner. There may be a market for this type of recreation in New Jersey.

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Appendix

Definition of Terms

Land Area Classes

Land area.—(a) Bureau of the Census. The area of dry land and land that is temporarily or partly covered by water, such as marshes, swamps, and river flood plains; streams, sloughs, estuaries, and canals that are less than ⅛ statute mile in width; and lakes, reservoirs, and ponds that are less than 40 acres in area. (b) Forest Survey. The same as the Bureau of the Census, except that the minimum width of streams, etc., is 120 feet, and the minimum size of lakes, etc., is 1 acre.

Forest land.—Land that is at least 16.7 percent stocked (contains at least 7.5 square feet of basal area) by forest trees of any size, or that formerly had such tree cover and is not currently developed for nonforest use. (Forest trees are woody plants that have a well-developed stem and usually are more than 12 feet in height at maturity.) The minimum area for classification of forest land is 1 acre.

Commercial forest land.—Forest land that is producing or capable of producing crops of industrial wood (more than 20 cubic feet per acre per year) and is not withdrawn from timber utilization. (Industrial wood: all roundwood products, except fuelwood.)

Noncommercial forest land.—Forest land that is incapable of yielding timber crops because of adverse site conditions (unproductive forest land), and productive forest land that is withdrawn from commercial timber use (productive-reserved forest land).

Productive-reserved forest land.—Forest land that is sufficiently productive to qualify as commercial forest land, but is withdrawn from timber utilization through statute, administrative designation, or exclusive use for Christmas-tree production.

Unproductive 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.

Nonforest land.—Land that has never supported forests, and land formerly forested but now in nonforest use such as for crops, improved pasture, residential areas, and the like.

Ownership Classes

Federal.—Lands (other than National Forests) that are administered by Federal agencies.

State.—Lands that are owned by the State of New Jersey or leased to the State for 50 years or more.

County and municipal.—Lands that are owned by counties and local public agencies or municipalities or leased to them for 50 years or more.

Forest industry.—Lands that are owned by companies or individuals operating wood-using plants.

Farmer-owned.—Lands that are owned by farm operators, whether part of the farmstead or not. Excludes land leased by farm operators from nonfarm owners.

Miscellaneous private.—Privately owned lands other than forest-industry and farmer-owned lands.

Stand-size Classes

Stand.—A growth of trees (see definitions under "Tree Classes") on a minimum of 1 acre of forest land that is at least 16.7 percent stocked by forest trees of any size.

Sawtimber stands.—Stands that are at least 16.7 percent stocked with growing-stock trees, with half or more of total stocking in sawtimber or poletimber trees, and with sawtimber stocking at least equal to poletimber stocking.

Poletimber stands.—Stands that are at least 16.7 percent stocked with growing-stock trees, of which half or more of this stocking is in poletimber and/or sawtimber trees and with poletimber stocking exceeding that of sawtimber.

Sapling-seedling stands.—Stands that are at least 16.7 percent stocked with growing-stock trees, of which more than half of the stocking is saplings and/or seedlings.

Nonstocked areas.—Commercial forest land that is less than 16.7 percent stocked with growing-stock trees.

Stocking Classes

Stocking.—The degree of occupancy of land by trees, measured in terms of basal area of trees in a stand compared to the basal area of trees required to utilize fully the growth potential of the land. The actual stocking at a point was evaluated against a standard of 75 square feet of basal area per acre (see definition of basal area under "Tree Measurement and Volume"). The stocking percentage for a sample plot is derived from the stocking for each of 10 points. Three categories of stocking are used:

All live trees.—These are used in the classification of forest land and forest types.
Growing-stock trees.—These are used in the classification of stand-size classes.
Desirable trees.—These are used in the classification of area-condition classes.

The degree of plot stocking is viewed as a range of values rather than single points. A fully stocked stand lies within the range of 100 to 133 percent of the basal-area standard. An overstocked stand contains more than 133 percent. The range for medium stocking is 60 to 100 percent and for poor stocking is 16.7 to 60 percent of the basal-area standard. Forest land with less than 16.7 percent of the basal-area standard is classed as nonstocked.

Tree Classes

Forest trees.—Woody plants that have a well-developed stem and usually are more than 12 feet in height at maturity.

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

Growing-stock trees.—Live trees of commercial species that are classified as sawtimber, poletimber, saplings, and seedlings; that is, all live trees of com-

mercial species except rough and rotten trees. (See definitions under "Class of timber.")

Acceptable trees.—Growing-stock trees of commercial species that meet specified standards of size and quality, but do not qualify as desirable trees.

Desirable trees.—Growing-stock trees of commercial species, (a) that have no serious quality defects that limit present or prospective use for timber products, (b) that are of relatively high vigor, and (c) that contain no pathogens that may result in death or serious deterioration before rotation age.

Rotten trees.—Live trees of commercial species that do not contain at least one 12-foot sawlog or two noncontiguous sawlogs, each 8 feet or longer, now or prospectively, and do not meet regional specifications for freedom from defect primarily because of rot; that is, when more than 50 percent of the cull volume in a tree is rotten.

Rough trees.—(a) The same as above, except that rough trees do not meet regional specifications for freedom from defect primarily because of roughness or poor form, and (b) all live trees that are of noncommercial species.

Site-quality Classes

Site class.—A classification of forest land in terms of inherent capacity to grow crops of industrial wood. Classifications are based upon the mean annual growth of growing stock attainable in fully stocked natural stands at culmination of mean annual growth.

Forest Types

Forest type.—A classification of forest land based upon the species forming a plurality of live-tree stocking. The many local forest types in New Jersey were combined into the following major forest types:

White pine-hemlock.—Forests in which eastern white pine or hemlock, singly or in combination, make up a plurality of the stocking. (Common associates include aspen, birch, and maple.)

Pitch-shortleaf pine (yellow pine).—Forests in which pitch pine, shortleaf pine, or other southern yellow pines, singly or in combination, make up a plurality of the stocking. Includes a small acreage of the eastern redcedar type. (Common associates include sweetgum, black tupelo, and southern red oak.)

Oak-pine.—Forests in which oaks or hickory, singly or in combination, make up a plurality of the stocking, but in which southern pines make up 25 to 50 percent of the stocking.

Oak-hickory.—Forests in which oaks or hickory, singly or in combination, make up a plurality of the stocking, except where southern pines make up 25 to 50 percent, in which case the stand would be classified oak-pine. (Common associates include yellow-poplar, sweetgum, and red maple.)

Oak-gum.—Bottom land forests in which oak, or gum, singly or in combination, make up a plurality of the stocking, except where pines make up 25 to 50 percent, in which case the stand would be classed as oak-pine. Includes a small acreage of the Atlantic white-cedar forest type. (Common associates include beech, river birch, and sycamore.)

Elm-ash-red maple.—Forests in which elm, ash, or red maple, singly or in combination, make up a plurality of the stocking. (Common associates include beech, sycamore, and gum.)

Maple-beech-birch.—Forests in which sugar maple, beech, or yellow birch, singly or in combination, make up a plurality of the stocking. Includes a small acreage of the black cherry forest type. (Common associates include sweet birch, hemlock, and white pine.)

Class of Timber

Softwoods.—Coniferous trees that are usually evergreen, having needlles or scalelike leaves.

Hardwoods.—Dicotyledonous trees that are usually broad-leaved and deciduous.

Sawtimber trees.—Live trees of commercial species, (a) that are of the following minimum diameters at breast height—softwoods 9.0 inches and hardwoods 11.0 inches, and (b) that contain at least one 12-foot merchantable sawlog and meet regional specifications for freedom from defect.

Poletimber trees.—Live trees of commercial species that meet regional specifications of soundness and form, and are at least 5.0 inches dbh but are smaller than sawtimber size.

Saplings.—Live trees of commercial species that are 1.0 to 5.0 inches dbh and of good form and vigor.

Seedlings.—Live trees of commercial species that are less than 1.0 inch dbh and are expected to survive.

Rough and rotten trees.—See definitions under "Tree Classes."

Timber Measurement and Volume

Basal area.—The area in square feet of the cross section at breast height of a single tree, or of all the trees in a stand, usually expressed as square feet of basal area per acre.

Board feet.—A unit of lumber measurement 1 foot long, and 1 foot wide, and 1 inch thick, or its equivalent. By forest-survey convention, softwoods less than 9.0 inches dbh and hardwoods less than 11.0 inches dbh do not contain board-foot volume.

Diameter at breast height (dbh).—The diameter outside bark of a standing tree measured at 4½ feet above the ground.

Growing-stock volume.—Net volume, in cubic feet, of live growing-stock trees that are 5.0 inches dbh and over, from a 1-foot stump to a minimum 4.0-inch top diameter outside bark of the central stem, or to the point where the central stem breaks into limbs. Net volume equals gross volume less deduction for rot.

International ¼-inch rule.—A log rule, or formula, for estimating the board-foot volume of logs. Stated mathematically, the formula is $[(D^2 \times 0.22) - 0.71 D] \times 0.904762$ for 4-foot sections, where D = the diameter inside bark at the small end of the 4-foot section. The International ¼-inch rule is used as the USDA Forest Service standard log rule in the northeastern United States.

Standard cord.—A unit of measure for stacked bolts of wood, encompassing 128 cubic feet of wood, bark, and air space. Cord estimates can be derived from cubic-foot estimates of growing stock by apply-

ing an average factor of 80 cubic feet of wood (inside bark) per rough cord.

Sawtimber volume.—Net volume in board feet, International ¼-inch rule, of merchantable sawlogs in live sawtimber trees. Net volume equals gross volume less deductions for rot, sweep, and other defects that affect use for lumber.

Sawlog.—A log that meets minimum standards of diameter, length, and defect, including logs at least 8 feet long, and with a minimum diameter inside bark of 6 inches for softwoods and 8 inches for hardwoods. (See specifications under "Log Grade Classification.")

Sawlog portion.—That part of the bole of a sawtimber tree between the stump and the sawlog top (merchantable height).

Sawlog top.—The point on the bole of a sawtimber tree above which a sawlog cannot be produced. The minimum sawlog top is 7.0 inches d.o.b. (diameter outside bark) for softwoods and 9.0 inches d.o.b. for hardwoods.

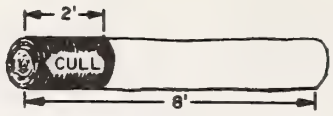
Upper-stem portion.—That part of the main stem or fork of a sawtimber tree above the sawlog top to a diameter of 4.0 inches outside bark or to the point where the main stem or fork breaks into limbs.

Log Grade Classification

Log grades are a classification of logs based on external characteristics as indicators of quality or value. The log-grade standards and grading systems for softwood and hardwood species used in this forest survey of New Jersey are shown in the following specifications:

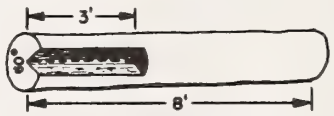
METHODS USED TO DETERMINE SCALING DEDUCTION

(Examples based on an 8-foot log with 20-inch scaling diameter)



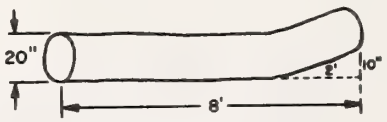
If section of bole is affected, deduct percent of log length affected.

Example $\frac{2}{8}$ = 25 percent cull



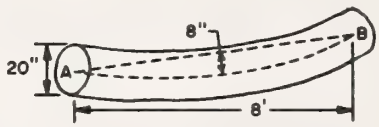
If sector is affected, multiply percent of circle times percent of length.

Example: $\frac{60°}{360°} \times \frac{3}{8}$ = 6 percent cull



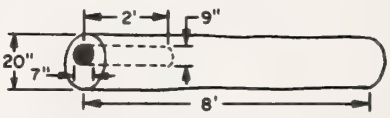
For a crook, multiply proportion of diameter displaced times proportion of log length affected by crook.*

Example: $\frac{10}{20} \times \frac{2}{8}$ = 12 percent board-foot cull



For a sweep, determine sweep departure and subtract 1 inch for 8-foot logs or 2 inches for 16-foot logs. Divide by log diameter.

Example: $\frac{8 - 1}{20}$ = 35 percent board-foot cull**



For interior cull, square out interior cull as a percent of total volume of the section. For board-foot cull, add 1 inch to width and to thickness; for cubic-foot cull, use actual dimensions of rot. For board-foot cull divide width and thickness by the scaling diameter (average d.i.b., small end) minus 1; for cubic-foot cull, divide by scaling diameter. Multiply fractions by percent of log affected.

Example: $\frac{8 \times 10}{20\text{-}1} \times \frac{2}{8}$ = 6 percent cubic-foot cull

* No reduction of cubic-foot volume will be made.

** If a straight line between A and B falls outside the bark, the affected section is over 50 percent cull in board feet.

SOUTHERN PINE LOG GRADES

Grade factor	Grade			
	1	*2*	*3*	*4*
Minimum diameter	17″	10″	6″	6″
Maximum K value	1/5D	1/2D	None	None
Minimum specification on bad knots			Any bad knots present are localized in section not exceeding ¼″ circumference and length.	No limit

Exceptions

a. Lower one grade any log, not grade 4, having 3 inches or more of sweep if such sweep is ⅓ or more of log diameter.

b. Lower one grade any log, not grade 4, if heart-rot fruiting has occurred or is imminent, as indicated by conk or visible, massed, heart-rot hyphae.

K = number of overgrown knots plus sum of diameters of sound knots plus twice sum of diameters of unsound knots.

Bad knot: A knot with diameter > D/6, or an unsound knot (advance decay or a hole > ¼″ and 2″ or more deep).

Source: Forest Service Log Grades for Southern Pine. SE. Forest Exp. Sta., U.S. Forest Serv. Res. Paper SE-11, 1964.

WHITE PINE LOG GRADES

(Unpublished trial specifications, revised 1963)

Log grade	*Minimum size*		*Defect allowance*		*Maximum weevil injury*	*Allowable knot size (inches) on 3 best faces or minimum clearness on 4 faces*
	Diameter	*Length*[1]	*Sweep or crook*	*Total cull including sweep*		
	Inches	*Feet*	*Percent*	*Percent*	*Number*	*Inches*
No. 1	12 & 13	8–16	20	50	0	4 faces free of knots ½″ or larger full length of log.
	14+	10–16	20	50	0	2 faces free of knots ½″ or larger full length of log, or 4 faces free of knots ½″ or larger 50 percent length of log (6′ minimum length)[2].
No. 2	6+	8–16	30	50	0	Sound red knots ≦[3] D/6 and no larger than 3″. Black knots: Butt logs ≦ D/12 and no larger than 1½″. Upper logs ≦ D/10 and no larger than 1½″. or 4 faces free of knots ½″ or larger 50 percent length of log.
No. 3	6+	8–16	40	50	8′ logs: 1 weevil 10′+ logs: 2 weevils	Sound red knots ≦ D/3 and no larger than 5″. Black knots ≦ D/6 and no larger than 2½″.
No. 4	6+	8–16	50	50	No limit	No limit.

[1] Plus trim.

[2] If the sum of the diameters of sound red knots plus 2X (sum of the diameters of dead or black knots) in inches is ≦ ½ the diameter of the log (in inches).

[3] ≦ means equal to or less than.

SPRUCE, FIR, HEMLOCK, TAMARACK, AND CEDAR LOG GRADE

(Minimum merchantability specifications)

Log grade	Minimum size		Defect allowance		Other requirements
	Diameter[1]	Length[2]	Sweep or crook	Total deduction	
	Inches	*Feet*	*Percent*	*Percent*	
1	10–12	8–16 in 2-foot multiples	25	50	Sound knots not over 2 inches in diameter permitted. Shake permitted up to 20 percent of gross scale if not combined with other serious defects.
	13+	8–16 in 2-foot multiples	25	50	Sound knots not over 3 inches in diameter permitted. Shake permitted up to 20 percent of gross scale if not combined with other serious defects.

[1] At small end of log.
[2] Without trim.

HARDWOOD FACTORY LUMBER LOG-GRADE SPECIFICATIONS

(From U.S. Forest Products Laboratory Report D 1737)

GRADE FACTORS*		SPECIFICATIONS							
		Log Grade 1			Log Grade 2				Log Grade 3
Position in tree		Butts only	Butts & uppers		Butts & uppers				Butts & uppers
Minimum diameter (inches)		13–15[1]	16–19	20+	11[2]		12+		8+
Minimum length (feet)		10+	10+	10+	10+	8–9	10–11	12+	8+
Clear cuttings** on each of the 3 best faces	Min. length (ft.)	7	5	3	3	3	3	3	2
	Max. number	2	2	2	2	2	2	3	—
	Min. yield in face length	5/6	5/6	5/6	2/3	3/4	2/3	2/3	1/2
Max. sweep and crook allowance (percent of gross volume)		15			30				50
Max. cull and sweep allowance (percent of gross volume)		40[3]			50[4]				50

* End defects, although not visible in standing trees, are important in grading cut logs. Instructions for dealing with this factor are contained in Forest Prod. Lab. Rpt. D 1737.

** A clear cutting is a portion of a face free of defects, extending the width of the face. A face is one-fourth the surface of the log as divided lengthwise.

[1] Ash and basswood butts can be 12 inches if otherwise meeting requirements for small No. 1's.

[2] 10-inch logs of all species can be No. 2 if otherwise meeting requirements for small No. 1's.

[3] Otherwise No. 1 logs with 41-50 percent cull can be No. 2.

[4] Otherwise No. 2 logs with 51-60 percent cull can be No. 3.

Source: A Guide to Hardwood Log Grading (pg 11), NE. Forest Exp. Sta., Upper Darby, Pa. 1965.

HARDWOOD CONSTRUCTION LOG SPECIFICATIONS

GRADE FACTORS		SPECIFICATIONS
Position in tree		Butts and uppers
Scaling diameter (inches)		8+
Length, without trim (feet)		8+
Clear cuttings		No requirements: not graded on cutting basis.
Max. sweep allowance		One-fourth d.i.b. of small end for half logs, and one-half d.i.b. for logs 16 feet long.
Sound surface defects permitted	Single knots	Any number, if none has an average collar* diameter that is more than one-third of log diameter at point of occurrence.
	Whorled knots	Any number, provided the sum of the collar diameters does not exceed one-third the log diameter at point of occurrence.
	Holes	Any number not exceeding knot specifications if they do not extend more than 3 inches into the contained tie or timber.
Unsound surface defects permitted**	Any number and size if they do not extend into contained tie or timber. If they extend into contained tie or timber, they shall not exceed size, number, and depth of limits for sound defects.	

* Knot collar is the average of the vertical and horizontal diameters of the limb or knot swelling as measured flush with the surface of the log.

** Interior defects are not visible in standing trees. They are considered in grading cut logs. No interior defects are permitted except one shake not more than one-third the width of the contained tie or timber, and one split not more than 5 inches long.

Source: A Guide to Hardwood Log Grading, (pg. 28), NE. Forest Exp. Sta., Upper Darby, Pa. 1965.

Annual Net Growth and Timber Removals

Average annual net growth of growing stock.—The change (resulting from natural causes) in volume of sound wood in sawtimber and poletimber trees during the period between surveys, divided by the length of the period. (Components of annual net growth of growing stock include the increment in net volume of trees present at the beginning of the period and surviving to its end, plus net volume of trees reaching poletimber size during the period, minus the net volume of trees that died during the period, minus the net volume of trees that became rough or rotten trees during the period, cull increment.)

Average annual ingrowth of growing stock.—The net cubic-foot volume of trees now classed as growing stock that were less than 5.0 inches dbh on the initial survey, divided by the length of the period between surveys.

Average annual mortality of growing stock.—The net cubic-foot volume removed from the growing stock because of death from natural causes during the period between surveys, divided by the length of the period between surveys.

Average annual growing-stock removals.—The net cubic-foot volume of growing-stock trees harvested or killed in logging, cultural operations such as timber-stand improvement, land-clearing, or changes in land use during the period between surveys, converted to an annual basis.

Average annual net growth of sawtimber.—The change (resulting from natural causes) in net board-foot volume of sawtimber during the period between surveys, divided by the length of the period. (Components of annual net growth of sawtimber include the increment in net volume of sawtimber trees present at the beginning of the period and surviving to its end, plus the net volume of trees reaching sawtimber size during the period, minus the net volume of sawtimber trees that died during the period, minus the net volume of sawtimber trees that became rough or rotten trees during the period between surveys, cull increment.)

Average annual ingrowth of sawtimber.—The net board-foot volume of trees now classed as sawtimber that were not tallied as such on the initial survey, divided by the length of the period between surveys.

Average annual mortality of sawtimber.—The net board-foot volume removed from live sawtimber by death from natural causes during the period between surveys, divided by the length of the period between surveys.

Average annual sawtimber removals.—The net board-foot volume of sawtimber trees harvested or killed in logging, cultural operations such as timber-stand improvement, land-clearing, or changes in land use during the period between surveys, converted to an annual basis.

Cull increment.—The net volume of growing-stock trees on the initial inventory that became rough or rotten trees in the second inventory.

Logging residues.—The unused growing-stock volume of trees cut for products and the total growing-stock volume of trees destroyed in the course of logging but not removed for products.

Other removals.—The growing-stock volume of trees that were removed from the inventory and not used for products, by cultural operations (weeding, thinning, etc.), land-clearing, and reclassification of some commercial forest land as noncommercial forest land.

Plant byproducts.—Wood products, such as slabs, edgings, and veneer cores, that are obtained incidental to the production of timber products and are utilized in the manufacture of other timber products. (Bark is not included.)

Plant residues.—Wood material produced incidental to the production of timber products but not utilized.

Roundwood products.—Logs, bolts, or other round sections cut from growing stock or non-growing stock for industrial or nonindustrial uses.

Timber products.—Roundwood products and plant byproducts from all sources.

Timber removals.—The growing-stock volume of trees removed from the inventory for roundwood products, plus logging residues and other removals.

Annual net growth trend-level.—The estimated growth of growing stock or sawtimber for a specific year that is consistent with the average annual growth during the period between surveys and with the current inventory. (1971 for New Jersey.)

Annual removals trend-level.—The estimated removals of growing stock or sawtimber for a specific year that is consistent with the trend of removals during the period between surveys and with the current inventory. (1971 for New Jersey.)

Forest-Survey Methods

The Northeastern Forest Experiment Station's Forest Survey project used the sampling-with-partial replacement (SPR) design in the re-inventory of New Jersey's timber resource. With this design, estimates of forest area and timber volume were made by combining a subsample of remeasured plots, a regression up-dating of the initial inventory, and a new independent photo- and ground-plot inventory. Thus the SPR design, by combining two independent estimates of the inventory, yields a better estimate of the timber resource at a given cost.

One estimate is based on the updating of the initial survey (1956). This required the remeasurement of 147 initial inventory ground plots. With the area-change and current-volume estimates obtained from the remeasured sample plots, regression techniques were used to update all the initial ground and photo plots to obtain an independent estimate of current timber volume and forest area.

The second estimate is also based on a large photo-plot sample with a subsample of ground plots. For the second estimate the most recent aerial photography coverage of New Jersey was used. Photo plots were pinpointed on each photograph to provide a uniformly distributed sample of the area. Each photo plot was examined stereoscopically and classified as either forest or nonforest land. Those classified as forest land were further stratified into cubic-foot-volume-per-acre classes. A subsample of these photo plots, which was selected to be proportional to the area in a photo class, was measured on the ground. From this ground measurement, estimates of the mean and variance of each photo class were obtained. These means were expanded by the photo-strata areas to yield a second independent estimate of forest area and timber volume.

The final estimates of current forest area and timber volume were developed by combining these two independent estimates. The combination process consisted of weighting each estimate by the reciprocal of its variance and then adding them. The associated sampling error for this new estimate was also obtained. These combined totals were partitioned into the various categories of area and volume (for example, volume by species and dbh class), using the data obtained from the new ground-plot sample.

In addition to estimating current timber volume and forest area, the forest survey of New Jersey was designed to obtain an estimate of the components of average annual change during the period between the initial and the current inventories. The parameters of interest include area change from forest to nonforest and vice versa, timber growth, timber removals, and timber mortality. All this information was obtained from the remeasured plots. The timber-change parameters were obtained by a tree-by-tree reconciliation of each remeasured plot. The reconciliation code for each remeasured tree was used to make estimates of the parameters of change, by species. The estimates of change were expressed as average annual figures by dividing the totals for the period by the number of years between measurements. These estimates were then used in the computations of annual net growth, mortality, and removals for 1971.

Remeasured-plot Phase

The initial forest inventory of New Jersey consisted of a large photo-plot sample plus a ground measurement of a subsample of these photo plots. (At the initial survey occasion, the ground plots were selected according to optimum allocation for volume estimation.) The photo plots were stratified according to land use as forest or nonforest. The forest plots were further classified into volume classes. A total of 282 ground plots were measured by field crews during this first inventory. These ground samples were 1/5-acre circular plots.

At this second measurement occasion, 147 initial ground plots (including 50 nonforest plots) were revisited. The plot center was relocated for each remeasured plot. On those plots that were forested, all the trees on the 1/5-acre were tallied. The new tally was reconciled with the initial tally to account for every tree at both occasions.

New Ground-plot Phase

The source of the new independent estimates of volume and forest area was a new photo stratification with a subsample of ground measurements. The photo sample of New Jersey consisted of about 9,300 photo points on the latest available aerial photography. A subset of 440 of these photo plots, including 253 nonforest plots, was located on the ground. Land use was verified and tree-measurement data were recorded for the 187 forest plots. Unlike the initial inventory, in which fixed-radius 1/5-acre plots were tallied, the new ground plots consisted of a cluster of 10 prism points systematically covering approximately 1 acre. At each point, trees were selected for tally by using a prism with a basal-area factor of 37.5. Area-attribute data were also tallied at each of the 10 points.

Data Processing

Field-tally data consisting of plot and individual-tree information were processed and compiled into various tables using FINSYS—Forest Inventory System—on modern, large-capacity, high-speed computers.

FINSYS is a data-processing system consisting primarily of a series of computer programs that was developed by the Northeastern Forest Experiment Station to process and compile a large volume of forest-inventory data. The system consists of an editing subsystem that edits field-tally data for errors; a table-compiling subsystem that compiles tables from edited field data; and finally, an output subsystem that expands the plot data to geographic-unit or statewide estimates and prints the final tables.

FINSYS was described in a series of research papers by R. W. Wilson and R. C. Peters in 1967: *The Northeastern Forest Inventory Data Processing System*; USDA Forest Service Research Papers NE-61 and NE-70 to 80.

Before modern computers came into use, the compiling of forest-inventory data was a major bottleneck in forest inventory work. Using FINSYS, it is possible, as in the case of the resurvey of New Jersey, to have preliminary estimates available within 6 months after the last plot is taken. To process and compile data for a state the size of New Jersey, from key-punching to the output of tables, requires about 2½ months of elapsed time and about 2½ hours of computer time.

FINSYS has several features that make it unique. One of these is the ability not only to calculate inventory estimates but also to calculate the variance and sampling error for each estimate. This feature provides the user with a measure of the reliability of each statistic and the ability to determine the reliability of a new estimate based upon a data combination he may make.

Another feature of FINSYS is its flexibility. The system is not restricted to the Northeastern forest survey but can be used for any large-scale forest inventory. Also, the system does not produce a standard set of tables. The individual user specifies the tables to be developed according to his particular need. Thus, at any stage in the data-processing phase or even at a later date, a specific table can be developed with minimum effort.

County Data

Many users of forest-survey data have shown a need for county information. To provide such information, within the framework of the survey design, tables for counties where more than one county makes up a geographic stratum have been developed, based on a survey-unit partitioning technique.

First, the geographic stratum means and variances for the various photo-plot strata were applied to the photo-plot data for each county within the stratum. This yielded an estimate of total volume or total commercial forest-land area for each county. Next, the data from all the new ground plots in each geographic stratum were used to partition the county totals into their various components. For example, if a table of cubic-foot volume by softwoods and hardwoods is to be made for a county, the estimate of total cubic-foot volume for that county is partitioned into softwood and hardwood totals according to the proportion of softwoods and hardwoods for all new forest-survey ground plots within the geographic stratum.

Comparisons Between Inventories

After inventories have been completed for several points in time, it is desirable to evaluate the trends between the several inventories and to make comparisons. A comparison of the 1971-72 and 1955-56 forest-survey estimates of volume, growth, removals, and mortality was made for New Jersey. A computer program, TRAS (Timber Resource Analysis System), was used.

Because of changes in procedures and in definitions, it was necessary to adjust the 1956 inventory-volume estimate to what it would have been had the 1971-72 procedures and definitions been used in 1956. This process involves several calculations and adjustments in the 1956 inventory in order to make it comparable with the 1972 inventory. One important step in this process is to recalculate the 1956 inventory volume, using the average net volume per tree from the resurvey. To do this, the average net volume per tree (for softwoods and for hardwoods) developed from the resurvey for each 2-inch diameter class was multiplied by the number of trees in each 2-inch diameter class from the 1956 inventory. These calculations resulted in an inventory estimate for 1956 adjusted to 1971-72 standards. The changes in the 1956 volume estimates for New Jersey are as follows:

- For softwood growing stock, the adjusted volume is 4 percent greater than reported.
- For hardwood growing stock, the volume is 8 percent greater than reported.
- For softwood sawtimber, the volume is 18 percent greater than reported.
- And for hardwood sawtimber, the volume is 6 percent lower than reported.

The adjusted 1956 volume estimates, not the volume estimates published in the report for the initial survey, are the basis for comparisons between surveys shown in this report.

Reliability of the Estimates

The forest-area and timber-volume data presented in this report were based upon a carefully designed sample of forest conditions throughout New Jersey. However, since neither every acre nor every tree in the State was measured, the data presented in this report are estimates. A measure of the reliability of these estimates is given by a sampling error. An associated sampling error was calculated for each estimate in this report. Many of these appear in the data tables.

Briefly, this is how the sampling error indicates the reliability of an estimate. Our estimate of the total growing-stock volume in New Jersey—1,470 million cubic feet—has an associated sampling error of 4 percent (59 million cubic feet). This means that our best estimate of the total growing-stock volume in New Jersey in 1972 is 1,470 million cubic feet. If there are no errors in procedure, the odds are 2 to 1 that, if we repeated the survey in the same way, the resulting estimate of growing-stock volume would be between 1,411 million and 1,529 million cubic feet (1,470 $\pm$ 59). Similarly, the odds are 19 to 1 that it would be within $\pm$ 118 million cubic feet and 300 to 1 that it would be within $\pm$ 177 million cubic feet.

The computed sampling error is not a complete measure of reliability. There are other sources of error that this term does not include. There could be imperfections in volume tables and equations, and errors in field measurement. Procedural errors were kept to a minimum by careful training of all person-

nel, frequent inspection of field work, and application of the most reliable survey methods.

Computed sampling errors for the totals shown in the statistical tables for New Jersey are:

	Sampling error (percent)
Commercial forest area:	
1,857 thousand acres	2.2
Growing-stock volume:	
1,470 million cubic feet	3.8
Sawtimber volume:	
3,070 million board feet	5.8
Annual net growth:	
24.9 million cubic feet	18.0
Annual removals:	
16.0 million cubic feet	31.0

Commercial Tree Species of New Jersey

Names are according to Elbert L. Little, Jr.: *Checklist of Native and Naturalized Trees of the United States (including Alaska)*. U.S. Dept. Agr. Handbook 41, 472 p., 1953.

Softwoods

Atlantic white-cedar	*Chamaecyparis thyoides*
Eastern redcedar	*Juniperus virginiana*
Tamarack	*Larix laricina*
Norway spruce	*Picea abies*
Shortleaf pine	*Pinus echinata*
Pitch pine	*P. rigida*
Pond pine	*P. serotina*
Eastern white pine	*P. strobus*
Red pine	*P. resinosa*
Scotch pine	*P. sylvestris*
Virginia pine	*P. virginiana*
Eastern hemlock	*Tsuga canadensis*

Hardwoods

Red maple	*Acer rubrum*
Silver maple	*A. saccharinum*
Sugar maple	*A. saccharum*
Yellow birch	*Betula alleghaniensis*
Sweet birch	*B. lenta*
River birch	*B. nigra*
Hickory	*Carya* species
Hackberry	*Celtis occidentalis*
Flowering dogwood	*Cornus florida*
Common persimmon	*Diospyros virginiana*
American beech	*Fagus grandifolia*
White ash	*Fraxinus americana*
Green ash	*F. pennsylvanica*
American holly	*Ilex opaca*
Butternut	*Juglans cinerea*
Black walnut	*J. nigra*
Sweetgum	*Liquidambar styraciflua*
Yellow-poplar	*Liriodendron tulipifera*
Sweetbay	*Magnolia virginiana*
Black tupelo (blackgum)	*Nyssa sylvatica*
Sycamore	*Platanus occidentalis*
Bigtooth aspen	*Populus grandidentata*
Black cherry	*Prunus serotina*
Black locust	*Robinia pseudoacacia*
White oak	*Quercus alba*
Swamp white oak	*Q. bicolor*
Scarlet oak	*Q. coccinea*
Southern red oak	*Q. falcata*
Swamp chestnut oak	*Q. michauxii*
Pin oak	*Q. palustris*
Willow oak	*Q. phellos*
Chestnut oak	*Q. prinus*
Northern red oak	*Q. rubra*
Post oak	*Q. stellata*
Black oak	*Q. velutina*
Black willow	*Salix nigra*
American basswood	*Tilia americana*
American elm	*Ulmus americana*
Slippery elm	*U. rubra*

Index to Tables

The acreage of commercial forest land in New Jersey has decreased about 12 percent. Above, some forest land has been cleared to create new farmland. Below, some has been used for residential developments.

THE WHARTON STATE FOREST IN BURLINGTON COUNTY

A stand of Atlantic white-cedar.

The water-powered sawmill at Batso Village.

White-cedar logs ready for sawing.

SOME FOREST TYPES OF NEW JERSEY

The Pitch pine—shortleaf pine forest type in southern New Jersey.

Atlantic white-cedar, a component of the oak—gum major forest type.

Oak—pine forest type in southern New Jersey.

A seedling—sapling stand. Half of the commercial forest area is in such stands of trees less than 5 inches dbh.

Oak—hickory forest type in northern New Jersey.

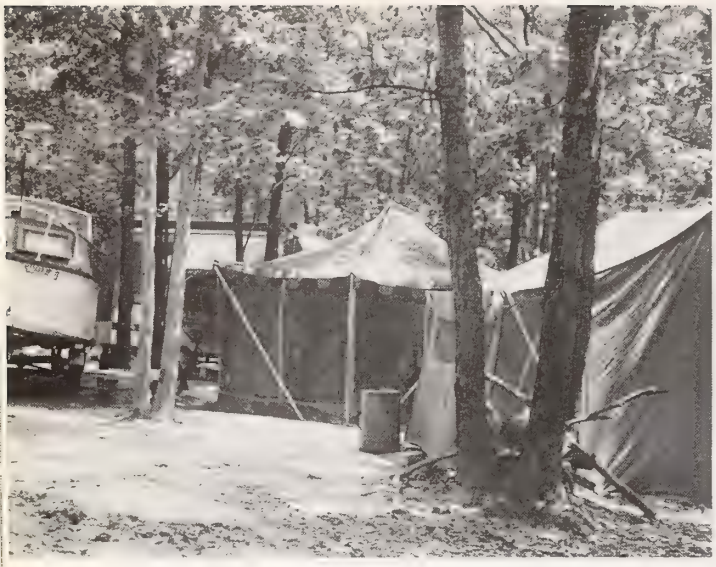
In 1970 about 22 million board feet of lumber were produced from hardwood sawlogs like these.

WOOD PRODUCTS

Among the miscellaneous wood products of New Jersey are these items of ship's gear made from oak and ash at Matawan. Top, ship's ladder. Below, fids and mallets.

Swartswood State Park in Sussex County provides boating and swimming.

A permanent campsite in the Bass River State Forest in Burlington and Ocean Counties.



Privately owned camping facilities in Cape May County provide other income from forest land.

A timber stand in northern New Jersey that has been killed by the gypsy moth.

New Jersey's forest tree nursery provides seedlings for landowners at cost.

Table 1.—Area by land classes, New Jersey, 1972

Land class	Area	
	Thousand acres	*Percent*
Forest land:		
Commercial	1,856.8	38
Productive-reserved	34.0	1
Unproductive	37.6	1
Total forest land	1,928.4	40
Urban and other:		
Land with tree cover[1]	685.0	14
Land with tree cover[2]	1,556.6	32
Cropland[3]	573.0	12
Pasture[3]	77.5	2
Total nonforest land	2,892.1	60
Total land area[4]	4,820.5	100

[1] These are lands where the principal use for the immediate future precludes planning or management for timber production but which are partially in tree cover. In New Jersey 75 percent of the land in this category is devoted to urban and suburban uses.

[2] Includes swampland, industrial and urban areas, other nonforest land, and 48,600 acres classed as water by Forest Survey standards, but defined by the Bureau of the Census as land.

[3] Source: 1969 Census of Agriculture. Total cropland includes cropland used for pasture. Data extrapolated to 1972.

[4] Source: United States Bureau of the Census, Areas of New Jersey: 1960 (Jan. 1967).

Table 2.—Area by land classes and counties, New Jersey, 1972

County	Total land area[1]	Nonforest land area	Forest-land area			
			Noncommercial[2]	Commercial		Sampling error[3]
	Thousand acres	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Percent*	*Percent*
Atlantic	364.2	165.1	2.0	197.1	54	6
Bergen*	149.8	149.8	—	—	—	—
Burlington	524.0	235.6	8.4	280.0	53	5
Camden	141.3	91.9	—	49.4	34	12
Cape May	170.7	103.6	1.8	65.3	38	10
Cumberland	319.7	194.5	3.0	122.2	38	7
Essex*	82.9	82.9	—	—	—	—
Gloucester	210.8	155.2	—	55.6	26	13
Hudson*	30.3	30.3	—	—	—	—
Hunterdon	277.5	188.0	—	89.5	32	12
Mercer	145.8	114.3	—	31.5	22	19
Middlesex	199.9	152.9	1.1	45.9	23	17
Monmouth	304.6	203.9	11.3	89.4	29	12
Morris	299.8	150.2	9.6	140.0	47	10
Ocean	411.0	150.9	13.3	246.8	60	6
Passaic	123.5	74.0	4.0	45.5	37	6
Salem	233.8	172.1	1.2	60.5	26	12
Somerset	196.3	136.1	—	60.2	31	15
Sussex	337.5	142.5	15.9	179.1	53	7
Union*	65.7	65.7	—	—	—	—
Warren	231.4	132.6	—	98.8	43	10
Total	4,820.5	2,892.1	71.6	1,856.8	38	2

[1] Source: Areas of New Jersey: 1960 (Jan. 1967), Bureau of the Census.
[2] Includes nonproductive and productive-reserved forest land.
[3] In percent for commercial forest land, at the 68 percent probability level.
* Urban counties, which will be omitted from all other county tables.

Table 3.—Area of commercial forest land, by ownership classes, New Jersey, 1972

Ownership class	Area[1]	
	Thousand acres	*Percent*
Federal	27.7	2
State	245.9	13
County and municipal	45.3	2
Total public	318.9	17
Forest industry	16.3	1
Farmer owned:		
Individual	56.2	3
Corporate	52.0	3
Miscellaneous private:		
Individual[2]	1,105.8	60
Corporate	307.6	16
Total private	1,537.9	83
All ownerships	1,856.8	100

[1] Estimates of area in each private ownership class are based upon the forest-land ownership study by the Northeastern Forest Experiment Station.

[2] Includes acreage owned by business partnerships and organizations such as churches, Boy Scouts of America, and associations.

Table 4.—Area of commercial forest land, by ownership classes and counties, New Jersey, 1972

[In thousands of acres]

County	Public-owned[1]	Private-owned		Total
		Farmer-owned[2]	Other private	
Atlantic	17.1	6.4	173.6	197.1
Burlington	108.0	24.5	147.5	280.0
Camden	15.9	1.2	32.3	49.4
Cape May	17.3	2.4	45.6	65.3
Cumberland	20.2	7.9	94.1	122.2
Gloucester	1.2	5.6	48.8	55.6
Hunterdon	.9	8.4	80.2	89.5
Mercer	—	3.3	28.2	31.5
Middlesex	.8	2.6	42.5	45.9
Monmouth	2.2	5.8	81.4	89.4
Morris	12.4	4.9	122.7	140.0
Ocean	47.7	2.1	197.0	246.8
Passaic	26.2	.6	18.7	45.5
Salem	—	7.3	53.2	60.5
Somerset	—	2.9	57.3	60.2
Sussex	37.8	13.8	127.5	179.1
Warren	11.2	8.5	79.1	98.8
Total	318.9	108.2	1,429.7	1,856.8

[1] From ownership records.

[2] Ratios for farmer-owned forest land by county were derived from the 1969 Census of Agriculture.

Table 5.—Area of commercial forest land, by stand-size and ownership classes, New Jersey, 1972

[In thousands of acres]

Stand-size class	All ownerships	Public	Forest industry	Farmer and other
Sawtimber stands	463.7	76.6	5.8	381.3
Poletimber stands	388.1	68.5	10.5	309.1
Sapling-seedling stands	943.6	160.1	—	783.5
Nonstocked areas	61.4	13.7	—	47.7
All classes	1,856.8	318.9	16.3	1,521.6

Table 6.—Area of commercial forest land, by stand-size classes and counties, New Jersey, 1972

[In thousands of acres]

County	Sawtimber stands	Poletimber stands	Sapling-seedling stands	Nonstocked areas	Total
Atlantic	25.0	40.1	126.7	5.3	197.1
Burlington	29.3	34.1	208.5	8.1	280.0
Camden	6.9	8.8	33.3	.4	49.4
Cape May	10.1	16.0	37.8	1.4	65.3
Cumberland	21.8	28.1	70.7	1.6	122.2
Gloucester	13.6	13.6	27.3	1.1	55.6
Hunterdon	41.9	24.9	19.8	2.9	89.5
Mercer	13.8	8.3	7.7	1.7	31.5
Middlesex	18.3	13.6	11.8	2.2	45.9
Monmouth	18.2	20.4	48.3	2.5	89.4
Morris	69.8	39.8	24.9	5.5	140.0
Ocean	19.0	26.6	193.3	7.9	246.8
Passaic	20.4	12.4	10.6	2.1	45.5
Salem	14.6	12.9	31.8	1.2	60.5
Somerset	20.3	13.2	22.6	4.1	60.2
Sussex	79.6	48.6	42.7	8.2	179.1
Warren	41.1	26.7	25.8	5.2	98.8
Total	463.7	388.1	943.6	61.4	1,856.8
Sampling error (in percent)	12	14	6	40	2.2

Table 7.—Area of commercial forest land, by stand-volume and ownership classes, New Jersey, 1972

[In thousands of acres]

Stand-volume per acre (board feet)[1]	All ownerships	Public	Forest industry	Farmer and other
Less than 1,500	1,079.9	201.8	10.5	867.6
1,500 to 5,000	602.3	81.9	5.8	514.6
More than 5,000	174.6	35.2	—	139.4
All classes	1,856.8	318.9	16.3	1,521.6

[1] International ¼-inch rule.

Table 8.—Area of commercial forest land, by stocking classes based on selected stand components, New Jersey, 1972

[In thousands of acres]

Stocking class (percent)	Stocking classified in terms of—				
	All trees	Growing-stock trees			Rough and rotten trees
		Total	Desirable	Acceptable	
160	48.5	—	—	—	—
150 to 160	51.0	10.0	—	10.0	—
140 to 150	141.9	20.5	—	20.5	—
130 to 140	140.4	71.2	—	40.2	—
Overstocked	381.8	101.7	—	70.7	—
120 to 130	414.6	105.1	—	74.5	9.7
110 to 120	303.5	279.2	—	207.6	10.0
100 to 110	339.8	227.2	—	259.4	18.0
90 to 100	171.5	293.4	—	332.6	10.0
80 to 90	81.2	238.1	—	229.9	10.0
70 to 80	62.3	138.9	—	198.4	29.5
Fully stocked	1,372.9	1,281.9	—	1,302.4	87.2
60 to 70	20.5	192.2	—	202.7	79.6
50 to 60	20.2	100.0	—	89.5	31.0
40 to 50	10.0	30.2	—	40.7	138.5
Medium stocked	50.7	322.4	—	332.9	249.1
30 to 40	10.5	59.1	—	59.1	195.8
20 to 30	30.9	20.2	70.6	20.2	318.4
10 to 20	—	41.0	215.9	41.0	468.0
Less than 10	10.0	30.5	1,570.3	30.5	538.3
Poorly stocked	51.4	150.8	1,856.8	150.8	1,520.5
All classes	1,856.8	1,856.8	1,856.8	1,856.8	1,856.8

Table 9.—Area of commercial forest land, by stocking-percent classes of growing-stock trees and counties, New Jersey, 1972

[In thousands of acres]

County	Stocking class (in percent)			Total
	70 or more	40 to 70	Less than 40	
Atlantic	140.7	38.9	17.5	197.1
Burlington	191.0	59.2	29.8	280.0
Camden	36.1	9.1	4.2	49.4
Cape May	48.4	12.5	4.4	65.3
Cumberland	93.9	20.9	7.4	122.2
Gloucester	40.3	12.0	3.3	55.6
Hunterdon	75.0	10.9	3.6	89.5
Mercer	25.2	3.5	2.8	31.5
Middlesex	36.6	6.0	3.3	45.9
Monmouth	63.5	18.8	7.1	89.4
Morris	116.9	13.7	9.4	140.0
Ocean	165.6	52.3	28.9	246.8
Passaic	36.8	6.0	2.7	45.5
Salem	45.4	11.6	3.5	60.5
Somerset	45.5	9.2	5.5	60.2
Sussex	144.3	24.0	10.8	179.1
Warren	78.4	13.8	6.6	98.8
Total	1,383.6	322.4	150.8	1,856.8

Table 10.—Area of commercial forest land, by area-condition and ownership classes, New Jersey, 1972

[In thousands of acres]

Area-condition class[1]	All ownerships	Public	Forest industry	Farmer and other
Class *10-40*	—	—	—	—
Class *50*	601.0	102.8	—	498.2
Class *60*	974.8	169.5	16.3	789.0
Class *70*	281.0	46.6	—	234.4
All classes	1,856.8	318.9	16.3	1,521.6

[1] Class *10-40*.—Areas medium to fully stocked with desirable trees.
Class *50*.—Areas poorly stocked with desirable trees, but fully stocked with growing-stock trees.
Class *60*.—Areas poorly stocked with desirable trees, but with medium to full stocking of growing-stock trees.
Class *70*.—Areas poorly stocked with desirable trees, and poorly stocked with growing-stock trees.

Table 11.—Area of commercial forest land, by potential site productivity and ownership classes, New Jersey, 1972

[In thousands of acres]

Growth-per-acre class (cubic feet)	All ownerships	Public	Forest industry	Farmer and other
120 to 165	70.0	13.7	—	56.3
85 to 120	41.1	6.9	—	34.2
50 to 85	524.1	63.1	5.8	455.2
Less than 50	1,221.6	235.2	10.5	975.9
All classes	1,856.8	318.9	16.3	1,521.6

Table 12.—Area of forest land, commercial and noncommercial, by forest types and ownership classes, New Jersey, 1972

[In thousands of acres]

Forest type	All ownerships	Public	Forest industry	Farmer and other
	COMMERCIAL FOREST LAND			
White pine-hemlock	20.2	13.7	—	6.5
Pitch-shortleaf pine	478.4	109.3	—	369.1
Oak-pine	172.1	41.8	—	130.3
Oak-hickory	754.0	105.5	16.3	632.2
Oak-gum-Atlantic white-cedar[1]	60.3	—	—	60.3
Elm-ash-red maple	267.6	34.3	—	233.3
Maple-beech-birch	104.2	14.3	—	89.9
All types	1,856.8	318.9	16.3	1,521.6
	NONCOMMERCIAL FOREST LAND			
White pine-hemlock	1.5	1.5	—	—
Pitch-shortleaf pine	11.7	11.7	—	—
Oak-pine	23.5	4.4	—	19.1
Oak-hickory	29.7	11.2	—	18.5
Oak-gum-Atlantic white-cedar	—	—	—	—
Elm-ash-red maple	3.7	3.7	—	—
Maple-beech-birch	1.5	1.5	—	—
All types	71.6	[2] 34.0	—	[3] 37.6

[1] This forest type is made up of 49,800 acres in the local Atlantic white-cedar type and 10,500 acres in the blackgum-red maple type.
[2] All productive-reserved forest land.
[3] All unproductive forest land.

Table 13.—Area of commercial forest land, by forest types and counties, New Jersey, 1972

[In thousands of acres]

County	Forest-type group					Total
	Yellow pine	Oak-pine	Oak-hickory[1]	Elm-ash-red maple	Maple-beech birch[2]	
Atlantic	68.5	23.0	73.3	32.3	—	197.1
Burlington	137.3	19.0	82.6	41.1	—	280.0
Camden	20.1	3.8	20.0	5.5	—	49.4
Cape May	18.7	7.3	26.9	12.4	—	65.3
Cumberland	37.6	9.6	53.7	21.3	—	122.2
Gloucester	11.0	5.3	25.5	13.8	—	55.6
Hunterdon	—	8.5	73.4	7.6	—	89.5
Mercer	—	3.3	25.7	2.5	—	31.5
Middlesex	—	5.8	36.4	3.7	—	45.9
Monmouth	45.3	9.6	9.6	24.9	—	89.4
Morris	—	12.4	115.4	12.2	—	140.0
Ocean	125.9	18.5	67.8	34.6	—	246.8
Passaic	—	4.8	30.1	5.1	5.5	45.5
Salem	14.0	5.2	26.0	15.3	—	60.5
Somerset	—	6.3	47.9	6.0	—	60.2
Sussex	—	18.9	58.1	20.7	81.4	179.1
Warren	—	10.8	41.9	8.6	37.5	98.8
Total	478.4	172.1	814.3	267.6	124.4	1,856.8
Sampling error (in percent)	11	23	9	18	29	2.2

[1] Includes 49,800 acres of the Atlantic white-cedar and 10,500 acres of the oak-gum forest types.
[2] Includes 20,200 acres of the white pine-hemlock forest type in Sussex and Passaic counties.

Table 14.—Number of trees on commercial forest land, by species groups, tree classes, and diameter classes, New Jersey, 1972

[In thousands of trees]

Dbh class (inches)	Softwoods			Hardwoods		
	Growing-stock trees	Rough and rotten trees	Total	Growing-stock trees	Rough and rotten trees	Total
1.0 to 2.9	76,979	43,697	120,676	242,633	257,126	499,759
3.0 to 4.9	53,833	10,839	64,672	118,613	62,310	180,923
Total saplings	130,812	54,536	185,348	361,246	319,436	680,682
5.0 to 6.9	21,511	4,462	25,973	67,953	11,182	79,135
7.0 to 8.9	14,181	1,185	15,366	34,410	5,315	39,725
9.0 to 10.9	6,833	682	7,515	20,343	1,567	21,910
11.0 to 12.9	2,871	251	3,122	9,457	1,683	11,140
13.0 to 14.9	1,070	29	1,099	5,821	643	6,464
Total poletimber and small sawtimber	46,466	6,609	53,075	137,984	20,390	158,374
15.0 to 16.9	483	79	562	3,941	395	4,336
17.0 to 18.9	118	—	118	1,700	156	1,856
19.0 to 20.9	55	—	55	1,011	86	1,097
21.0 and larger	90	—	90	1,065	138	1,203
Total large sawtimber	746	79	825	7,717	775	8,492
All classes	178,024	61,224	239,248	506,947	340,601	847,548

Table 15.—Number of growing-stock trees on commercial forest land, by species and diameter classes, New Jersey, 1972

[In thousands of trees]

Species	All classes	Diameter class (inches at breast height)								
		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	19.0—20.9	21.0+
Pitch pine	35,147	16,574	11,192	4,625	1,883	571	261	23	18	—
Shortleaf pine	2,653	373	887	779	453	137	—	24	—	—
Virginia pine	1,714	595	423	585	44	67	—	—	—	—
Other pines	728	—	443	64	55	63	80	23	—	—
Atlantic white-cedar	4,145	2,003	978	621	331	126	62	24	—	—
Other softwoods	2,825	1,966	258	159	105	106	80	24	37	90
Total softwoods	47,212	21,511	14,181	6,833	2,871	1,070	483	118	55	90
Select white oaks	23,218	13,822	4,132	2,614	844	562	374	388	216	266
Select red oaks	8,565	2,121	1,827	1,689	869	745	619	274	285	136
Other red oaks	29,965	13,403	8,017	3,631	1,487	1,369	1,065	441	229	323
Chestnut oak[1]	16,271	6,249	3,673	2,982	1,716	990	400	219	20	22
Hickory	7,397	2,646	2,211	1,325	669	286	203	22	35	—
Sugar maple	2,271	1,086	664	144	156	41	85	20	35	40
Soft maples	18,677	10,816	3,958	2,479	606	333	357	23	37	68
Beech	1,526	729	226	231	110	148	57	25	—	—
Blackgum	6,612	3,800	1,857	500	195	104	89	22	17	28
Sweetgum	7,616	2,353	2,175	1,557	601	528	257	70	35	40
Yellow-poplar	1,733	207	406	203	376	109	179	152	34	67
Black walnut	1,049	388	238	306	51	34	—	—	32	—
Black cherry	3,201	2,313	573	149	99	40	27	—	—	—
Elm	1,887	1,076	400	318	48	—	29	—	16	—
Other hardwoods	15,713	6,944	4,053	2,215	1,630	532	200	44	20	75
Total hardwoods	145,701	67,953	34,410	20,343	9,457	5,821	3,941	1,700	1,011	1,065
All species	192,913	89,464	48,591	27,176	12,328	6,891	4,424	1,818	1,066	1,155

[1] Includes 267,000 other white oak trees.

Table 16.—Net volume of timber on commercial forest land, by class of timber, softwoods and hardwoods, New Jersey, 1972

[In millions of cubic feet]

Class of timber	All species	Softwoods	Hardwoods
Sawtimber trees:			
Sawlog portion	647.6	135.3	512.3
Upper-stem portion	135.0	19.9	115.1
All sawtimber trees	782.6	155.2	627.4
Poletimber trees	687.7	102.8	584.9
All growing-stock trees	1,470.3	258.0	1,212.3
Rough trees	101.3	16.0	85.3
Rotten trees	29.9	4.7	25.2
Total, all timber	1,601.5	278.7	1,322.8

Table 17.—Net volume of growing stock and sawtimber on commercial forest land, by ownership classes, stand-size classes, softwoods and hardwoods, New Jersey, 1972

Ownership or stand-size class	Growing stock (million cubic feet)			Sawtimber (million board feet)[1]		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
BY OWNERSHIP CLASSES						
Public	231.3	59.4	171.9	494.6	146.5	348.1
Forest industry	26.9	—	26.9	44.1	—	44.1
Farmer and other	1,212.1	198.6	1,013.5	2,531.5	425.5	2,106.0
All ownerships	1,470.3	258.0	1,212.3	3,070.2	572.0	2,498.2
BY STAND-SIZE CLASSES						
Sawtimber stands	677.1	62.5	614.6	1,947.7	199.1	1,748.6
Poletimber stands	447.5	67.3	380.2	601.8	158.3	443.5
Sapling-seedling stands	338.3	126.4	211.9	508.0	208.3	299.7
Nonstocked areas	7.4	1.8	5.6	12.7	6.3	6.4
All classes	1,470.3	258.0	1,212.3	3,070.2	572.0	2,498.2

[1] International ¼-inch rule.

Table 18.—Net volume of growing stock on commercial forest land in New Jersey, by stand-size classes and counties, 1972

[In millions of cubic feet]

County	Sawtimber stands	Poletimber stands	Other stands	Total	Sampling error of total
					Percent
Atlantic	41.9	50.6	47.6	140.1	14
Burlington	49.0	40.7	66.5	156.2	13
Camden	11.0	10.6	13.3	34.9	25
Cape May	16.6	20.7	14.9	52.2	23
Cumberland	35.7	35.2	30.4	101.3	18
Gloucester	22.3	18.9	11.6	52.8	22
Hunterdon	57.1	25.8	8.7	91.6	20
Mercer	18.6	8.4	3.8	30.8	31
Middlesex	25.0	13.2	5.9	44.1	32
Monmouth	32.1	30.2	17.6	79.9	21
Morris	96.1	42.0	13.5	151.6	14
Ocean	32.0	33.1	57.9	123.0	16
Passaic	26.9	12.3	4.4	43.6	9
Salem	25.3	17.4	13.2	55.9	25
Somerset	26.5	12.9	8.1	47.5	28
Sussex	104.6	48.4	17.6	170.6	13
Warren	56.4	27.1	10.7	94.2	19
Total	677.1	447.5	345.7	1,470.3	4
Sampling error (in percent)	11	15	13	3.8	—

Table 19.—Net volume of sawtimber on commercial forest land in New Jersey, by stand-size classes and counties, 1972

[In millions of board feet][1]

County	Sawtimber stands	Poletimber stands	Other stands	Total	Sampling error of total
					Percent
Atlantic	138.9	62.2	72.0	273.1	21
Burlington	151.6	57.7	91.7	301.0	21
Camden	32.8	16.8	17.8	67.4	37
Cape May	55.8	25.8	21.4	103.0	34
Cumberland	109.6	51.9	40.5	202.0	27
Gloucester	74.8	23.8	14.2	112.8	31
Hunterdon	153.3	35.9	16.9	206.1	29
Mercer	47.6	11.1	8.3	67.0	44
Middlesex	67.1	19.2	11.8	98.1	45
Monmouth	117.1	33.9	23.0	174.0	31
Morris	253.8	55.2	29.2	338.2	21
Ocean	97.3	47.5	79.6	224.4	23
Passaic	70.4	16.8	7.8	95.0	11
Salem	83.3	22.4	18.5	124.2	37
Somerset	68.9	17.2	16.8	102.9	41
Sussex	275.0	66.7	31.3	373.0	20
Warren	150.4	37.7	19.9	208.0	29
Total	1,947.7	601.8	520.7	3,070.2	6
Sampling error (in percent)	9	20	19	5.8	—

[1] International ¼-inch rule.

Table 20.—Net volume of growing stock on commercial forest land in New Jersey, by tree classes and counties, 1972

[In millions of cubic feet]

County	Sawtimber trees	Poletimber trees	Total growing stock
Atlantic	59.6	80.5	140.1
Burlington	71.3	84.9	156.2
Camden	16.8	18.1	34.9
Cape May	22.1	30.1	52.2
Cumberland	47.6	53.7	101.3
Gloucester	23.6	29.2	52.8
Hunterdon	56.8	34.8	91.6
Mercer	18.9	11.9	30.8
Middlesex	27.3	16.8	44.1
Monmouth	33.0	46.9	79.9
Morris	94.8	56.8	151.6
Ocean	54.1	68.9	123.0
Passaic	27.0	16.6	43.6
Salem	26.4	29.5	55.9
Somerset	29.0	18.5	47.5
Sussex	105.4	65.2	170.6
Warren	58.1	36.1	94.2
Total	771.8	698.5	1,470.3
Sampling error (in percent)	6	6	3.8

Table 21.—Net volume of growing stock and sawtimber on commercial forest land, by forest types, New Jersey, 1972

Forest type	Growing stock	Sawtimber
	Million cubic feet	*Million board feet*[1]
White pine-hemlock	22.0	90.7
Pitch-shortleaf pine	186.8	322.7
Oak-pine	93.0	173.6
Oak-hickory	830.9	1,820.7
Oak-gum-Atlantic white-cedar	63.3	94.0
Elm-ash-red maple	155.4	263.1
Maple-beech-birch	118.9	305.4
All types	1,470.3	3,070.2

[1] International ¼-inch rule.

Table 22.—Net volume of growing stock on commercial forest land, by forest types and counties, New Jersey, 1972

[In millions of cubic feet]

County	Forest-type group					Total
	Yellow pine	Oak-pine	Oak-hickory[1]	Elm-ash-red maple	Maple-beech-birch[2]	
Atlantic	29.2	14.1	78.2	18.6	—	140.1
Burlington	45.6	10.7	79.1	20.8	—	156.2
Camden	10.8	1.7	19.1	3.3	—	34.9
Cape May	9.6	4.5	30.8	7.3	—	52.2
Cumberland	24.6	5.2	58.6	12.9	—	101.3
Gloucester	6.9	3.4	31.6	10.9	—	52.8
Hunterdon	—	4.1	83.7	3.8	—	91.6
Mercer	—	1.6	28.2	1.0	—	30.8
Middlesex	—	2.8	39.0	2.3	—	44.1
Monmouth	15.2	6.8	40.1	17.8	—	79.9
Morris	—	5.8	134.8	11.0	—	151.6
Ocean	36.6	10.1	61.1	15.2	—	123.0
Passaic	—	2.2	32.4	3.6	5.4	43.6
Salem	8.3	3.3	32.5	11.8	—	55.9
Somerset	—	2.8	40.6	4.1	—	47.5
Sussex	—	8.9	61.9	7.5	92.3	170.6
Warren	—	5.0	42.5	3.5	43.2	94.2
Total	186.8	93.0	894.2	155.4	140.9	1,470.3
Sampling error (in percent)	20	27	9	45	20	3.8

[1] Includes 63.3 million cubic feet in the oak-gum and Atlantic white-cedar forest types.
[2] Includes 22.0 million cubic feet in the white pine-hemlock forest type, in Sussex and Warren counties.

Table 23.—Net volume of sawtimber on commercial forest land, by forest types and counties, New Jersey, 1972

[In millions of board feet][1]

County	Forest-type group					Total
	Yellow pine	Oak-pine	Oak-hickory[2]	Elm-ash red maple	Maple-beech-birch[3]	
Atlantic	51.2	26.3	168.3	27.3	—	273.1
Burlington	72.4	22.1	172.3	34.2	—	301.0
Camden	18.5	3.9	39.3	5.7	—	67.4
Cape May	18.9	7.2	65.7	11.2	—	103.0
Cumberland	47.9	8.6	123.3	22.2	—	202.0
Gloucester	15.2	4.1	72.7	20.8	—	112.8
Hunterdon	—	7.9	190.9	7.3	—	206.1
Mercer	—	3.3	61.5	2.2	—	67.0
Middlesex	—	5.0	89.1	4.0	—	98.1
Monmouth	25.0	9.5	105.3	34.2	—	174.0
Morris	—	13.1	308.4	16.7	—	338.2
Ocean	56.9	22.4	123.3	21.8	—	224.4
Passaic	—	4.1	63.2	5.3	22.4	95.0
Salem	16.7	4.8	79.2	23.5	—	124.2
Somerset	—	5.3	91.6	6.0	—	102.9
Sussex	—	16.2	80.0	13.9	262.9	373.0
Warren	—	9.8	80.6	6.8	110.8	208.0
Total	322.7	173.6	1,914.7	263.1	396.1	3,070.2
Sampling error (in percent)	25	31	11	49	24	5.8

[1] International ¼-inch rule.
[2] Includes 94 0 million board feet in the oak-gum and Atlantic white-cedar forest type.
[3] Includes 90.7 million board feet in the white pine-hemlock forest type, in Sussex and Warren counties.

Table 24.—Net volume of growing stock on commercial forest land, by species and diameter classes, New Jersey, 1972

[In millions of cubic feet]

Species	Sampling error of total (*percent*)	Total, all classes	Diameter class (inches at breast height)								
			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	19.0—20.9	21.0+
Pitch pine	14	167.4	26.5	48.4	41.3	27.9	12.3	9.0	0.9	1.1	—
Shortleaf pine	32	22.8	.8	3.8	7.6	6.4	3.3	—	.9	—	—
Virginia pine	*	10.6	1.1	2.1	5.1	.7	1.6	—	—	—	—
Other pines	*	7.9	—	1.8	.6	.7	1.5	2.5	.8	—	—
Atlantic white-cedar	43	26.1	6.0	5.1	5.5	4.6	2.3	1.7	.9	—	—
Other softwoods	*	23.2	6.0	1.2	1.3	1.4	2.1	2.4	.8	1.7	6.3
Total softwoods	13	258.0	40.4	62.4	61.4	41.7	23.1	15.6	4.3	2.8	6.3
Select white oaks	13	178.0	36.5	21.9	24.9	13.2	13.2	12.7	18.0	12.5	25.1
Select red oaks	15	127.0	7.0	11.0	17.3	14.9	18.0	19.6	11.8	16.1	11.3
Other red oaks	12	275.7	42.0	45.0	37.8	25.0	33.3	35.8	20.0	12.5	24.3
Chestnut oak[1]	20	139.9	16.4	20.4	28.4	27.1	23.2	12.6	9.2	.9	1.7
Hickory	27	63.8	8.8	13.7	13.8	10.9	7.2	6.5	1.0	1.9	—
Sugar maple	39	22.3	4.0	4.3	1.4	2.3	.8	2.8	1.1	2.2	3.4
Soft maples	17	106.8	33.3	20.8	21.6	8.2	6.3	9.8	.8	1.6	4.4
Beech	43	15.1	2.7	1.4	2.4	1.8	3.8	2.0	1.0	—	—
Blackgum	32	38.5	11.1	10.0	5.1	2.9	2.6	2.9	.9	1.1	1.9
Sweetgum	37	75.2	7.4	12.7	16.7	10.0	12.0	8.4	3.0	2.0	3.0
Yellow-poplar	31	29.3	.7	1.9	2.0	5.6	2.3	4.6	5.9	1.8	4.5
Black walnut	*	8.9	1.1	1.3	2.8	.8	.9	—	—	2.0	—
Black cherry	34	13.8	6.7	2.8	1.3	1.4	.8	.8	—	—	—
Elm	30	11.1	2.8	1.7	3.8	.9	—	.9	—	1.0	—
Other hardwoods	16	106.9	19.3	20.4	16.5	25.2	11.6	5.8	1.9	1.1	5.1
Total hardwoods	5	1,212.3	199.8	189.3	195.8	150.2	136.0	125.2	74.6	56.7	84.7
All species	3.8	1,470.3	240.2	251.7	257.2	191.9	159.1	140.8	78.9	59.5	91.0

[1] Includes 1.3 million cubic feet of other white oaks.
* Sampling errors of more than 50 percent.

Table 25.—Net volume of growing stock on commercial forest land, by species and counties, New Jersey, 1972

[In millions of cubic feet]

County	Yellow pines	Other soft-woods	Total soft-woods	White oaks	Red oaks	Hickory	Soft maples	Sweet-gum	Other hard-woods	Total hard-woods	All species
Atlantic	35.0	5.3	40.3	26.6	37.6	1.7	14.1	13.1	6.7	99.8	140.1
Burlington	48.8	5.7	54.5	27.2	37.0	2.0	15.4	9.7	10.4	101.7	156.2
Camden	11.5	2.0	13.5	5.4	8.0	.5	2.8	2.4	2.3	21.4	34.9
Cape May	11.7	1.9	13.6	10.1	14.4	.6	5.3	5.6	2.6	38.6	52.2
Cumberland	26.2	6.0	32.2	19.5	24.4	1.4	9.3	6.5	8.0	69.1	101.3
Gloucester	9.4	2.0	11.4	10.2	14.0	.2	6.8	5.4	4.8	41.4	52.8
Hunterdon	—	2.8	2.8	24.3	27.5	6.6	3.2	1.3	25.9	88.8	91.6
Mercer	—	.7	.7	7.6	9.6	2.6	1.2	.2	8.9	30.1	30.8
Middlesex	—	1.5	1.5	10.9	13.7	3.2	1.7	.6	12.5	42.6	44.1
Monmouth	12.0	1.5	13.5	15.7	22.8	.4	11.1	10.2	6.2	66.4	79.9
Morris	—	4.0	4.0	41.0	45.8	12.2	5.3	1.7	41.6	147.6	151.6
Ocean	42.2	4.6	46.8	18.3	27.8	1.4	10.4	10.8	7.5	76.2	123.0
Passaic	—	1.4	1.4	11.1	12.9	4.0	1.4	.4	12.4	42.2	43.6
Salem	9.6	2.0	11.6	11.5	14.9	.5	8.0	4.3	5.1	44.3	55.9
Somerset	—	1.4	1.4	11.4	14.2	3.9	1.6	.1	14.9	46.1	47.5
Sussex	—	5.5	5.5	43.1	50.2	15.6	5.9	1.6	48.7	165.1	170.6
Warren	—	3.3	3.3	24.0	27.9	7.0	3.3	1.3	27.4	90.9	94.2
Total	206.4	51.6	258.0	317.9	402.7	63.8	106.8	75.2	245.9	1,212.3	1,470.3

Table 26.—Net volume of sawtimber on commercial forest land, by species and diameter classes, New Jersey, 1972

[In millions of board feet, International ¼-inch rule]

Species	Sampling error of total (*percent*)	Total, all classes	Diameter class (inches at breast height)						
			9.0–10.9	11.0–12.9	13.0–14.9	15.0–16.9	17.0–18.9	19.0–20.9	21.0+
Pitch pine	19	332.6	131.3	103.8	50.3	38.0	4.1	5.1	—
Shortleaf pine	36	65.4	24.1	23.6	13.4	—	4.3	—	—
Virginia pine	*	25.1	16.0	2.7	6.4	—	—	—	—
Other pines	*	24.2	1.9	2.6	5.9	10.2	3.6	—	—
Atlantic white-cedar	*	53.7	17.3	16.6	9.2	7.1	3.5	—	—
Other softwoods	*	71.0	4.2	5.2	8.4	10.3	3.8	8.3	30.8
Total softwoods	18	572.0	194.8	154.5	93.6	65.6	19.3	13.4	30.8
Select white oaks	17	399.3	—	47.8	51.3	52.4	76.5	55.5	115.8
Select red oaks	16	378.0	—	52.8	70.2	80.7	50.4	71.5	52.4
Other red oaks	16	620.3	—	91.9	129.2	147.3	85.0	55.8	111.1
Chestnut oak[1]	23	287.3	—	94.8	89.6	51.9	38.9	4.2	7.9
Hickory	37	104.6	—	36.8	28.1	27.0	4.2	8.5	—
Sugar maple	45	53.7	—	8.5	3.5	11.8	4.7	9.5	15.7
Soft maples	27	124.7	—	29.6	24.2	39.8	3.5	7.3	20.3
Beech	47	33.6	—	6.3	15.1	8.1	4.1	—	—
Blackgum	36	48.9	—	10.3	9.8	11.7	3.7	4.7	8.7
Sweetgum	40	153.0	—	35.6	47.0	34.9	13.0	8.9	13.6
Yellow-poplar	32	101.7	—	19.7	9.0	18.8	25.0	8.2	21.0
Black walnut	50	15.3	—	2.8	3.4	—	—	9.1	—
Black cherry	*	11.6	—	5.2	3.3	3.1	—	—	—
Elm	*	11.6	—	3.2	—	3.9	—	4.5	—
Other hardwoods	19	154.6	—	50.2	44.1	23.9	8.0	4.8	23.6
Total hardwoods	7	2,498.2	—	495.5	527.8	515.3	317.0	252.5	390.1
All species	5.8	3,070.2	194.8	650.0	621.4	580.9	336.3	265.9	420.9

[1] Includes 2.6 million board feet of other white oaks.
* Sampling errors of more than 50 percent.

Table 27.—Net volume of sawtimber on commercial forest land, by species and counties, New Jersey, 1972

[In millions of board feet, International ¼-inch rule]

County	Yellow pines	Other soft-woods	Total soft-woods	White oaks	Red oaks	Hickory	Soft maples	Sweet-gum	Other hard-woods	Total hard-woods	All species
Atlantic	74.7	11.1	85.8	48.6	96.3	3.4	11.8	20.1	7.1	187.3	273.1
Burlington	96.2	10.8	107.0	52.1	94.5	3.5	16.4	15.4	12.1	194.0	301.0
Camden	23.7	4.6	28.3	9.7	17.7	.9	2.7	5.5	2.6	39.1	67.4
Cape May	26.7	4.5	31.2	18.5	35.7	.9	4.7	9.2	2.8	71.8	103.0
Cumberland	59.6	14.9	74.5	36.6	58.7	1.9	10.2	11.4	8.7	127.5	202.0
Gloucester	22.9	5.4	28.3	23.5	37.6	.4	8.8	8.0	6.2	84.5	112.8
Hunterdon	—	9.0	9.0	57.5	68.6	9.1	5.0	6.1	50.8	197.1	206.1
Mercer	—	2.2	2.2	17.6	22.8	4.2	1.9	1.3	17.0	64.8	67.0
Middlesex	—	4.7	4.7	25.4	34.8	4.6	2.5	2.9	23.2	93.4	98.1
Monmouth	28.2	3.8	32.0	37.1	66.0	.6	13.9	15.9	8.5	142.0	174.0
Morris	—	13.9	13.9	95.1	110.7	19.4	8.7	9.2	81.2	324.3	338.2
Ocean	83.6	9.3	92.9	28.6	65.4	3.5	7.1	21.1	5.8	131.5	224.4
Passaic	—	4.3	4.3	25.5	29.4	7.4	2.3	2.7	23.4	90.7	95.0
Salem	22.3	4.6	26.9	28.3	43.8	.6	11.4	5.2	8.0	97.3	124.2
Somerset	—	3.7	3.7	26.5	33.2	5.9	2.8	2.0	28.8	99.2	102.9
Sussex	—	16.9	16.9	100.1	116.1	27.9	9.1	10.7	92.2	356.1	373.0
Warren	—	10.4	10.4	55.9	67.0	10.4	5.4	6.3	52.6	197.6	208.0
Total	437.9	134.1	572.0	686.6	998.3	104.6	124.7	153.0	431.0	2,498.2	3,070.2

Table 28.—Net volume of sawtimber on commercial forest land, by species and log-quality classes, New Jersey, 1972

[In millions of board feet][1]

Species	All classes	Standard-lumber logs			
		Grade 1	Grade 2	Grade 3	Grade 4[2]
Pitch pine	332.6	4.2	7.3	321.1	—
Shortleaf pine	65.4	5.1	14.1	46.2	—
Virginia pine	25.1	—	2.0	23.1	—
Other pines	24.2	—	—	21.8	2.4
Other softwoods[3]	124.7	—	—	—	—
Total softwoods	572.0	9.3	23.4	412.2	2.4
Select white oaks	399.3	17.9	73.6	213.8	94.0
Select red oaks	378.0	40.6	69.5	164.7	103.2
Other red oaks	620.3	37.7	103.2	243.2	236.2
Chestnut oak[4]	287.3	10.8	46.5	140.6	89.4
Hickory	104.6	4.4	7.0	42.2	51.0
Sugar maple	53.7	.2	6.2	26.5	20.8
Soft maples	124.7	4.5	15.1	58.5	46.6
Beech	33.6	.2	—	21.3	12.1
Blackgum	48.9	3.9	4.3	33.8	6.9
Sweetgum	153.0	17.6	24.4	72.3	38.7
Yellow-poplar	101.7	33.5	20.8	29.9	17.5
Black walnut	15.3	—	5.4	8.7	1.2
Black cherry	11.6	—	1.7	3.0	6.9
Elm	11.6	—	5.6	5.2	.8
Other hardwoods	154.6	5.0	20.2	71.4	58.0
Total hardwoods	2,498.2	176.3	403.5	1,135.1	783.3
Hardwood quality (in percent)	100	7	16	46	31

[1] International ¼-inch rule.
[2] Grade 4 applies only to white pine. For hardwoods the volumes in this column are for construction logs.
[3] Softwood species other than pine were not graded into standard-lumber logs.

Table 29.—Net growth, removals, and mortality of growing stock and sawtimber on commercial forest land, by ownership classes, softwoods and hardwoods, New Jersey, 1971

Species	Growing stock			Sawtimber		
	Net growth	Timber removals	Mortality	Net growth	Timber removals	Mortality
	Thousand cubic feet			*Thousand board feet* [1]		
Softwoods:						
Pitch pine	3,964	2,867	1,092	11,905	3,362	1,681
Shortleaf pine	297	528	82	543	2,349	126
Other pine	238	1,666	36	472	1,772	55
White-cedar	127	603	19	478	1,953	29
Other softwoods	474	536	71	602	2,564	109
Total softwoods	5,100	6,200	1,300	14,000	12,000	2,000
Hardwoods:						
Select white oaks	2,724	898	1,459	4,734	1,385	3,567
Select red oaks	1,859	3,248	1,086	5,651	11,820	2,398
Other red oaks	7,022	2,272	1,338	7,292	2,136	3,182
Other white oaks	632	776	1,898	741	148	6,718
Hickory	542	15	144	1,160	51	282
Sugar maple	221	41	59	283	11	116
Soft maples	2,674	353	528	2,488	599	737
Beech	364	106	97	1,280	355	190
Blackgum	496	44	132	256	5	258
Sweetgum	682	1,258	969	2,406	4,450	3,292
Yellow-poplar	1,155	417	63	3,244	875	123
Black walnut & cherry	202	34	72	204	21	141
Other hardwoods	1,227	338	2,455	1,261	144	2,996
Total hardwoods	19,800	9,800	10,300	31,000	22,000	24,000
Total, all species	24,900	16,000	11,600	45,000	34,000	26,000

[1] International ¼-inch rule.

Table 30.—Net growth and removals of growing stock and sawtimber on commercial forest land, by ownership classes, softwoods and hardwoods, New Jersey, 1971

Ownership	Net growth			Timber removals		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
	GROWING STOCK *Thousand cubic feet*					
Public	3,980	1,174	2,806	2,747	1,064	1,683
Forest industry	292	—	292	135	—	135
Farmer and misc. private	20,628	3,926	16,702	13,118	5,136	7,982
All ownerships	24,900	5,100	19,800	16,000	6,200	9,800
	SAWTIMBER *Thousand board feet*[1]					
Public	7,903	3,584	4,319	5,839	2,061	3,778
Forest industry	233	—	233	264	—	264
Farmer and misc. private	36,864	10,416	26,448	27,897	9,939	17,958
All ownerships	45,000	14,000	31,000	34,000	12,000	22,000

[1] International ¼-inch rule.

Table 31.—Mortality of growing stock and sawtimber on commercial forest land, by ownership class, causes, softwoods and hardwoods, New Jersey, 1971

Ownership and cause	Growing stock (thousand cubic feet)			Sawtimber (thousand board feet)[1]		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
			BY OWNERSHIP CLASS			
Public	1,758	299	1,459	3,856	512	3,344
Forest industry	152	—	152	182	—	182
Farmer and other	9,690	1,001	8,689	21,962	1,488	20,474
All ownerships	11,600	1,300	10,300	26,000	2,000	24,000
			BY CAUSE			
Fire	2,923	563	2,360	6,332	879	5,453
Insects	1,036	—	1,036	4,629	—	4,629
Disease	6,587	737	5,850	11,247	1,121	10,126
Weather	383	—	383	764	—	764
Logging	611	—	611	3,028	—	3,028
Unknown	60	—	60	—	—	—
All causes	11,600	1,300	10,300	26,000	2,000	24,000

[1] International ¼-inch rule.

Table 32.—Components of average annual net growth of growing stock and sawtimber on commercial forest land, softwoods and hardwoods, New Jersey, 1955-71

Components	All species	Softwoods	Hardwoods
	GROWING STOCK *Thousand cubic feet*		
Growth on initial growing-stock inventory[1]	21,154	4,009	17,145
Ingrowth-saplings that became poletimber	16,507	3,376	13,131
Gross growth	37,661	7,385	30,276
Cull increment	3,561	485	3,076
Annual mortality	10,900	1,450	9,450
Average annual net growth	23,200	5,450	17,750
	SAWTIMBER *Thousand board feet*[2]		
Growth on initial sawtimber inventory[1]	44,246	10,104	34,142
Ingrowth—poletimber trees that became sawtimber	35,700	7,279	28,421
Gross growth	79,946	17,383	62,563
Cull increment	8,446	1,383	7,063
Annual mortality	29,000	2,000	27,000
Average annual net growth	42,500	14,000	28,500

[1] Including growth on trees that were cut.
[2] International ¼-inch rule.

Table 33.—Output of timber products, by source of material, softwoods and hardwoods, New Jersey, 1970

Product and species group	Standard units	Total output		Output from roundwood		Output from plant byproducts	
		Number of units	Thousand cubic feet	Number of units	Thousand cubic feet	Number of units	Thousand cubic feet
Sawlogs:							
Softwoods	M board feet[1]	2,109	340	2,109	340	—	—
Hardwoods	M board feet[1]	11,657	1,746	11,657	1,746	—	—
Total	M board feet[1]	13,766	2,086	13,766	2,086	—	—
Veneer logs and bolts:							
Softwoods	M board feet[1]	—	—	—	—	—	—
Hardwoods	M board feet[1]	1,448	215	1,448	215	—	—
Total	M board feet[1]	1,448	215	1,448	215	—	—
Pulpwood:							
Softwoods	Standard cords[2]	38,376	3,070	38,376	3,070	—	—
Hardwoods	Standard cords[2]	9,054	724	8,129	650	925	74
Total	Standard cords[2]	47,430	3,794	46,505	3,720	925	74
Piling:							
Softwoods	M linear feet	56	34	56	34	—	—
Hardwoods	M linear feet	389	233	389	233	—	—
Total	M linear feet	445	267	445	267	—	—
Poles:							
Softwoods	M pieces	—	—	—	—	—	—
Hardwoods	M pieces	17	374	17	374	—	—
Total	M pieces	17	374	17	374	—	—
Posts (round & split):							
Softwoods	M pieces	44	48	44	48	—	—
Hardwoods	M pieces	—	—	—	—	—	—
Total	M pieces	44	48	44	48	—	—
Other:[3]							
Softwoods	M cubic feet	524	524	505	505	19	19
Hardwoods	M cubic feet	127	127	70	70	57	57
Total	M cubic feet	651	651	575	575	76	76
Total industrial products:							
Softwoods	—	—	4,016	—	3,997	—	19
Hardwoods	—	—	3,419	—	3,288	—	131
Total	—	—	7,435	—	7,285	—	150
Fuelwood:							
Softwoods	Standard cords	400	32	100	8	300	24
Hardwoods	Standard cords	49,350	3,948	40,100	3,208	9,250	740
Total	Standard cords	49,750	3,980	40,200	3,216	9,550	764
All products:							
Softwoods	—	—	4,048	—	4,005	—	43
Hardwoods	—	—	7,367	—	6,496	—	871
Total	—	—	11,415	—	10,501	—	914

[1] International ¼-inch rule.
[2] Rough wood basis (for example, chips converted to equivalent standard cords).
[3] Includes fencing bolts, handle stock, and dimension bolts, and includes 1,000 cubic feet of hardwood mine timbers.
[4] Does not include 104,400 cubic feet of softwood and 345,200 cubic feet of hardwood residues used mainly for chicken litter and livestock bedding.
Note: No cooperage logs and bolts were produced in New Jersey in 1970.

Table 34.—Output of roundwood products, by source, softwoods and hardwoods, New Jersey, 1970

[In thousands of cubic feet]

Product and species group	All sources	Growing-stock trees[1]			Rough and rotten trees[1]	Salvable dead trees[1]	Other sources[2]
		Total	Sawtimber	Poletimber			
PRINCIPAL INDUSTRIAL PRODUCTS							
Sawlogs:							
Softwoods	340	336	336	—	—	—	4
Hardwoods	1,746	1,674	1,674	—	—	—	72
Total	2,086	2,010	2,010	—	—	—	76
Veneer logs and bolts:							
Softwoods	—	—	—	—	—	—	—
Hardwoods	215	214	—	—	—	—	1
Total	215	214	—	—	—	—	1
Pulpwood:							
Softwoods	3,070	2,425	1,430	995	—	—	645
Hardwoods	650	584	525	59	—	—	66
Total	3,720	3,009	1,955	1,054	—	—	711
MISCELLANEOUS INDUSTRIAL PRODUCTS							
Piling:							
Softwoods	34	30	18	12	—	—	4
Hardwoods	233	222	—	222	—	—	11
Total	267	252	18	234	—	—	15
Poles:							
Softwoods	—	—	—	—	—	—	—
Hardwoods	374	297	—	297	11	—	66
Total	374	297	—	297	11	—	66
Posts (round and split):							
Softwoods	48	44	26	18	—	—	4
Hardwoods	—	—	—	—	—	—	—
Total	48	44	26	18	—	—	4
Other:							
Softwoods	505	437	261	176	7	7	54
Hardwoods	70	56	—	56	2	—	12
Total	575	493	261	232	9	7	66
All misc. industrial products:							
Softwoods	587	511	305	206	7	7	62
Hardwoods	677	575	—	575	13	—	89
Total	1,264	1,086	305	781	20	7	151
TOTAL INDUSTRIAL PRODUCTS							
Softwoods	3,997	3,272	2,071	1,201	7	7	711
Hardwoods	3,288	3,047	2,413	634	13	—	228
Total	7,285	6,319	4,484	1,835	20	7	939
NONINDUSTRIAL PRODUCTS (FUELWOOD)							
Softwoods	8	7	4	3	—	—	1
Hardwoods	3,208	2,551	—	2,551	87	—	570
Total	3,216	2,558	4	2,554	87	—	571

CONTINUED

Table 34.—Continued

Product and species group	All sources	Growing-stock trees[1]			Rough and rotten trees[1]	Salvable dead trees[1]	Other sources[2]
		Total	Sawtimber	Poletimber			
			TOTAL ALL PRODUCTS				
Softwoods	4,005	3,279	2,075	1,204	7	7	712
Hardwoods	6,496	5,598	2,413	3,185	100	—	798
Total	10,501	8,877	4,488	4,389	107	7	1,510

[1] On commercial forest land.
[2] Includes trees less than 5.0 inches in diameter, tree tops and limbs from commercial forest areas, or any material from noncommercial forest land, or nonforest land such as fence rows and suburban areas.

Table 35.—Timber removals from growing stock and live sawtimber on commercial forest land, by items, softwoods and hardwoods, New Jersey, 1970

Item	Growing stock (thousand cubic feet)			Sawtimber (thousand board feet)[1]		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
Roundwood products:						
Sawlogs	2,010	336	1,674	9,468	1,329	8,139
Veneer logs and bolts	214	—	214	1,239	—	1,239
Pulpwood	3,009	2,425	584	7,165	5,160	2,005
Piling	252	30	222	71	71	—
Poles	297	—	297	—	—	—
Posts	44	44	—	103	103	—
Other	493	437	56	1,033	1,033	—
Fuelwood	2,558	7	2,551	16	16	—
All products	8,877	3,279	5,598	19,095	7,712	11,383
Logging residues	1,135	164	971	466	130	336
Other removals	3,367	2,525	842	3,042	635	2,407
Total removals	13,379	5,968	7,411	22,603	8,477	14,126

[1] International ¼-inch rule.

Table 36.—Volume of unused residues at primary manufacturing plants, by industry and type of residue, softwoods and hardwoods, New Jersey, 1970

[In thousands of cubic feet]

Species group and type of residues	All industries	Lumber	Veneer and plywood	Other
Softwoods:				
Coarse[1]	7.4	7.4	—	—
Fine[2]	.6	.6	—	—
Total	8.0	8.0	—	—
Hardwoods:				
Coarse[1]	21.7	18.4	3.3	—
Fine[2]	18.7	16.8	1.9	—
Total	40.4	35.2	5.2	—
All species:				
Coarse[1]	29.1	25.8	3.3	—
Fine[2]	19.3	17.4	1.9	—
Total	48.4	43.2	5.2	—

[1] Material such as slabs, edgings, and veneer cores.
[2] Material, such as sawdust and shavings.
Note: The volume of used residues is shown under "Output from plant byproducts" of table 33.

Table 37.—Projections of net annual growth, available cut, and inventory of growing stock and sawtimber on commercial forest land, New Jersey, 1972-2002[1]

Species group	1972 (inventory year)	1982	1992	2002
	GROWING STOCK (*Million cubic feet*)			
Softwoods:				
Cut	6.2	5.7	4.9	4.2
Growth	5.1	4.8	4.5	4.2
Inventory	258.0	247.4	241.0	239.2
Hardwoods:				
Cut	9.8	15.2	20.4	24.8
Growth	19.8	22.2	23.9	24.8
Inventory	1,212.3	1,298.1	1,348.6	1,363.7
Total:				
Cut	16.0	20.9	25.3	29.0
Growth	24.9	27.0	28.4	29.0
Inventory	1,470.3	1,545.5	1,589.6	1,602.9
	SAWTIMBER (*Million board feet*)[2]			
Softwoods:				
Cut	12	12	12	10
Growth	14	14	13	13
Inventory	572	587	604	629
Hardwoods:				
Cut	22	34	43	50
Growth	31	34	36	37
Inventory	2,498	2,538	2,496	2,391
Total:				
Cut	34	46	55	60
Growth	45	48	49	50
Inventory	3,070	3,125	3,100	3,020

[1] Based upon the following assumptions: Farmland abandonment and reversion to forest will be offset by forest land lost by land clearing, growth rates will continue to be the same for the next 30 years, and trends in forestry programs will continue at the same rate as in the past. Timber available for cutting in this projection is assumed to be that amount that will bring growth and cut into balance by the end of 30 years.

[2] International 1/4-inch rule.

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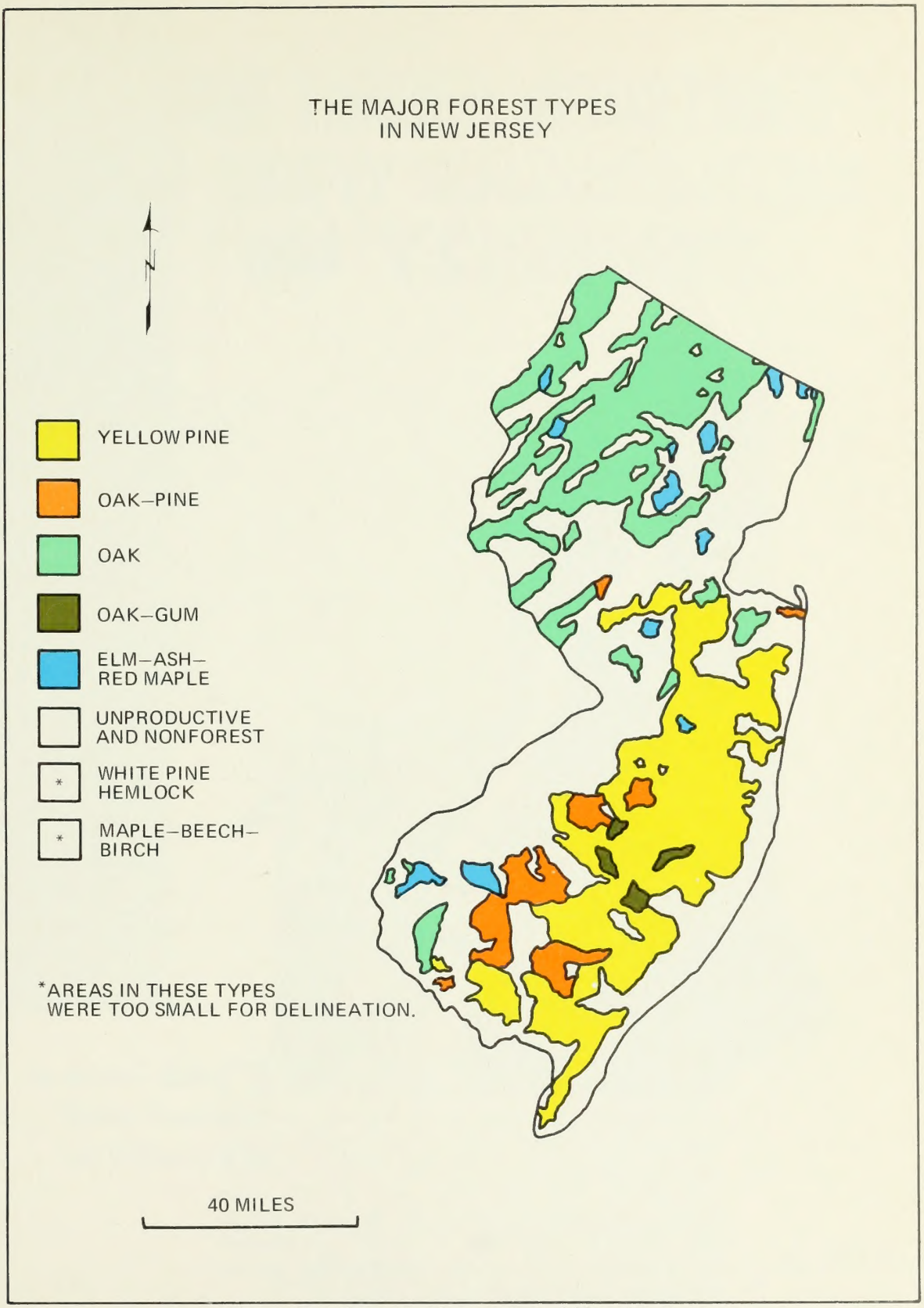

Figure 13.—The major forest types of New Jersey.

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