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The Timber Resources of RHODE ISLAND



NORTHEASTERN FOREST EXPERIMENT STATION

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RALPH W. MARQUIS, DIRECTOR

PREFACE

THIS is a report on the first comprehensive survey ever made of the timber resources of Rhode Island. It shows, for the years 1952 and 1953, the area and condition of the forest land, the volume and quality of standing timber, the rates of timber growth and mortality, and the extent of timber cutting for forest products. The survey was made by the Forest Service as part of a nationwide survey of timber resources.

The Timber Resources of RHODE ISLAND

by

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CONTENTS

People & forests	1
Use of the timber resource	6
Supply of standing timber	11
Condition of the forests	22
Developing the timber resource ...	29
Literature cited	30
Appendix	31

PEOPLE & FORESTS

RHODE ISLAND is the most densely populated state in the Union and one of the most extensively forested. With 750 persons per square mile of land, it has a population density that is 15 times the national average. Yet two-thirds of its land area is forest land.

The timber on the forest land is little used. It is growing more than six times as fast as it is being cut, and the ratio of timber growth to timber cut is one of the highest in the Nation. Yet it would be difficult to find a comparable forest area where the timber growing stock is so depleted. Rhode Island's standing timber averages less than 400 cubic feet per acre, half the average volume in the East as a whole. Sawtimber stands of 1,500 or more board feet per acre are found on only 3 percent of the forest-land area.

Though timber values are now low, potentially they are high. If rehabilitated, the forest resource could make significant contributions to income and employment. The opportunity depends largely upon the forest policies and programs that the people of Rhode Island choose. This report contains some of the information that may be helpful in reaching decisions about future use of the forest resource in Rhode Island.

Population Is Growing

The 1950 Census enumerated 792,000 persons in Rhode Island. All but 125,000 of them live in cities, chiefly Providence and its suburbs. Nonfarm people make up most of the rural population. About one-tenth of the land is so thickly populated that it has been classified by the Census as "urbanized area." An urbanized area is defined as thickly settled territory, usually characterized by a closely spaced street pattern, which contains at least one city with 50,000 inhabitants or more.

Since 1900 the population of Rhode Island has nearly doubled. Though the population has not grown quite so fast as the national average, continuation of the present rate of increase will raise the population to more than 1,000,000 persons by 1975. Further expansion of urban population and of urbanized area can be expected. However, recent trends indicate that the rural nonfarm population is likely to show the largest percentage increase.

As population expands, more forest land will be cleared for homes, streets, and other facilities. More demand will be created for the non-timber uses of the forest land.

Competition For Forest Land Is Increasing

The forests of Rhode Island are highly important for purposes other than timber production, especially for uses such as watershed protection and recreation.

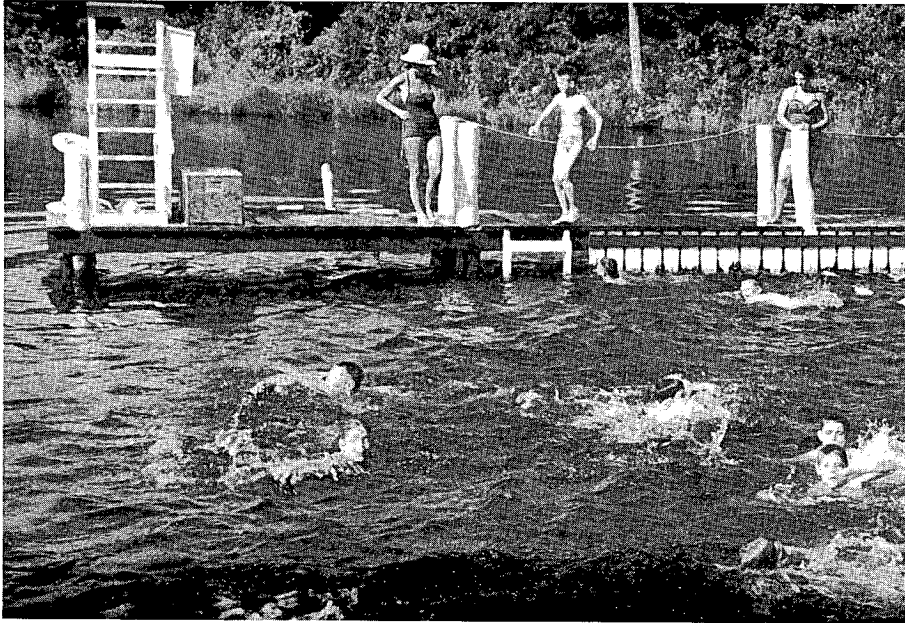
Rhode Island consumes about 120,000 gallons of water daily per square mile--more than twice the national average (8).¹ This use reflects not only the State's small area and dense population but also the size of her industrial economy. A single textile-finishing plant may consume 6 to 8 million gallons daily. Steam power plants require 600 to 1,000 tons of water for each ton of coal burned (3).

Both ground water and surface water supplies are adequate at present--due in no small part to protection that forests give to the state's watersheds. Except for the Blackstone River, nearly all of the rivers in the state are short coastal streams that originate on forest land. Forest cover prevents erosion of their watersheds, minimizes flooding, and helps to regulate the flow of water into streams and reservoirs. Forests also aid in the replenishment of ground water supplies.

More apparent to most people is the value of forests for hunting, fishing, and other kinds of recreation. Close to a large urban population, Rhode Island's forest land is

¹Underlined numbers in parentheses refer to Literature Cited, page 30.

U. S. FOREST SERVICE PHOTO



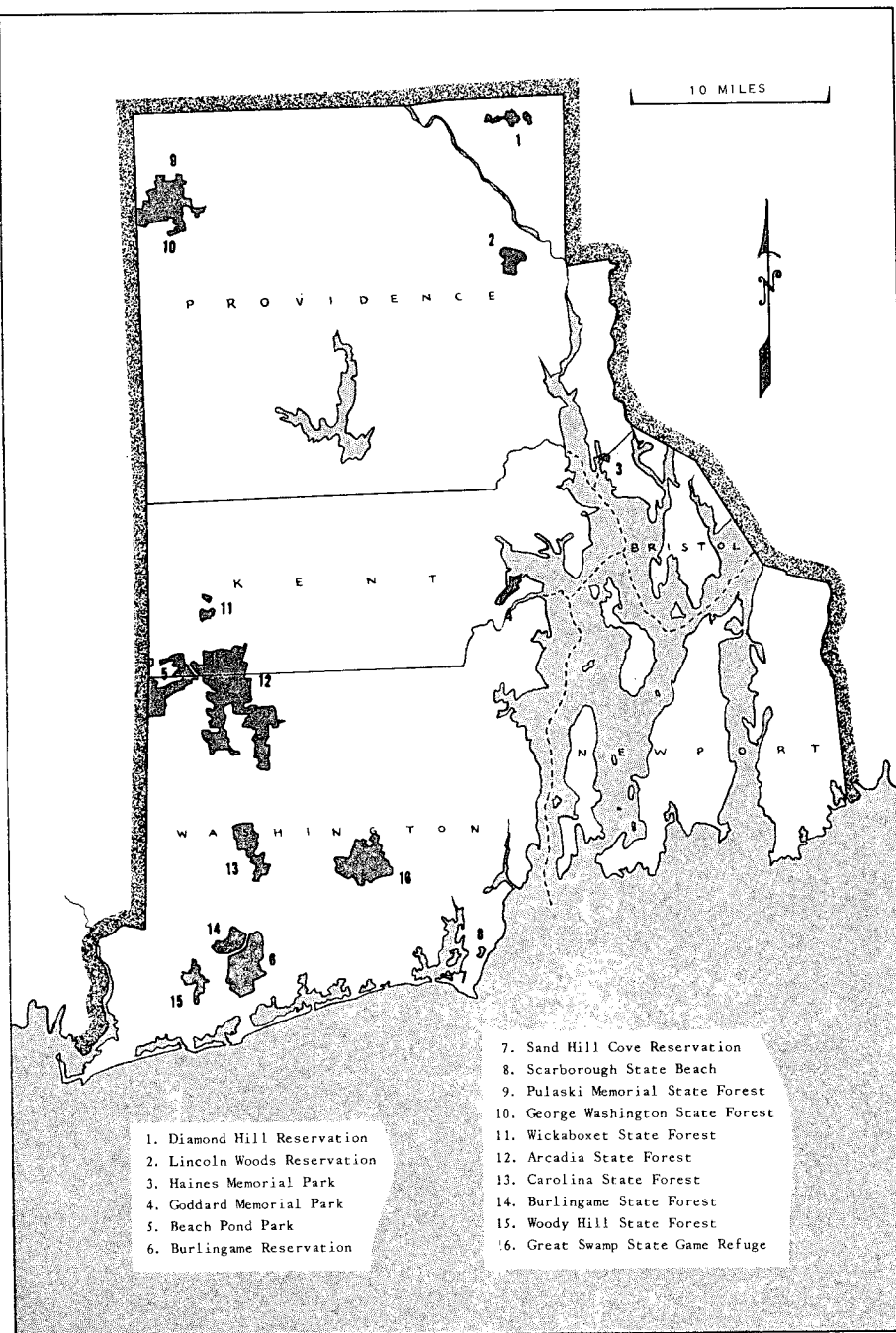
*RHODE ISLAND'S FOREST
LAND IS USED INTENS-
IVELY FOR RECREATION*

↑ *Swimming at Arcadia State Park*

↓ *Stepstone Falls in Wickabonet
State Forest attract tourists*



RHODE ISLAND DIVISION OF PARKS PHOTO



*Rhode Island has 21,000 acres of
land in state parks and forests.*

used intensively for this purpose, particularly the 21,000 acres of land in state parks and forests.

Since Rhode Island's major tourist attraction is its long (400-mile) coast line, estimates of the size of the recreation industry reflect much more than forest use. However it is noteworthy that recreation income is nearly equal to cash income from agriculture (8)

Forests provide food and cover for many kinds of game animals and birds. Many thousands of persons use the forest for the outdoor pleasure of hunting and fishing. For the year ended in June 1954, more than 25,000 fishing licenses and 13,000 hunting licenses were sold (7).

Multiple Use Of Forest Land Is Possible

Water, recreation, agriculture, and residential and industrial development compete with timber for the use of land in Rhode Island. Already rural land values are higher than in most other states; undoubtedly they will continue to rise as population increases. Forward-looking owners of forest land may well question whether timber will bring as much income as some of these other competing land uses. Whether the land use is likely to change before timber benefits accrue will have to be considered in public rehabilitation programs.

These issues cannot be decided here. However, much of the present forest area is well suited for multiple use. Watershed protection and timber production frequently go hand in hand. Timber-growing is also compatible with many forms of recreational use. These two combinations--timber and water, and timber and recreation--may spell most efficient use in the future for a large part of the present forest-land area.

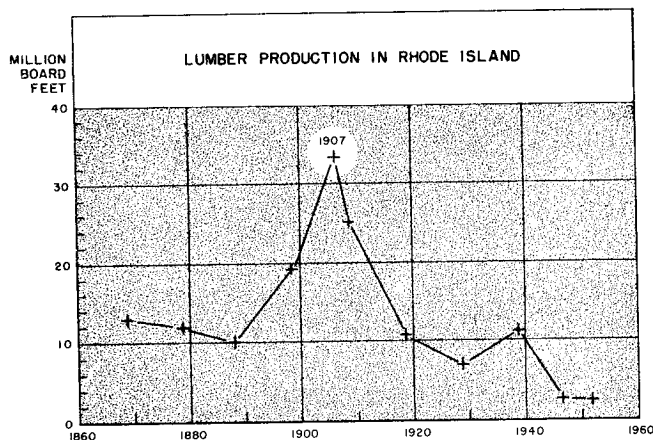
Hence it would be a mistake to write off the forest of Rhode Island as a source of timber. Although this report is concerned with timber only, the future of the timber resource will hinge chiefly upon the possibilities that exist for multiple use of the forest land.

USE OF THE TIMBER RESOURCE

THE OUTPUT of timber products from Rhode Island's forests in 1952 was less than 2,000,000 cubic feet of logs, bolts, piling, posts, and other roundwood (table 1). The total value of the output was \$50,000 to \$75,000, estimated on the stump before logging. The volume of output is less than 2 percent of the total volume of lumber, paper, fuelwood, and other timber products that are consumed annually in the state (measured in terms of roundwood).

Sawlogs And Lumber Output

Sawlogs are the most valuable timber product cut from the forests. Unfortunately, very few trees in Rhode Island are big enough to make into sawlogs. In 1952, the sawlog cut was $2\frac{1}{2}$ million board feet (log scale, International $\frac{1}{4}$ -inch rule). All of this output was sawed into lumber at Rhode Island sawmills, except for some 200,000 board feet that were shipped to out-of-state mills. An equal amount of sawlogs, cut in other states, was shipped into Rhode Island.



Lumber production reached its peak in Rhode Island in 1907, is now at a low level.



Portable sawmills like this one produce much of the lumber that is sawed in Rhode Island.

Sawmilling is one of the oldest industries in the state. The first-up-and-down saws, in mills powered by water, were operating before 1700. The steam engine, introduced just before the Civil War, revolutionized the industry. But by then more than half of the land had been cleared for farming and the area of sawtimber available for the lumber industry was already small. In fact, depletion of timber supplies had caused some concern as far back as 1820 (6).

In the 1870's, portable steam sawmill operations were cutting the timber to such an extent that agricultural associations of that decade called for special forestry studies by the agricultural experiment station. Jesse B. Mowry, the first Forest Commissioner (appointed in 1907), stated in one of his annual reports that "Between the fires and the portable sawmills, the valuable pine-oak forest has gradually given place to sprout hardwoods, which do not grow rapidly on our types of soil."

Now, almost 50 years later, no sawmill in the state saws as much as a million board feet in a year. In the

Table 1.--Output of timber products and annual cut of live sawtimber and growing stock, Rhode Island, 1952

Product ¹	Output of timber products					Annual cut of live sawtimber					Annual cut of growing stock			
	Volume, standard units		Roundwood volume			Soft-woods	Hard-woods	Total	Soft-woods	Hard-woods	Total	Soft-woods	Hard-woods	Total
			Standard units	Number	Soft-woods									
	M cubic feet													
Sawlogs	M board feet ²	2,505	28	399	427	118	1,845	1,963	28	412	440			
Pulpwood	Standard cords ³	5,000	203	197	400	--	141	141	205	162	367			
Fuelwood	Standard cords	4 11,672	91	859	950	8	37	45	51	435	486			
Piling	M linear feet	20	--	12	12	--	56	56	--	13	13			
Posts	M pieces	19	10	4	14	--	--	--	9	3	12			
Miscellaneous ⁵	M cubic feet	3	1	2	3	5	--	5	1	2	3			
Total	--	--	333	1,473	1,806	131	2,079	2,210	294	1,027	1,321	294	1,027	1,321

¹Products not listed here were insignificant in Rhode Island.

²International $\frac{1}{4}$ -inch rule.

³Rough-wood basis.

⁴Does not include 112,000 cubic feet of wood from mill residues.

⁵Includes shingles and laths.

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state's directory of buyers of forest products (2), there are the names and addresses of 30 sawmill operators within the state. Most have portable sawmills. A few of these sawmills are now idle. Some do a small amount of custom-sawing and are idle most of the year. Many of the sawmills are operated in conjunction with other activities such as farming, trucking, or milling.

Lumber production in Rhode Island climbed to a peak of 33 million board feet in 1907, and then it declined to a low of 4 million board feet in 1937 (10). After the hurricane of 1938, production from salvaged trees amounted to almost 12 million board feet; then lumber production dropped to approximately $2\frac{1}{2}$ million board feet in 1947 and was at that level again in 1952. Ninety-four percent of the lumber now produced comes from hardwood trees (table 2), principally oak.

Important uses of the lumber sawed today include blocking and dunnage, pallets, ship timbers, railroad ties, and material for local construction in rural areas. There are a number of small industries that use lumber for manufacturing wooden boxes, woodenware, millwork, furniture, and fixtures (4), but they draw nearly all of their lumber requirements from outside the state.

Pulpwood

There is only one pulpmill (Bird and Son, Inc.) in Rhode Island. This mill, which uses the Asplund defibrator process, is located in East Providence. In 1952 it had a 24-hour capacity of about 200 tons of wood pulp, and used about 40,000 standard cords of wood and a large quantity of rags and paper. Only 5,000 cords of pulpwood came from the timber cut in Rhode Island. Sixty percent was hardwood, mostly oak; and 40 percent was softwood, mostly pitch pine.

Half The Output Is Fuelwood

Approximately half of the 1952 timber-products output was used in the round form without further manufacturing. Most of this is fuelwood. Even though fuelwood consumption has dropped greatly since its peak year of 1918, about 11,700 cords of fuelwood were produced from trees in addition to 1,400 cords salvaged from plant residues (5).

Table 2.--Lumber produced from Rhode Island's forests,
by species, 1952

Species	Total production ¹	
	Thousand bd.ft.	Percent
SOFTWOODS		
White pine	154	6
Other softwoods	3	(2)
Total softwoods	157	6
HARDWOODS		
Oaks	2,323	93
Beech-yellow birch-hard maple	20	1
Other hardwoods	5	(2)
Total hardwoods	2,348	94
ALL SPECIES ³	2,505	100

¹Includes 217,000 board feet of lumber produced from sawlogs exported from Rhode Island.

²Less than 1 percent.

³Does not include 216,000 board feet of lumber produced from sawlogs imported into Rhode Island.

About 2 percent of the timber-product output is divided between piling and posts. A negligible amount of wood was used for shingles, lath, and charcoal. However, charcoal production is growing in importance. There were two shingle mills and three charcoal kilns in Rhode Island in 1952. Since then many more charcoal kilns have been built.

The Cut From Growing Stock

The 1952 output of timber products (1,800,000 cubic feet) required a cut of about 1,300,000 cubic feet² of growing stock on commercial forest land (table 1). About 600,000 cubic feet of timber products--almost all of it fuelwood--

²The sampling error of this estimate of timber cut from the forest growing stock is plus or minus 11 percent; that is, the probabilities are 2 out of 3 that the actual volume of timber cut in 1952 does not vary from the estimated volume by more than 11 percent.

were obtained from cull trees, dead trees, hardwood limbs, and plant residues. On the other hand, almost 100,000 cubic feet of growing stock were cut but were left in the woods. This logging residue consisted chiefly of upper stems.

In terms of sawtimber, the 1952 cut on commercial forest land was almost $2\frac{1}{4}$ million board feet (log scale, International $\frac{1}{4}$ -inch rule). All but about 12 percent of the sawtimber volume cut was for sawlog production. Most of the sawtimber that was not used for sawlogs was made into pulpwood.

SUPPLY

OF STANDING TIMBER

THE ESTIMATES in this report are based on a sampling method that was designed for large forest areas. Because of the relatively small area of Rhode Island, the errors of estimate are somewhat larger than the errors of estimate reported for forest surveys in the other New England states. (See Appendix for further discussion of accuracy of the estimates.)

To strengthen the estimates, the sampling design was modified in various ways. The accuracy of the timber-cut estimates has been improved by using 100-percent canvasses of output wherever possible. The growth estimates have been strengthened by using measurements taken in Connecticut and Massachusetts on trees similar to those in Rhode Island.

Net Growth
Much Greater
Than Annual Cut

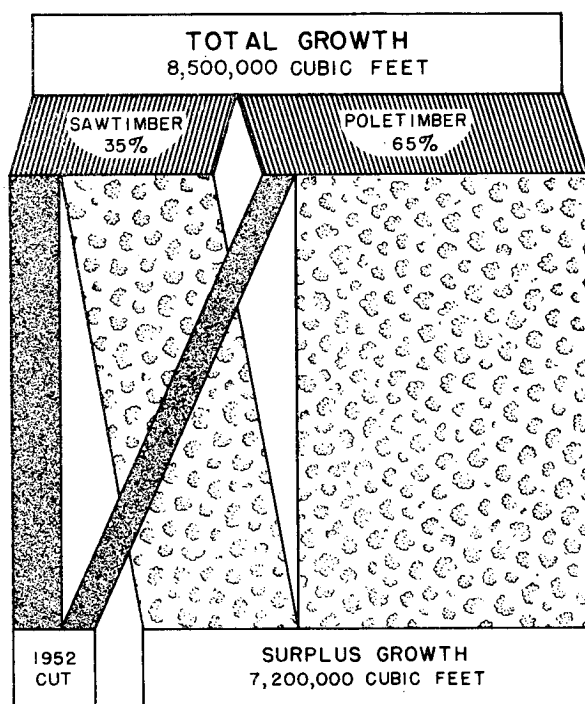
In contrast to the 1952 cut of 1,300,000 cubic feet of growing stock, the net growth of growing stock on commercial forest land was 8,500,000 cubic feet (plus or minus 15 percent). Thus the harvest was only one-sixth of the net cubic-foot growth.

The net growth of sawtimber also exceeded the cut during 1952. While 9,400,000 board feet were added to timber stands through net sawtimber growth, 2,200,000 board feet were cut. The cut was divided between hardwoods and softwoods this way:

	<i>Net growth (thousand board feet)</i>	<i>Annual cut (thousand board feet)</i>
Softwood	2,100	131
Hardwood	7,300	2,079
All species	9,400	2,210

This cut was only one-fourth of the net board-foot growth. Few other states have such favorable growth-cut ratios.

Per acre of commercial forest land, the annual growth of growing stock averages about 20 cubic feet, including 22 board feet of sawtimber. These figures confirm earlier estimates made by the Rhode Island Division of Forests. The cubic-foot growth per acre is less than one-fourth of what it might be because close to one-half of the commercial for-



Only about one-sixth of the net growth in Rhode Island's forests is cut, leaving a large surplus of growing stock.

est land carries few trees big enough to measure and count as growing stock. The board-foot growth per acre is less than one-tenth of the possible growth because sawtimber stands occur on only 3 percent of the commercial forest-land area.

The over-all annual cut of growing stock is 16 percent of total growth. The annual cut of softwoods, however, is a little more than 30 percent of growth. The cut-and-growth ratio is about the same for poletimber trees as for sawtimber trees. In terms of sawtimber volume, the annual cut is almost one-fourth of the annual growth. Less than 6 percent of the sawtimber volume cut comes from softwood trees.

Table 3.--Components of net annual growth of growing stock on commercial forest land, by species group, Rhode Island, 1952

Item	Softwoods	Hardwoods	All species
	<u>Thousand</u> <u>cu.ft.</u>	<u>Thousand</u> <u>cu.ft.</u>	<u>Thousand</u> <u>cu.ft.</u>
Growth on growing stock	700	3,800	4,500
Ingrowth--saplings that became poletimber trees in 1952	300	4,600	4,900
Total	1,000	8,400	9,400
Annual mortality	100	800	900
Net annual growth	900	7,600	8,500

The annual cut of growing stock is equivalent to about 3,400 rough standard cords of softwoods and about 13,100 rough standard cords of hardwoods. Growth on growing stock is equivalent to 11,200 rough standard cords of softwood and about 95,000 rough standard cords of hardwoods.

Ingrowth
More Than Half
Of Growth

In addition to volume increment in trees that were big enough to count at the beginning of the year, net annual

growth includes two other important elements: ingrowth and allowance for mortality.

Ingrowth, the volume in small trees that grow into measurable size during the year, is the major component of timber growth in Rhode Island (table 3). It more than equals the growth on the initial growing stock. Ingrowth of growing stock totals nearly 5 million cubic feet, ingrowth of sawtimber about 7 million board feet.

Table 4.--Net volume of all timber on commercial forest land,
by class of material and species group, Rhode Island, 1953

Class of material	Softwoods	Hardwoods	Total
	<u>Million</u> <u>cu.ft.</u>	<u>Million</u> <u>cu.ft.</u>	<u>Million</u> <u>cu.ft.</u>
GROWING STOCK			
Sawtimber trees:			165
Sawlog portion	29 8.9	32	4140.9
Upper stem portion	1	10	11
Total	30 9.9	42.0	5251.9
Poletimber trees	5.1	104.0	109.1
Total, growing stock	15.0	146.0	161.0
OTHER MATERIAL ¹			
Sound cull trees	6	33	39
Rotten cull trees	(2)	12	12
Hardwood limbs	--	20	20
Total other material	6	65	71
Total, all timber	21 ✓	211 - 20	232

¹The volume of salvable dead trees is negligible.

²None tallied on sample plots.

Tree mortality is due to fire, windthrow, insects, disease, and suppression. Losses to these destructive agents in 1952 approached 1 million cubic feet of growing stock, including more than 1 million board feet of sawtimber. Allowance for such mortality is made in calculating net annual growth.

Forest Growing Stock

The commercial forest land carries about 232 million cubic feet of sound wood, though not all this volume is classified as growing stock. About 71 million cubic feet of sound wood are in cull trees and hardwood limbs, which are not counted as forest growing stock (table 4). Growing stock--the volume of sound wood in the main stems of sawtimber and poletimber trees, from a 1-foot stump to a 4-inch top inside bark--is estimated to be about 161 million cubic feet (plus or minus 8 percent).

More than two-thirds of the 161 million cubic feet are in poletimber trees. Red maple, which accounts for one-fourth of the total volume, has six times as much volume in poletimber trees as in sawtimber trees.

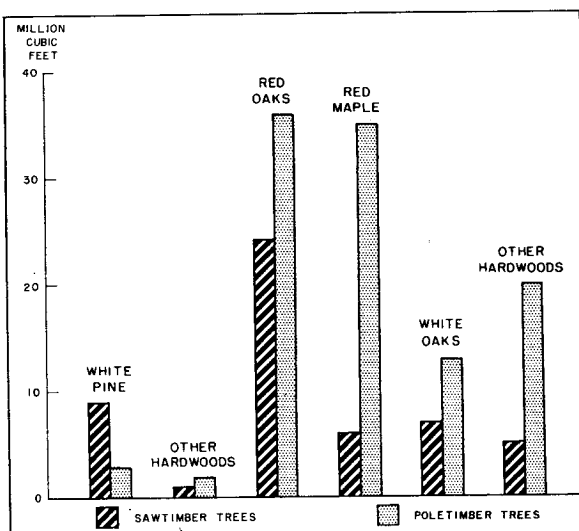
More than 90 percent of the timber products used by the forest industries is supplied from the growing stock; fuelwood is the only major product partially derived from other material such as cull trees. Even so, about one-half of the fuelwood cut comes from growing stock.

Sawtimber Volume

The sawlog portion of sawtimber trees, amounting to 41 million cubic feet of sound wood, account for one-fourth of the growing stock. Measured according to the International $\frac{1}{4}$ -inch Rule, which approximates lumber tally, this material is equivalent to about 165 million board feet, log scale (plus or minus 17 percent).

About one-fifth of the sawtimber volume is in softwood species, mostly white pine (table 5). The oaks, principally northern red oak, make up almost two-thirds of all sawtimber volume. Red maple accounts for better than a tenth of the volume.

For sawlog use, most of the sawtimber is poor in quality. For example, more than 70 percent of the hardwood sawtimber volume is in 12- and 14-inch trees. Such trees are too small to make high-grade lumber. Low quality is also characteristic of much of the softwood sawtimber.



The growing stock in Rhode Island's forests. The oaks provide a large part of the sawtimber. There is a large volume in red maple poletimber.

Volume per acre (or stand size) is another important factor that affects sawlog production. The average volume per acre of all sawtimber stands in Rhode Island is less than 3,000 board feet per acre, but many of the sawtimber stands have barely the minimum volume of 1,500 net board feet per acre. Even more important than this, about 125 million board feet (more than three-fourths of the total) of sawtimber is scattered through poletimber stands and seedling-and-sapling stands:

Stand-size class	Million board feet	Million cubic feet
Sawtimber stands	40	18
Poletimber stands	97	127
Scattered trees	28	16
Total	165	161

The operable stands are widely scattered in the western part of the state, and many are small in area.

Most of the timber volume is privately owned. Although the data by ownership are weak, roughly 20 million board feet of standing timber is in public ownership. The remainder is owned by farmers, other individuals, and industries:

<i>Ownership</i>	<i>Million board feet</i>	<i>Million cubic feet</i>
Public	20	12
Farm	12	32
Other private	133	117
Total	165	161

**Volume Suitable
For Pulpwood**

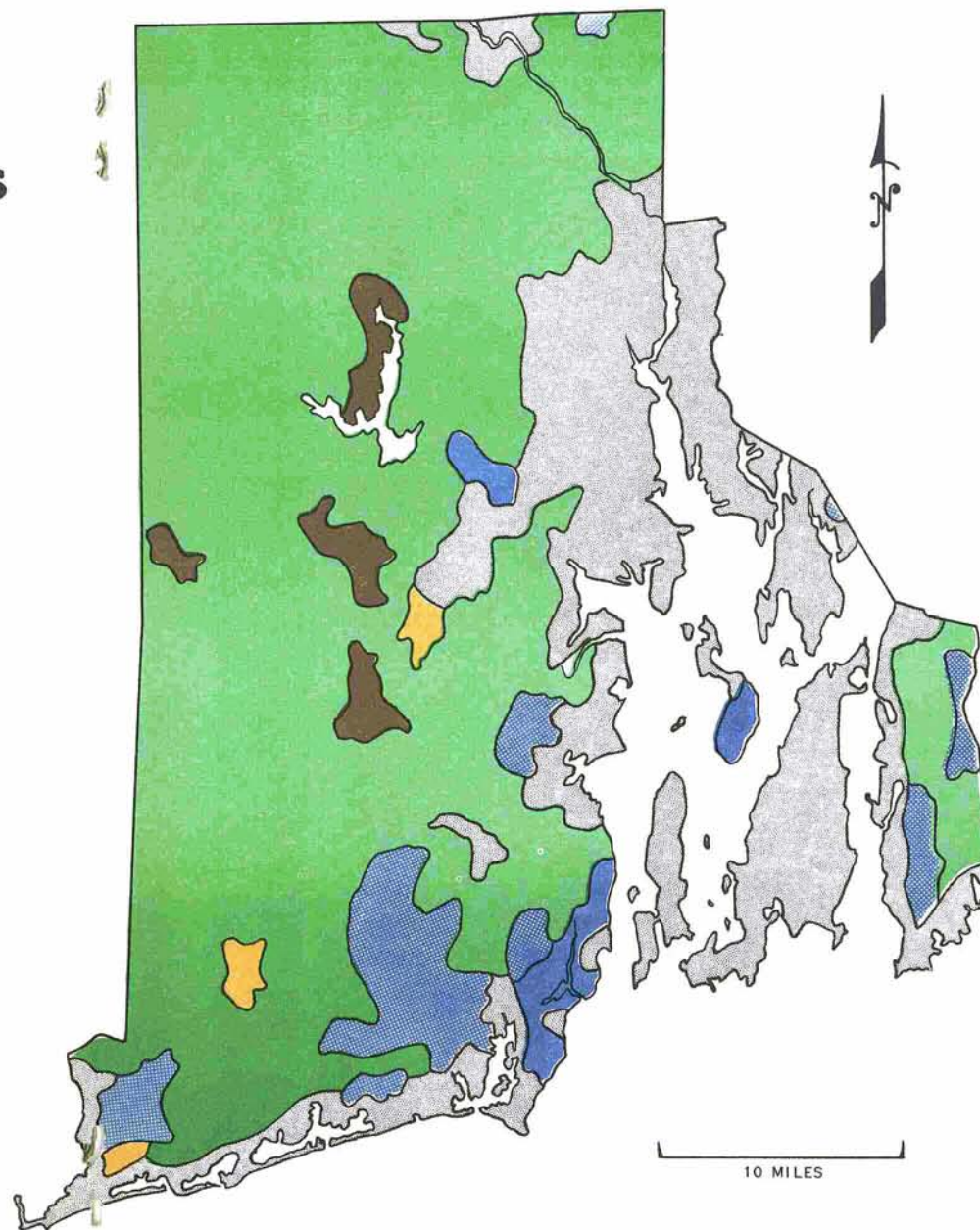
About 85 percent of the growing stock--including most of the sawtimber--also meets regional specifications for pulpwood. This volume totals about 1,700,000 cords. Although about half of the pulpwood cut in the state is softwood, the softwood species represent less than one tenth of the total volume suitable for pulpwood (table 6).

Table 5.--Net volume of live sawtimber and growing stock
on commercial forest land, by species,
Rhode Island, 1953

Species	Sawtimber ¹	Growing stock
	<u>Million bd.ft.</u>	<u>Million cu.ft.</u>
SOFTWOODS		
White pine	26	12
Other softwoods	3	3
Total	29	15 ✓
HARDWOODS		
Red oaks	75	60
Red maple	18	41
White oaks	28	20
Hickory	8	6
White ash	4	6
Other hardwoods	3	13
Total	136	146
ALL SPECIES	165	161

¹ Log scale, International $\frac{1}{4}$ -inch rule.

THE MAJOR FOREST TYPES IN RHODE ISLAND



The pulpwood industry in general has increased its interest in hardwood pulping. Compared to conifers, hardwoods yield considerably more chemical pulp, and new processes are available for pulping hardwoods cheaply. There are more than 1,500,000 standard cords of hardwood timber in the state that are suitable for pulping. The high-yield hard-hardwood species--such as oak and hickory--account for more than half of it.

Table 6.--Net volume suitable for pulpwood
on commercial forest land by species,
Rhode Island, 1953

Species	Volume suitable ¹ for pulpwood
	<u>Thousand</u> <u>cords</u>
SOFTWOODS	
White pine	126
Other softwoods	29
Total	155
HARDWOODS	
Red oaks	633
Soft maple	433
White oaks	212
Hickory	67
Ash	64
Yellow birch	45
Other hardwoods	90
Total	1,544
ALL SPECIES	1,699

¹In terms of the pulpwood specifications established by the Northeastern Technical Committee of the American Pulpwood Association. The total growing stock in Rhode Island represents about 2,000,000 cords, of which about 85 percent is pulpwood material.

Most of the pulpwood volume is available, though some species are not used at present and much of the higher value material will be used for lumber. Though some of the pulpwood timber is in stands that contain less than 5 cords per acre, about 80 percent is located in operable stands of 5 or

more cords per acre, and 13 percent is to be found in stands of more than 15 cords per acre:

<i>Stands of--</i>	<i>Thousand cords</i>
0-5 cords per acre	331
5-15 cords per acre	1,148
15+ cords per acre	220
Total	1,699

RHODE ISLAND DIVISION OF FORESTS PHOTO



Much of Rhode Island's timber is small. Poplartimber trees in stands like this one make up two thirds of the growing-stock volume.

CONDITION OF THE FORESTS

THE EARLIEST estimate of forest area by counties in Rhode Island was made in 1767 (1). At that time 31 percent of the State was forested. The forest area by counties was as follows:

	<i>Forest area</i> <i>(thousand acres)</i>
Bristol	1
Kent	47
Newport	9
Providence	101
Kings (Washington)	84
State	242

In 1908 State Forest Commissioner Jesse B. Mowry visited all towns, examined the forests, and came up with an estimate of 256,000 acres of forest land--38 percent of the total land area. Then in 1935 the Rhode Island State Bureau of Forestry published a set of tables showing estimated forest areas by towns and counties. With the exception of Newport County, the estimates of 1935 agree closely with our Forest Survey estimates of 1953 (table 7).

There are now 434,000 acres (plus or minus 4 percent) of forest land in Rhode Island--64 percent of the land area of the state. Practically all of it is commercial forest land. Only 3,500 acres of productive forest land are reserved from timber cutting, all in state parks.

Oak Forests Most Extensive

Stands of hardwood trees cover 96 percent of the commercial forest land (table 8). Throughout the state, the most extensive type of forest cover is oak. Oak forests (50 percent or more oak) occupy almost three-fourths of all the commercial forest land. There are small amounts of pine and other softwoods scattered throughout the various oak types.

The distribution of timber volume by forest type is not much different from the distribution of forest area by types. The average volume per acre is less than 400 board feet and also less than 400 cubic feet. White pine types

Table 7.--Land area and forest-land area by counties,
Rhode Island, 1935 and 1953

County	Land area ¹	1935 forest-land area ²	1953 commercial forest-land area	
	<u>Thousand acres</u>	<u>Thousand acres</u>	<u>Thousand acres</u>	<u>Percent forested</u>
Bristol	16	4	4	26
Kent	110	76	79	72
Newport	74	17	24	33
Providence	270	172	172	64
Washington	207	150	151	73
Total	677	419	430	64

¹Census of Agriculture, 1950.

²Rhode Island State Bureau of Forestry; includes reserved forest land.

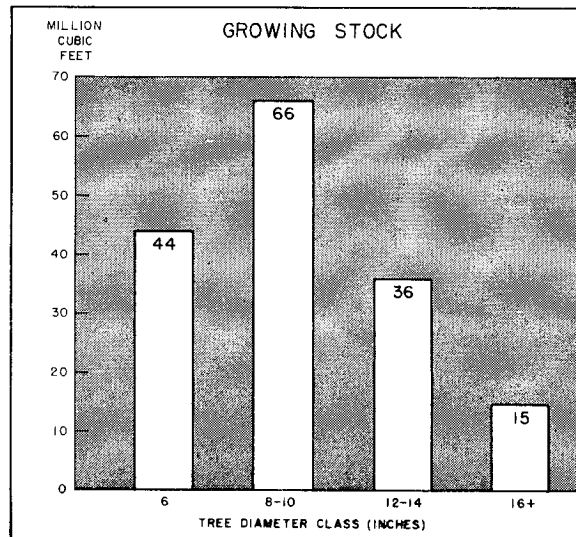
carry somewhat more timber per acre than average, but the white pine acreage is small. About 70 percent of all the timber volume in the state is found in the oak types.

Timber Volume Is Spread Unevenly

Sawtimber stands having more than 1,500 board feet per acre are found on 3 percent of the forest land:

<i>Stand-size class</i>	<i>Thousand acres</i>	<i>Percent</i>
Sawtimber stands	14	3
Poletimber stands	234	54
Seedling-and-sapling stands and other areas	182	43
Total area	430	100

Most of the timber volume is in small trees----10 inches diameter or less.



Sawtimber stands carry less than one-fourth of the total sawtimber volume and about one-tenth of the growing stock. Poletimber, sapling, and other stands--covering 97 percent of the forest land--contain the remaining 90 percent of the growing stock. The white pine type has the largest percentage of its area in sawtimber stands, 22 percent. The red oak type has the largest percentage of sawtimber of any hardwood forest type, but it amounts to only 5 percent.

Small Trees Predominate

More than 70 percent of all sawtimber volume is found in trees 14 inches and smaller. This holds true for white pine as well as for hardwood sawtimber volume. Of total growing stock (trees in the 6-inch-and-larger diameter classes), about two-thirds of the volume is in poletimber trees and 90 percent is found in trees of the 14-inch and smaller diameter classes.

Most Of The Forest Is Privately Owned

Private owners hold 94 percent of the commercial forest land in Rhode Island. The other 6 percent is in public ownership:

<i>Ownership class</i>	<i>Thousand acres</i>	<i>Percent</i>
Farm	79	18
Other private	325	76
State	13	3
Municipal	13	3
Total	430	100

The public commercial forest land is about equally divided between municipal ownership and state ownership. The state has about 13,300 acres, including nine state forests located in Kent, Providence, and Washington Counties (table 9). Of the 12,700 acres of municipal forest land, the City of Providence owns all but 900 acres. Federal holdings of commercial forest land comprise less than 500 acres.

Some 1,300 farm forests account for one-fifth of the total commercial forest area. Farm forests are found on approximately half of all the farms in the state. Undoubtedly there are a few small forest-industry holdings, though none were located in the areas where ownerships were sampled.

The predominant type of ownership, both in numbers of holdings and in area owned, is that classified as "other

Table 8.--Area of commercial forest land,
by forest cover types, Rhode Island, 1953

Forest cover type ¹	Area	
	<u>Thousand acres</u>	<u>Percent</u>
Red oak	197	46
White oak	60	14
Ash-elm-maple	78	18
Oak-white pine	27	6
Aspen-gray birch	27	6
Other oak types ²	23	6
White pine	8	2
Eastern red cedar	10	2
All types	430	100

¹See Appendix for definitions and explanation of relationship to major forest type groups.

²Including 3,000 acres of oak-pitch pine.

Table 9.--Total area (including nonforest area) of State
Forests, State Parks, and State Game Refuges, 1954

Name	Area ¹
	<u>Acres</u>
STATE FORESTS	
People's	90
Dawley	190
George Washington	244
Wickaboxet	288
Arcadia	6,332
Pulaski Memorial	2,961
Carolina	1,434
Woody Hill	723
Burlingame	840
Total	13,102
STATE PARKS AND MEMORIALS	
Beach Pond Park	482
Burlingame Reservation	2,100
Diamond Hill Reservation	373
Goddard Memorial Park	472
Haines Memorial Park	102
Lincoln Woods Reservation	638
Scarborough State Beach	23
Sand Hill Cove Reservation	27
27 undeveloped parks and reservations	823
Undesignated park, including Wickaboxet and "The Ledges" picnic areas	2,983
Total	8,023
STATE GAME REFUGES ²	
Great Swamp	2,680
Other refuges	2,000
Total	4,680
Total State-owned	25,805

¹Preliminary estimates until an actual survey is made.

²In addition there are about 12,000 acres of game refuge in the State Forests and State Parks. Acreage in State game refuges is not included in commercial forest-land area.



*Land burned over, and now covered
with sprout growth and undesirable
species, needs rehabilitation.*

private". Other private forest properties represent three-fourths of all the commercial forest land. There are 11,000 such ownerships--held by business and professional people, laborers, clerks, retired folks, housewives and others from all walks of life.

Small Forests Are The Rule

Half of all the commercial forest land in Rhode Island is in forest holdings of less than 100 acres. Less than two-fifths is represented by properties of 100 to 500 acres, and larger private forests account for only a minor acreage:

	<i>Thousand acres</i>
Private forests:	
3 to 100 acres	209
100 to 500 acres	155
500 or more acres	40
Total, private	404
Public forests	26
Total, commercial forest area	430

In numbers of private ownerships, the smallest class also predominates. Altogether there are about 12,000 forest holdings in private ownerships--90 percent of them smaller than 100 acres in size and 10 percent in the 100- to 500-acre class. Larger holdings number about 30, less than 1 percent of the total. No private forests are larger than 5,000 acres.

DEVELOPING

THE TIMBER RESOURCE

THIS FOREST SURVEY showed that Rhode Island is extensively forested, more so than most other states. Though timber volumes are extremely low, growth far exceeds cutting; and timber volumes are increasing, particularly in the hardwood species. However, some forest land is being withdrawn from timber production and is being developed for residential or recreational use. The remaining forest area is suitable for timber growing. Particular attention must be given to fire, insect, and other protection programs; to technical assistance for private forest owners; and to marketing small hardwood logs and bolts.

In a situation like this it is difficult for forest owners to see potential values in timber production. Risk of fire, insect epidemics, windstorms, and disease; inadequate markets for small, low-grade timber; high land values near urban areas; lack of technical knowledge, manpower, and equipment; meager cash income from small stands; and a long waiting period until small trees mature are some of the major obstacles they face.

Nevertheless, the potential value of the timber resource is high. Most forest sites have already yielded three or more harvests and are capable of yielding more. The forest land is readily accessible and transportation facilities are excellent. Demand for timber products is likely to expand considerably.

Rhode Island's forest land and timber are more valuable assets than is commonly realized. Even in their present state they offer some opportunity for increasing income and employment if new industrial markets for small hardwood timber can be developed. Thousands of acres of forest land have been burned over by fire. Much of the land is perhaps better suited to the softwood species than to the hardwood species that occupy it. With rehabilitation the timber resource could make substantial contributions to the economy of the state.

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APPENDIX

DEFINITIONS OF TERMS

Forest Area

Forest-land area.--Includes (a) lands that are at least 10 percent stocked by trees of any size and capable of producing timber or other wood products, or of exerting an influence on the climate or on the water regime; (b) land from which the trees described in (a) have been removed to less than 10 percent stocking and which has not been developed for other use; and (c) afforested areas. Forest tracts of less than 1 acre, isolated strips of timber less than 120 feet wide, and abandoned fields and pastures not yet 10 percent stocked with trees are excluded.

Commercial forest-land area.--Forest land that is (a) producing, or physically capable of producing, usable crops (usually sawtimber), (b) economically available now or prospectively, and (c) not withdrawn from timber utilization.

Noncommercial forest-land area.--Forest land (a) withdrawn from timber utilization through statute, ordinance, or administrative order but that otherwise qualifies as commercial forest land, or (b) incapable of yielding usable wood products (usually sawtimber) because of adverse site conditions.

Cover Types

All local types are keyed to certain major forest types to facilitate combining the Rhode Island estimates with estimates made for other states. The forest cover types are determined upon the basis of predominant species as indicated by cubic volume for sawtimber and poletimber stands, and number of trees for seedling-and-sapling stands. Where none of the indicated species comprise 50 percent or more of a given stand, the stand is typed on the basis of plurality of cubic volume or number of trees.

White pine.--Forests in which 50 percent or more of the stand is white pine. Common associates include hemlock, aspen, birch, and maple. (This type is part of the white-red-jack pine major forest type group.)

Oak-white pine.--Forests in which 50 percent or more of the stand is in the oak species, but in which white pine makes up 25 to 49 percent of the stand. Common associates are hickory, elm, maple and ash. (Part of the oak-hickory major forest type.)

Red oak, white oak and other oak types.--Forests in which 50 percent or more of the stand is in the specified oak species or species group except where white pine comprises 25 to 49 percent. Common associates include hickory, elm, maple, white pine, and ash. (All of these types are part of the oak-hickory major forest type group except for a small acreage of oak-pitch pine. The latter has been included with "other oak types" although it is part of the oak-pine major forest type group.)

Eastern redcedar.--Forests in which 50 percent or more of the stand is eastern redcedar. Common associates include oak and hickory. (Counted as part of the oak-hickory major forest type.)

Ash-elm-maple.--Forests in which 50 percent or more of the stand is in red maple, elm, or ash, singly or in combination. Common associates are beech and maple. (Part of the elm-ash-cottonwood major forest type group.)

Aspen-gray birch.--Forests in which 50 percent or more of the stand is gray birch or aspen, singly or in combination. Common associates are maple and pitch pine. (Part of the aspen-birch major forest type group.)

Stand-Size Classes

Sawtimber stands.--Stands that contain sawtimber trees having a minimum net volume per acre of 1,500 board feet, International $\frac{1}{4}$ -inch rule.

Poletimber stands.--Stands that fail to meet the sawtimber stand specification but are at least 10 percent stocked with poletimber and larger trees (5.0 inches d.b.h. and larger) and have at least half of the minimum stocking

in poletimber trees. Poletimber stands carry at least 200 cubic feet per acre.

Seedling-and-sapling stands.--Stands that do not qualify as either sawtimber or poletimber stands but have at least 10 percent stocking of trees of commercial species and have at least half the minimum stocking in seedling-and-sapling trees.

Nonstocked and other areas not elsewhere classified.--Areas that do not qualify as sawtimber, poletimber, or seedling-and-sapling stands.

Tree Classes

Sawtimber trees.--Trees of commercial species that contain at least one merchantable sawlog, as defined below, and that are of the following minimum diameters at breast height (d.b.h.): Softwoods 9.0 inches; hardwoods 11.0 inches.

Poletimber trees.--Trees of commercial species that meet regional specifications of soundness and form, and that are of the following diameters at breast height: Softwoods 5.0 to 9.0 inches; hardwoods 5.0 to 11.0 inches. Such trees will usually become sawtimber trees if left to grow.

Seedling-and-sapling trees.--Live trees of commercial species less than 5.0 inches in diameter at breast height and of good form and vigor.

Cull trees.--Live trees of sawtimber or poletimber size that are unmerchantable for sawlogs now or prospectively because of defect, rot, or species.

Pulpwood trees.³--Live trees of commercial species 5.0 inches d.b.h. and larger, that contain at least two contiguous pulpwood bolts and have 50 percent or more of the main stem volume usable for pulpwood. Most of the sawtimber and poletimber trees are also pulpwood trees.

³As defined by the Northeastern and Appalachian Technical Committees, American Pulpwood Association.

Timber
Volume

Growing stock.--Net volume in cubic feet of live sawtimber trees and live poletimber trees from stump to a minimum 4.0-inch top of central stem, inside bark.

Net volume in cubic feet.--Gross volume less deductions for rot.

Live sawtimber volume.--Net volume in board feet, International $\frac{1}{4}$ -inch rule, of live sawtimber trees of commercial species. Sawtimber volume is measured in 16-foot merchantable sawlogs except that the uppermost merchantable sawlog may be as short as 8 feet.

Net volume in board feet.--Gross volume in terms of the International $\frac{1}{4}$ -inch log rule less deductions for rot, sweep, and other defects affecting use for lumber.

Pulpwood volume.³--Net volume in standard cords, including bark, of the main stem of pulpwood trees from stump to a point where the top breaks up into branches, unless a minimum top diameter of 4.0 inches, inside bark, is reached first. Pulpwood volume is measured in 4-foot bolts, having a minimum continuous length of 8 feet.

Net volume in standard cords.--Gross volume in terms of the standard rough cord less deductions for rot, sweep, and other defects affecting use for pulpwood. Cord estimates are derived from cubic-foot measurements by applying a factor of 80 cubic feet of wood, inside bark, per standard cord, outside bark.

Merchantable sawlogs.--Sections of tree bole that meet one of the following sawlog specifications:

Hardwood sawlogs are sections of the main stem of hardwood trees of commercial species that meet one of the grade specifications for standard lumber logs⁴ or, failing to do so, qualify as tie and timber logs.⁵

⁴United States Forest Products Laboratory. Hardwood log grades for standard lumber. Proposals and results. U.S. Forest Prod. Lab. Rpt.D1737. 15 pp. illus. Madison, Wis. 1949.

⁵Southern Forest Experiment Station. Interim log grades for southern hardwoods. U.S. Forest Serv. South. Forest Expt. Sta. 9 pp. New Orleans. 1948.

White pine sawlogs are sections of the main stem of white pine trees that meet the minimum grade specifications developed by the New England Timber Salvage Administration, U. S. Forest Service.

Other softwood sawlogs are sections of the main stem of softwood trees, except white pine, that are at least 6.0 inches in top diameter and at least 8 feet long. Spruce, fir, and hemlock sawlogs meet the minimum grade specifications developed by the New England Timber Salvage Administration, U.S. Forest Service.

Pulpwood bolts.³ --Sections of the main stem of trees of commercial species, 4 feet long; 4.0 inches or more in diameter inside bark at the small end; free from any indication of rot, charred wood, tramp metal, or hollow center; and contiguous to one or more sections meeting these same requirements. Crotches are excluded; sweep or crook in any section disqualifies the bolt if an imaginary line through the bolt, from center of top cut to center of bottom cut, passes outside the wood at any point.

Growth And Cut

Net annual growth of sawtimber.--The change during a specified year in net board-foot volume of live sawtimber on commercial forest land resulting from natural causes.

Net annual growth of growing stock.--The change during a specified year in net cubic-foot volume of growing stock on commercial forest land resulting from natural causes.

Annual cut of live sawtimber.--The net board-foot volume of live sawtimber trees cut or killed by logging on commercial forest land during a specified year.

Annual cut of growing stock.--The net cubic-foot volume of live sawtimber and poletimber trees cut or killed by logging on commercial forest land during a specified year.

FOREST SURVEY METHODS

Estimates of forest area, timber volume, and tree growth in Rhode Island are based on data obtained from

aerial photographs and sample plots examined on the ground.

Each aerial photograph had two 1-acre circular plots printed on it by use of a multilith machine. There were a total of 1,111 of these circular plots. Each plot was examined under a stereoscope and classified as forest or non-forest. Forest plots were further classified according to broad forest type, stand-size class, and density. These plots are commonly referred to as photo-interpretation plots or PI plots.

From the PI forest plots, 80 were selected at random for examination on the ground. In selecting these plots for field study, those stand-size classes containing the heaviest timber volume were sampled most intensively, while the lightest sample of forest plots was taken in the seedling-and-sapling stands and nonstocked areas. An accurate tally of all trees, by species and size class, was obtained on each field plot. These plots also provided a check on the accuracy of photo classification as well as data on timber volume, and growth.

A number of PI nonforest plots were randomly selected for field examination to provide a check on the accuracy of the photo classification between forest and nonforest land.

Growth was computed from measurements of tree rings on increment cores taken from sample trees. These data were used in estimating the diameter distribution of each species group 10 years hence. Future volume was predicted from this new distribution of diameters. Growth was then determined by subtracting present volume from estimated future volume and reducing the difference to an annual basis. Allowances were made for mortality, ingrowth, and timber cut.

Estimates of timber cut in Rhode Island were based on production surveys and woods-utilization studies conducted by the Northeastern Station. The production surveys yielded reliable estimates of the output of all timber products. From studies conducted in all types of logging operations, factors were developed, that, when applied to timber-products output, gave timber cut from growing stock.

ACCURACY OF THE ESTIMATES

The estimates in this report may contain two kinds of error. The first type results from possible human errors

such as mistakes in judgment, and mistakes in measuring or recording, and errors of reporting. There is no practical way of determining the frequency or magnitude of these errors, but close training and supervision minimize them. The second type of error is associated with sampling procedures and can be measured. If there are no errors of the first kind, the probabilities are two out of three that the actual areas and volumes do not vary from the estimates by more than the following percentages:

	<i>Percent</i> <i>(plus or minus)</i>
Commercial forest-land area	4
Net volume of live sawtimber	17
Net volume of growing stock	8
Net annual growth of growing stock	15
Annual cut of growing stock	11

In each of the tables, the total figures are more reliable than the subtotals. The subtotals are more reliable than any of the individual figures. Figures that are small in relation to totals are subject to larger sampling errors.

SPECIES TALLIED

The various tree species tallied in Rhode Island are listed below.⁶ Approved common names are shown in parentheses if these differ from the brief name used in the tables. Other tree species may occur within the State but unless they were tallied on the field plots they are not included in the following list.

Commercial Softwood Species

White pine	
(Eastern white pine)	- <u>Pinus strobus</u>
(Red pine)	- <u>Pinus resinosa</u>
Pitch pine	- <u>Pinus rigida</u>
Eastern hemlock	- <u>Tsuga canadensis</u>

⁶Little, Elbert L., Jr. Check list of native and naturalized trees of the United States (including Alaska). U.S. Dept. Agr. Agr. Handbook 41. 472 pp. 1953.

Eastern redcedar	- <u>Juniperus virginiana</u>
Atlantic white-cedar	- <u>Chamaecyparis thyoides</u>

Commercial Hardwood Species

Red oaks	
(Northern red oak)	- <u>Quercus rubra</u>
(Black oak)	- <u>Quercus velutina</u>
(Scarlet oak)	- <u>Quercus coccinea</u>
Red maple	- <u>Acer rubrum</u>
White oaks	
(White oak)	- <u>Quercus alba</u>
(Chestnut oak)	- <u>Quercus prinus</u>
Hickory	- <u>Carya species</u>
White ash	- <u>Fraxinus americana</u>
Yellow birch	- <u>Betula alleghaniensis</u>
American beech	- <u>Fagus grandifolia</u>
Elm	- <u>Ulmus species</u>
Aspen	- <u>Populus species</u>
Blackgum	- <u>Nyssa sylvatica</u>
Black locust	- <u>Robinia pseudoacacia</u>
Yellow-poplar	- <u>Liriodendron tulipifera</u>

Noncommercial Species

Gray birch	- <u>Betula populifolia</u>
Eastern hophornbeam	- <u>Ostrya virginiana</u>
American hornbeam	- <u>Carpinus caroliniana</u>

NATIONAL STANDARD TABLES

To facilitate compilation of forest-survey data for any group of states, region, or the Nation as a whole, a standard set of tables is customarily presented in the forest-survey report for each state. In this report these tables, which give information on forest area, ownership, timber volume, growth, and drain, are scattered through the text. The relatively small number of sample plots used in Rhode Island did not permit the detailed breakdown of some classifications that are shown in forest-survey reports for some other states.

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