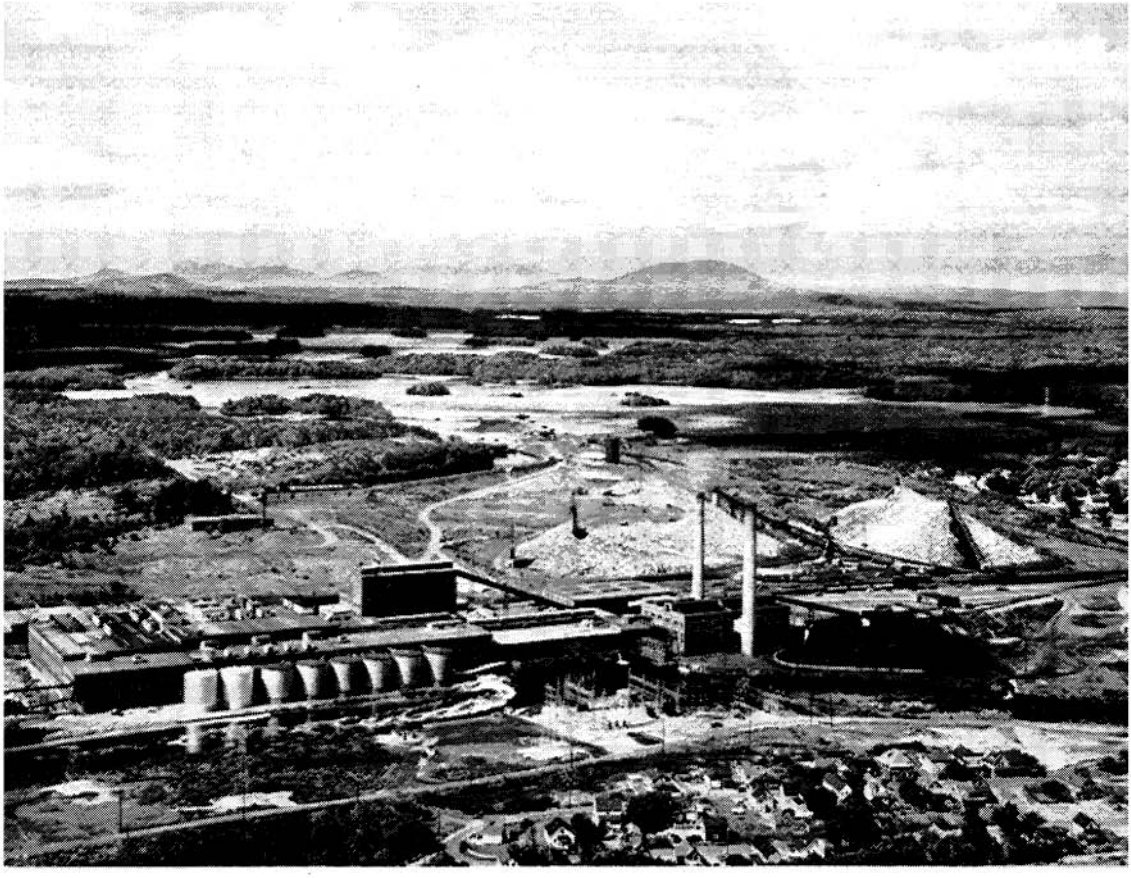
The Timber Resources of MAINE

A Report on the Forest Survey made by the U.S. Forest Service



NORTHEASTERN FOREST EXPERIMENT STATION 1960
FOREST SERVICE • U. S. DEPARTMENT OF AGRICULTURE • UPPER DARBY, PA.
RALPH W. MARQUIS, DIRECTOR

PREFACE

THIS is a report on the timber resources of Maine. It is based on the findings of a forest survey made in 1954-58 by the Northeastern Forest Experiment Station, U. S. Forest Service. The Maine survey was part of a nationwide survey that is being made to evaluate the extent and condition of the Nation's forest resources.

This report describes the current forest land area, the volume of standing timber, and the current annual growth, mortality, and rate of timber cutting. However, we have prepared this report in a somewhat different manner than our earlier reports. A recent study indicated that our other survey reports were being used extensively by high school students, interested laymen, and legislators who wanted to learn more about forests and forest-industries in their state. The text of this report, therefore, has been written to paint a generalized word-picture of Maine's forest resources—past, present, and potential.

The detailed statistical information compiled in the Forest Survey is presented in an Appendix. Users of these data are cautioned to read with care the precise definitions of the terms used, the description of the Forest Survey methods, and the statements pertaining to the reliability of the estimates. Comparisons of these estimates with similar data from earlier studies do not necessarily indicate trends in forest conditions because of differences in definitions, standards, and sampling procedures.

THE COVER

Homes, industries, water, and vast reaches of forest land symbolize the multiple benefits that the people of Maine get from their forest resource. Photo by courtesy of Great Northern Paper Company.

The Timber Resources of MAINE

by

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Great Northern Paper Co. photo

Maine — A Forest State

MAINE, the Pine Tree State, stands like a giant green thumb at the extreme northeastern corner of the Nation. It is truly a forest state, having 87 percent of its land area covered by forests. No other state has so large a proportion of forest land.

Though the State itself has fewer than a million people, Maine's forests are within easy access of 30 million people, one-sixth of the Nation's population. Most of these people can reach Maine's forests in a single day's drive; so they are potential users of the State's forest lands and products. In the long run, they may also have considerable influence on the management and utilization of the State's forests.

Forests are undeniably Maine's greatest natural resource — the backbone of her economy. They provide income to landowners from the sale of forest products. They supply the sawlogs, pulpwood, and other raw material for the wood-using companies that comprise the forest products industries. The State's rapidly developing recreation industry is based on the extensive forests and the lakes and streams they support. Hunting and fishing attract more than a quarter million sportsmen each year. The forests are the source of water for domestic and industrial use. And they provide a place for year-around pleasure and relaxation for Maine's people.

Thus, in one way or another, the livelihood and well-being of everyone in Maine is closely associated with the forests.

However, the very diversity of the uses and values of these forests makes an analysis of their true importance difficult. Their contribution through the forest-products industries is well known: wood-

using companies provide more employment than any other industry in Maine. And more than a third of the value of all of Maine's manufactured products is produced by these same forest-products industries (9)[1]. The actual value of other forest products is more difficult, if not impossible, to calculate, because these products are not bought and sold and thus do not have prices.

This diversity of uses also means that the many people who are concerned with this resource may not always agree on just how a forest should be managed and used. No single point of view is likely to provide a complete basis for deciding the most appropriate program of management for Maine's forests. Fortunately, however, a well-managed forest resource can provide many benefits simultaneously.

Let's, turn for a closer look at these forests. Let's look first to see how they have served Maine's people over the past three and a half centuries; then let's take a somewhat closer look at the benefits they are providing today; and finally, let's look at the present timber resource and consider ways of increasing the benefits from Maine's forests by improved management practices.

A History of Long Use

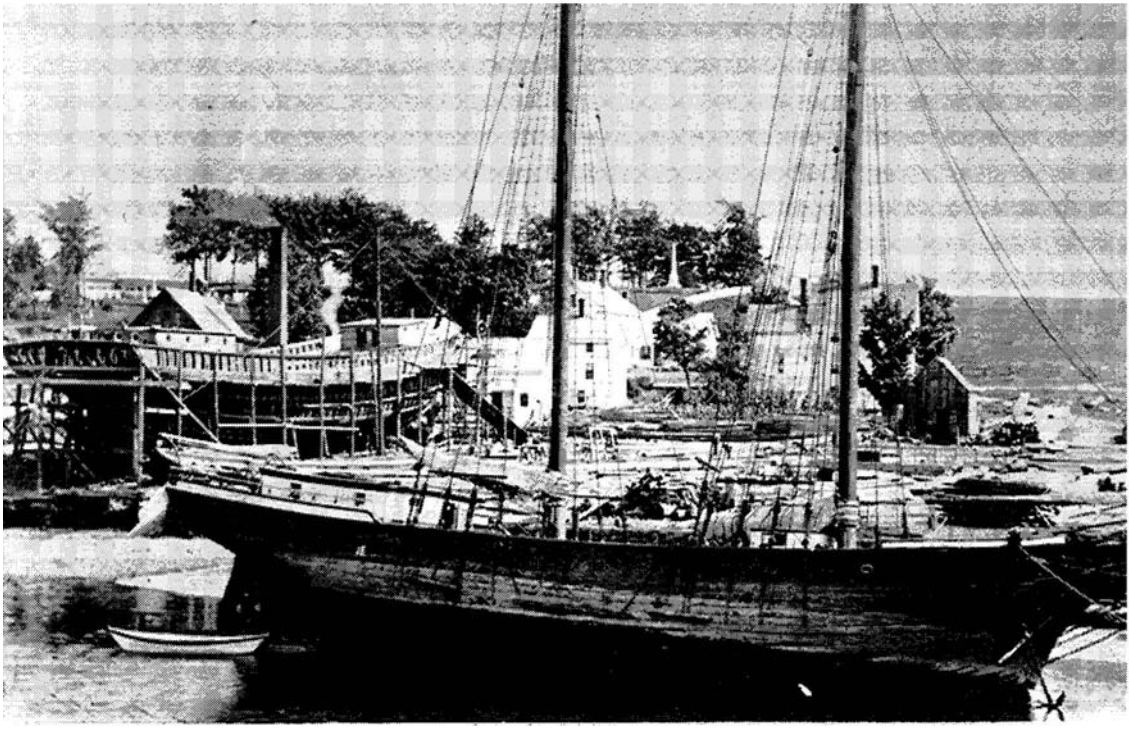
MAINE'S forests have supplied wood to a growing nation for more than 350 years. Yet they are still the State's most valuable natural resource.

The first recorded exploitation of the State's forests occurred in 1605 when Captain George Weymouth sailed up one of Maine's rivers and collected samples of white pine, which he took back to England for display (5). The name "Weymouth pine" is still used in the trade. Two years after Captain Weymouth's visit, the Popham colonists arrived in Maine and built the first ship to be constructed by English-speaking people in the Western Hemisphere. This little ship of 30-tons, built at Sagadahoc (now Bath) in 1607, was the first of many thousands of Maine-built wooden ships.

The first commercial shipyard was established on Richmond Island in 1632. Utilizing the abundant supply of pine, oak, and "hackmatack" (tamarack, larch), this industry flourished for the next 200 years. By 1855, when the United States possessed the world's largest merchant marine, more than half of its wooden ships had been built in Maine. As late as 1840, shipbuilding was the State's second largest industry, surpassed only by textile manufacturing. However, after 1860, shipbuilding in the State declined rapidly as iron replaced wood in ship construction (17).

The date and location of the first sawmill in Maine are unsettled. Some say it was at York, in 1623. A carpenter, James Wall, made a deposition stating in part that "... about the year 1634, he and his partners . . . did build upp at the fall there (called by the Indian name of Asbenbendick) . . . one sawe mill and one stamping mill for corn wch we did keep the space of three or four years next after." This took place on Great Works River at what is now called South Berwick (15). Though sawmilling spread slowly up the Saco, Kennebec, Penobscot,

[1] Numbers in parentheses refer to Literature Cited, page 41.

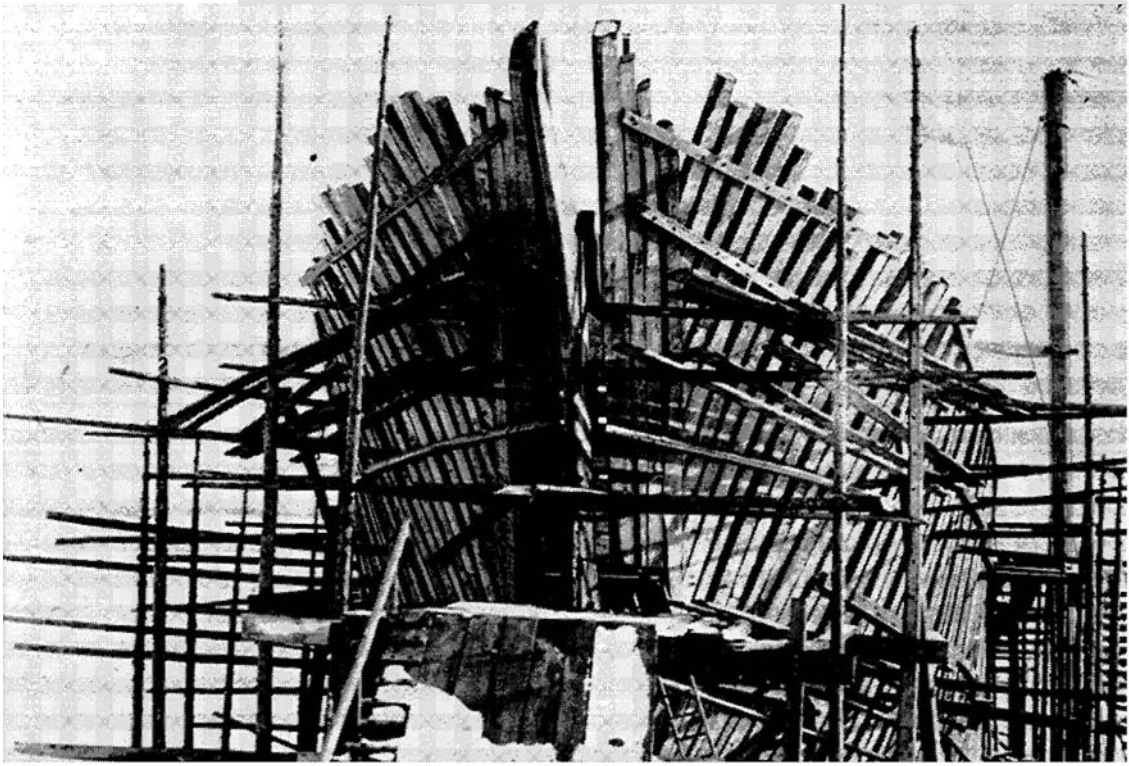


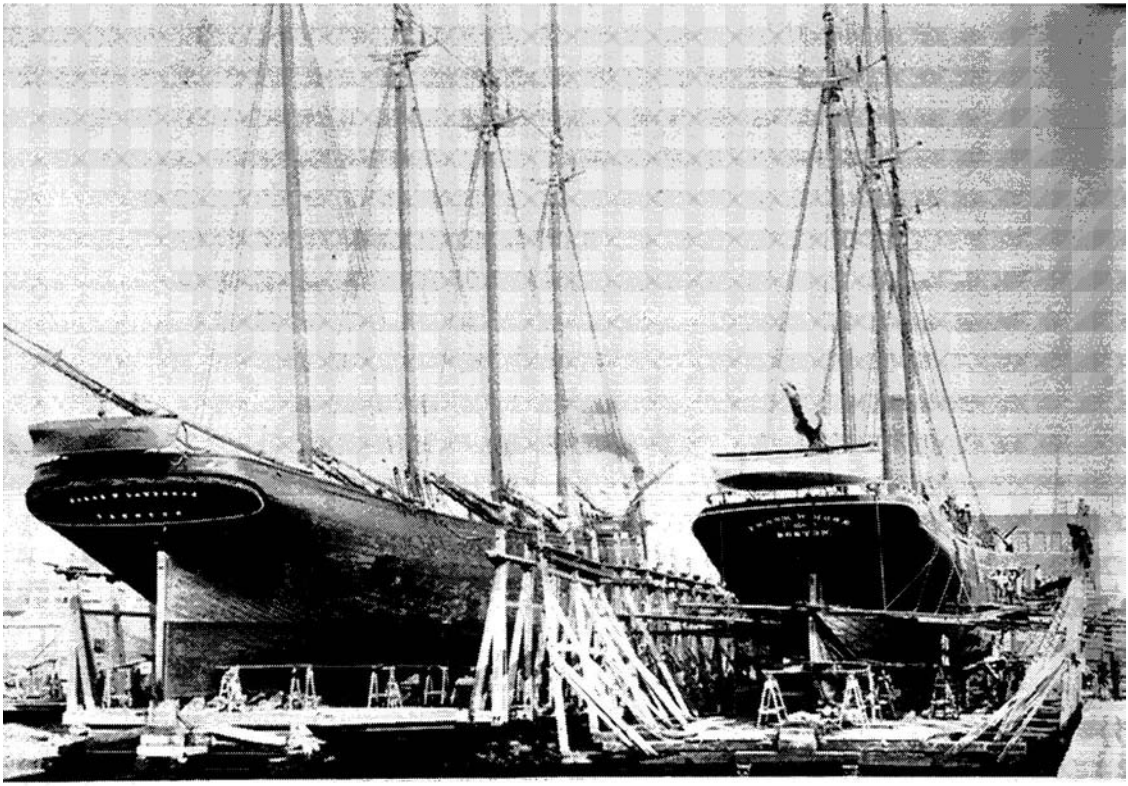
From Maine's forests came the timber that for 200 years supported a world-famous shipbuilding industry. Thousands of wooden ships sailed from Maine shipyards like this one at Brewer.

Bangor Public Library photo

Shipbuilding demanded huge quantities of wood. The timbers that went into this ship were hand-hewn in the woods and hauled 20 miles by team to the shipyard.

Littlefield Safe & Lock Co. photo

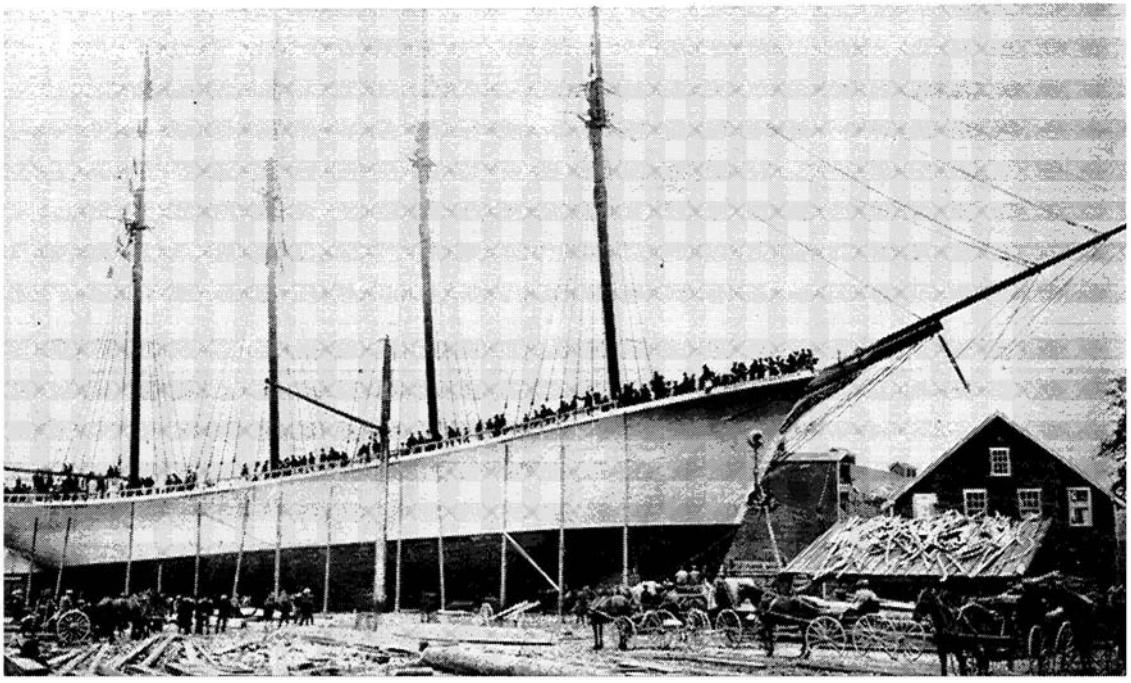




Early sailing ships in drydock at a Maine shipyard.

Littlefield Safe & Lock Co. photos

The Augustus Babcork ready for launching at the McGilvery shipyard in Brewer, about 1880. By this time iron was replacing wood in ship construction, and shipbuilding was on the wane.



Androscoggin, Salmon Falls, and other coastal waterways, the production of sawed lumber in Maine did not gain national importance until 200 years later (26).

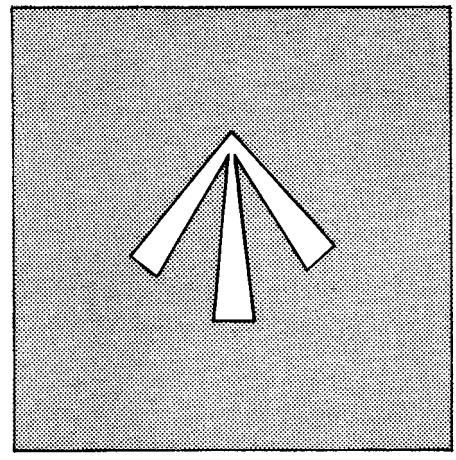
Early explorers and the settlers who followed were amazed at the great abundance of tall, straight pines growing close to the shores of Maine's numerous streams, bays, and estuaries. The European countries had faced a shortage of mast-trees for ships for centuries. Having found what appeared to be an almost inexhaustible supply, the colonists lost no time in developing a mast industry along the Kennebec and Saco rivers. Portland became the center of operations.

The English soon recognized the importance of the New England pines, and in 1691 they instituted their Broad Arrow Policy. Under this policy all pine trees over 24 inches in diameter and standing within 3 miles of water were reserved for the Royal Navy. In practice, however, this arrow mark served more to identify the best mast and lumber trees for the colonists than to discourage cutting. The English attempted sporadically to enforce this policy until the start of the Revolutionary War. But they had little success. By 1774, Maine had wrested first place in mast production from New Hampshire (26). The industry's prosperity continued until the rise of the lumber industry late in the first half of the nineteenth century.

Hand-rived pipe (barrel) staves were one of the first products exported from the Maine forests. By 1634 a Pipe-Stave Landing was recorded on the Great Works River at South Berwick (1). White oak staves were first sent to England, and soon after to the West Indies. They were also shipped to Madeira and the Canary Islands. The staves were used for hogsheads to store and ship rum, wine, sugar, and molasses. When the foreign stave trade declined, a local cooperage trade developed to supply casks for the shipment of lime from Knox County.

Shingles were another early export. As late as 1840 shingles were used as a medium of exchange in Aroostook County. White cedar and white pine bolts were split with mallet and froe and then the shingles were shaved by hand. This was done for nearly 200 years before the first shingle saw was introduced in Maine.

Tanning of leather was another early industry based in part on the forests. By 1810 some 200 small tanneries in Maine were using tannic acid from hemlock bark. By 1860 tanning was the State's third largest industry, exceeded only by the manufacture of textiles and lumber. The tanning industry reached its peak during the period 1870-90, fell to second place by 1900, and declined rapidly afterwards. The last purchase of hemlock bark by a Maine tannery was in 1956.



The King's Broad Arrow, the mark used to reserve shipmast trees for the Royal Navy. The colonists had little respect for it.

Tanneries required large quantities of hemlock bark in their tanning processes. This bark was obtained by stripping felled hemlock trees. The logs themselves

were not salable, so they were left in the woods to rot. This industry accounted for the cutting of millions of hemlock logs. One unpublished study indicates that the total volume cut was more than 9 billion feet, of which only a fraction was utilized.

The advent of the lumber industry can be traced from the timberlands around Massachusetts Bay into the Province of New Hampshire and then into Maine at about the beginning of the 18th century. Beginning first along the Saco river, the industry moved slowly to the north and east, reaching the Aroostook area in the early 1800s. Timber cutting was limited almost exclusively to pine during the colonial period, when Maine dominated the lumber industry (4).

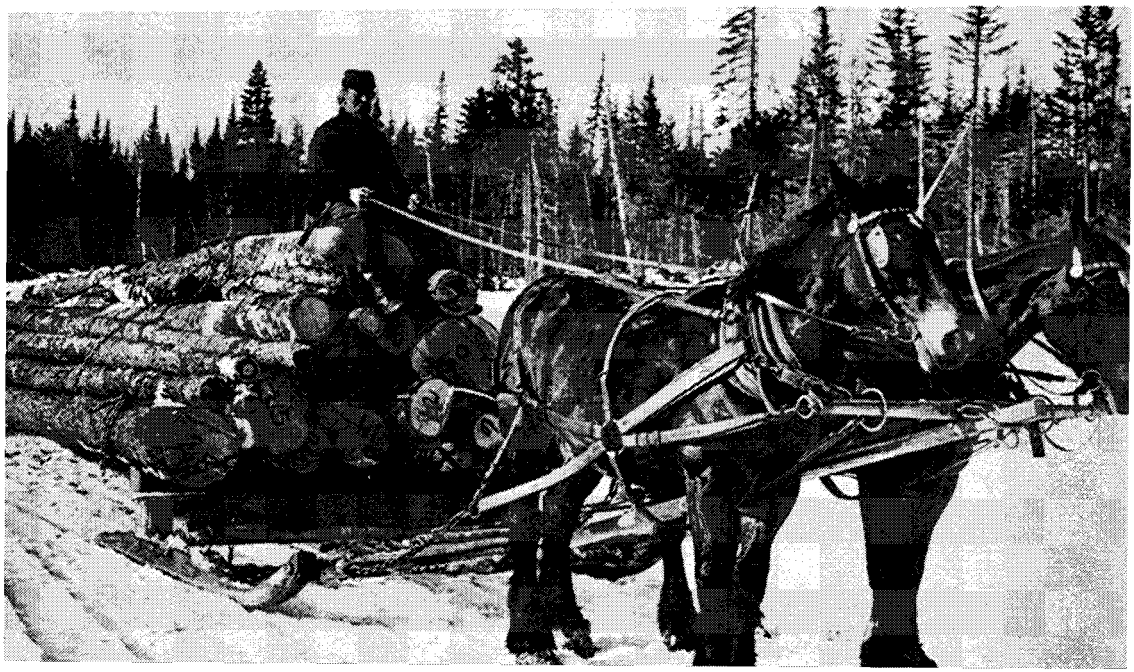
Maine can claim many firsts and near-firsts in the lumber industry. George and Richard Leader constructed what is believed to be the first sash gangsaw on this continent at South Berwick, in 1651. This mill had 19 saws cutting simultaneously — a big advance beyond the usual one-saw operations. Though Benjamin Cummings patented the first circular saw, this innovation did not come into general use until after the patent of a circular saw by Eastman and Jacquith of Brunswick. The first of these circular saws was installed on the Kenduskeag Stream by John Webster. By 1824 a circular saw was also operating in Waterville.

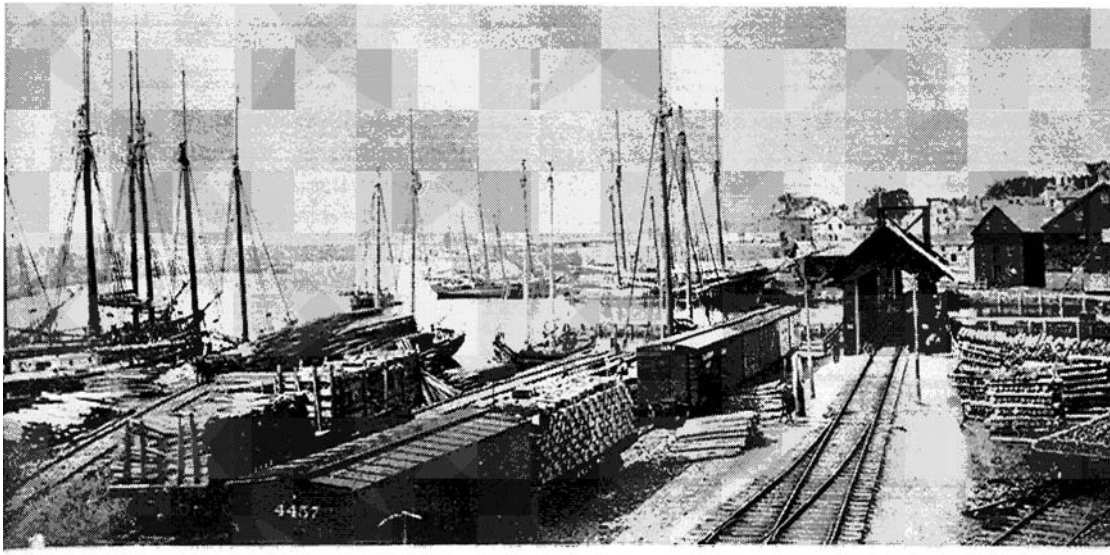
Steam began to replace waterpower at about the time that circular saws were coming into use. A steam sawmill is recorded at Bath in 1820 or 1821; another on the Penobscot River at Hampden in 1835. By 1850, there were 36 steam-powered mills in Maine. Band saws, which never became numerous in Maine, were first used in the State in 1889.

Although the State became famous as a lumber center during the 19th century, it did not hold first place in the lumber industry after 1800 (26). By 1840, when Maine ranked second to New York in lumber production, the center of the in-

In the lumber industry, Maine has been a leader since its earliest days. Hauled to the Penobscot River by team, these logs were floated downstream to Bangor.

Scott Paper Co. photo





Bangor Public Library photo

At one time Bangor shipped out more lumber than any other port in the world. This old photo shows Maine-built ships loading lumber in the late nineteenth century. Lumber production hit its peak in Maine in 1909.

dustry had shifted from the Saco River to Bangor on the Penobscot River. The cutting was still limited to pine and little attention was paid to spruce or other species. During 1842 more lumber is said to have been shipped from Bangor than from any other city in the world.

Maine's lumber production increased steadily to a peak of more than 1.1 billion board-feet in 1909, although its relative position continued to drop (16). The State rated 19th in lumber production at that time.

By 1850 the bulk of the pine had been cut throughout the accessible areas of the State. The loggers then turned to spruce, recutting the same areas where they had formerly cut only pine. The volume of spruce logs coming down the Penobscot River was greater than the volume of white pine for the first time in 1861. The volume of spruce increased rapidly in the following years. The year 1861 is generally regarded as the end of the pine era in Maine (26), but it was close to the end of the century before the reported cut of spruce lumber for the entire State exceeded that of pine (16). Hardwood lumber was to gain a degree of importance somewhat later, when better roads and transportation became available.

The wood-turning industry had an early start in Maine. By 1848, R. D. Bartlett, of Harmony, had taken out a patent on a lathe for turning handles. One of the first turning mills was established by Captain John Dearborn at Lockes Mills in 1865. This mill manufactured thread spools until 1879, when it was destroyed by fire. The neighboring town of Bryants Pond seized this opportunity to gain an industry. It voted to build Captain Dearborn a new mill and exempt him from taxation for 10 years. By 1860, the U. S. Census listed many turned products manufactured in Maine, including bobbins and spools, spokes and hubs, shoe pegs, clothespins, and rake, shovel, and hoe handles.

Toothpicks are another product of the turning industry. They were first manufactured in Maine by Charles Forster, the "original toothpick man" (25). He had learned the art of whittling out toothpicks by hand while in South America, and, after a period of selling native-pro-

duced toothpicks to hotels, began the manufacture of toothpicks by machinery at Strong, in 1860. More than 16 million toothpicks were turned out the first year. Toothpicks have been a Maine product for 100 years.

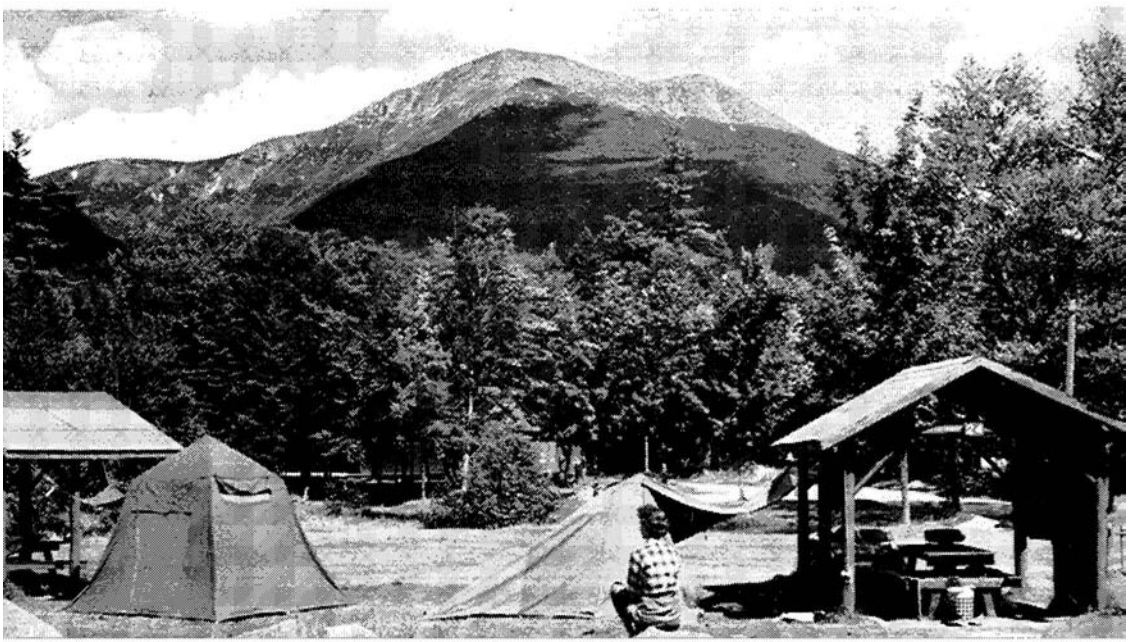
Plywood was being manufactured in quantity by 1897 (1). One large mill was located near St. Croix Lake on the Ashland Branch of the Bangor and Aroostook Railroad. Other plywood mills were operating in Foxcroft and Newport at this time. The Cooper Brothers' Mill in Newport was using basswood for the manufacture of sleigh and carriage dashes and panels and for mirror and picture framing. Pour large mills were reported operating in Blaine, Oakfield, Danforth, and Princeton in 1900. These plants used beech, birch, and maple in the manufacture of box material.

The first use of wood for paper-making in Maine took place in 1868 or 1869 in the basement of a sawmill at Topsham[2]. In this operation ground wood was combined with rags to produce 1 ton of paper every 24 hours. Today, the Pejepscot Paper Company has its office on the site of the original paper mill. The first chemical pulp mill in Maine was built in 1872 at Yarmouthville in the town of Yarmouth. It employed the soda process. In 1880 the S. D. Warren plant at Cumberland Mills also began making paper by the same process. Other mills followed at Fairfield, Rumford, Old Town, and Great Works.

In 1880 the Denison Manufacturing Company, in Canton, produced the first paper made entirely from wood. The S. D. Warren Paper Company began experimenting with the soda pulping process in 1875 and subsequently employed this process to pulp aspen in their mill at Coopsecook, in 1880. The Eastern Manufacturing Company built the State's first sulfite mill at South Brewer in 1889, converting slab waste from their sawmill into pulp (6). During the next few months other sulfite mills were established by the Orono Pulp and Paper Company at Orono and by the Cushnoc Fiber Company at Fairfield. This marked the begin-

[2] Goode, Robert Donald. The pulpwood industry in Maine. Unpublished thesis, University of Maine Library, Orono, Maine, 1934.

Maine Dept. of Inland Fisheries & Game photo



ning of a new industrial era for Maine. The State was at the very forefront of the pulp and paper industry from 1875 to 1900.

Spruce was then and still is the favored pulping species. More recently pine, balsam fir, hemlock, larch, and most of the native hardwoods have also been utilized.

By 1890 Maine led in pulp production, producing nearly one-fourth of the Nation's output. Maine continued to lead all other states in pulp production for nearly 50 years. However, with the development of the kraft pulping process in the 1930's, the Southern pines could be made into paper. This development, and other pulping improvements, caused Maine to lose its dominance in the pulp industry. In 1956 Maine held fourth place—behind Washington, Georgia, and Florida. Despite an increase in woodpulp production of nearly 40 percent since 1950, Maine's relative position in this field remains about the same.

Uses of the Forests Today

THE wood-using industries of Maine are concerned mainly with forests as a source of timber; and most of the private owners of forest land in Maine are also interested in the production of wood, because this provides them with a source of income. Yet to the general public the same forests provide many other benefits. Consequently the true value of the forest resource includes not only timber, but also recreation, wildlife, and water-supply benefits. The values of the forest indeed are multiple.

During recent decades, markets for wood products have grown substantially; and in the decades ahead they are expected to grow even larger. In response to this growth, additional permanent manufacturing facilities have been constructed, and the harvest of timber products has increased. In the decades ahead, the same forests will be called upon to supply wood in even greater volumes, as indicated by the recent trend toward more intensive timber management on forests owned by the wood-using industries.

But increases in population and leisure time have, at the same time, created an unprecedented growth in the demand for recreation, fishing, hunting, and other public uses of the forests.

As a result, there is a more urgent need for the multiple-use management of Maine's forests. Multiple use implies management that is designed to produce a combination of values on the same area. Effective multiple-use management can increase the production of all the benefits now being derived from Maine's forests.

Such management will help conserve the productive capacity of the soil and insure water benefits. Well-managed forests help stabilize the flow of streams throughout the year, by storing water when it is most abundant and releasing it gradually. This reduces the hazards of

Recreation is considered an important use of forest land, and both Federal and State governments provide facilities in Maine. This is a State campground. Mt. Katahdin rears its mass in the background.

floods and assures a more dependable streamflow. Reduced erosion also prevents rapid sedimentation of streams and reservoirs.

Let's look briefly at the recreation and wildlife benefits being produced on Maine's forest lands.

RECREATION

Recreation is now the State's second largest industry, bringing in an estimated revenue of 272 million dollars in 1958, according to Maine's Department of Economic Development. Many things contribute to make this possible. Certainly one important factor is the natural recreational opportunities present on privately owned forest land. Tourists and residents are permitted to hunt, fish, picnic, and camp on much of the forest land held by private owners.

Timber harvesting has not appreciably changed the recreational value of the forests during the 3½ centuries they have supplied raw material for the wood-using industries. The possibilities for canoeing in northern Maine are nearly the same as they were 300 years ago. Vast areas in northern and central Maine remain unpopulated — almost as wild as they were when Thoreau visited there in the 1840s.

Maine Dept. of Inland Fisheries & Game photo

One change has been made: industrial landowners have built many hundreds of miles of improved roads into the forest areas. These roads were built and are maintained to service timber-harvesting operations, but they also provide access by car to many of the State's 2,500 lakes and 3,600 streams. A recent survey by the Maine Department of Inland Fisheries and Game found that 14 of the largest owners have built and are maintaining nearly 1,700 miles of improved roads. More than 85 percent of these roads are open to travel by the public.

Summer homes, hunting and fishing camps, organized camps, private beaches, hotels, and other recreational facilities are scattered throughout the forest areas. In central and northern Maine many of these facilities are on land that is leased from industrial forest landowners, and some are on land leased from the Maine Forest Service. Most of these developments are within areas managed primarily for timber production.

The State Park Commission, Maine Forest Service, U. S. Forest Service, Fish and Wildlife Service, National Park Service, the State Highway Department, and the Appalachian Trail Club all offer public camping, picnicking, and other recreational facilities in Maine. A growing number of privately owned camp and picnic grounds and four winter sport areas are also open to the public.

Maine's public recreational system includes approximately one-third million

Fish and game, another benefit from the timber resource, attract tourists and sportsmen to the forests of Maine.

Winter cover for deer, on left, was reserved from cutting on this pulpwood operation. State game biologists recommend Practices like this to maintain healthy animal and fish populations.

Maine Dapt. of Inland Fisheries & Game photo

acres of land, mostly forested, that has been designated for public use and recreational purposes (12). Baxter State Park (193,254 acres) in northern Maine is a wilderness park administered by the Baxter Park Authority. About 20,000 acres more are in the 12 state parks and 11 state memorials (13). Over half a million people used these areas in 1958. Four additional state parks, encompassing over 1,000 acres of forest land, are under development.

Acadia National Park on the southern coast of Maine is also dedicated to recreational use. This park contains 28,619 acres of gentle to rugged terrain, most of it covered by forest. It was visited by 816,000 people in 1958.

Some 46,000 acres of the White Mountain National Forest are located in Maine. This land is under multiple-use management for both public recreation and timber production. The Moosehorn National Wildlife Refuge of 22,336 acres is also partially developed for recreational use. Some additional acreage owned by municipalities provides a limited amount of recreational opportunities.

The Maine Forest Service maintains 260 campsites and 89 lunch grounds in the Maine Forestry District (10). Many of these are located in remote forest areas, on land leased without charge from private owners. A sample count shows that more than 100,000 people used these facilities in 1958. The State Highway Department also maintains more than 200 roadside picnic areas, many of them with facilities for overnight camping (11).

WILDLIFE

The words *forest* and *wildlife* have become almost synonymous in this country's great exodus to the outdoors. Few people hear the word forest without associating it with wildlife — the fish and game that are natural products of woodlands. According to the National Survey of Fishing and Hunting (20), 7 percent of the people in New England hunt, and 13 percent fish. The average hunter spends about $92 and the fisherman $79 annually for licenses, travel, accommodations, and equipment. These expenditures mean income for Maine's people.

. Maine's inland fish and game are produced largely within the 87 percent of the State's land area in forests. Most of these lands were acquired and are managed for timber products. Yet they produce an abundance of wildlife for the enjoyment of the public.

Maine's forests are estimated to contain 180,000 wintering deer, 3,000 moose, and more than 7,000 bear, plus an abundance of small animals, game birds, and fish. This resource is a prime attraction for tourists, and a source of food and sport for those living in the State.

Approximately 256,000 resident and 130,000 non-resident hunting and inland fishing licenses were issued during fiscal year 1958 (8). During the same period 1,600 trapping licenses were issued. By planned harvesting of wildlife, under the recommendation of game and fish biologists, vigorous and healthy animal and fish populations are maintained.

With 99 percent of the State's forests in private ownerships, most management practices to favor game must be carried out on private lands. Some progress is being made in this direction. An increasing amount of industry-owned forest land is being managed to produce more game Some 100,000 acres of commercial forest along the United States side of the St. Croix River have been designated for multiple-use management for recreation, wildlife, and timber by the Eastern Pulp Wood Company. The industrial owners are dedicating an equal area to this use

on the Canadian side of the St. Croix. Picnic and camp areas have been located at three sites on the American side and more are planned. Present plans are to allow the public virtually unrestricted use of company-owned roads, and to permit hunting and fishing over the entire area.

Twenty-five winter deer yards located within industrial forests in northern Maine are now managed in such a way that winter protection and food for deer is provided. In other areas, timber harvesting is planned to meet wildlife and recreational needs, including the reservation of woodland strips along streams and lakes. This cooperative program between the landowners and the Maine Department of Inland Fisheries and Game is directed toward maintaining a healthy deer herd.

Another wildlife program involves the seeding of abandoned log roads with clover and grasses to provide more food for grouse in remote woodland areas in northern Maine. More than 80 miles of log roads treated in this manner have materially increased the harvest of grouse without seriously depleting the future breeding stock. Such forest practices also mean less erosion of woods roads, and thus some clearer streams and lakes in Maine.

The Wood-Using Industries

BESIDES producing other values, forests serve as a factory for producing wood. They derive a large part of their value from the use people make of this wood. If the wood produced by the forest is not utilized, society loses these values.

Today timber is probably the most valuable single product of Maine's forests. Her forests thus can be valued mainly according to the amount and type of timber products that they yield. In Maine, pulpwood and sawlogs account for 90 percent of the timber use, so they are the principal measure of forest values.

The annual cut of lumber and pulpwood in Maine reached a 30-year peak in 1956. For that year the Maine Forest Service reported an output of 550,000,000 board-feet of lumber, veneer, and cooperage, and 2,700,000 rough cords of round wood and chips for pulpwood (14). As a result of the nation-wide business recession, the pulpwood cut was lower in 1957; it remained low in 1958 as pulp companies reduced woodyard inventories that had accumulated during the slack period.

The 1958 cut for all products amounted to 242 million cubic feet, or 3.0 million cords.[3] This volume includes 371,000 rough cords of logging residues that were left in the woods. Softwood species[4] made up approximately 70 percent (2,112,000 cords) of the total cut, hardwoods the remainder. Wood for lumber and pulp accounted for 90 percent of the total cut for all products.

[3] For the convenience of the reader, cubic-foot volumes have been converted to rough cords of 80 cubic feet of solid wood. Thus cubic-foot volumes may be computed by multiplying the number of cords by 80. Definitions of these and other terms used in this report will be found in the Appendix.

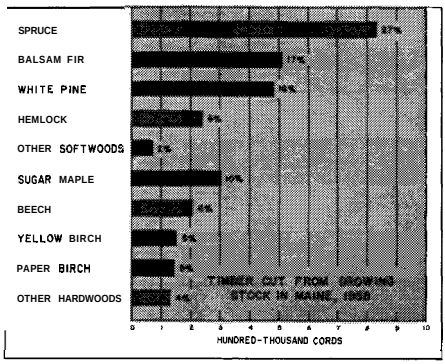
[4] The terms "softwood" and "hardwood" do not necessarily refer to the actual hardness of the wood. In general, softwoods are those tree species that have needles and are green throughout the year (larch is an exception). Hardwoods are broad-leafed trees; they usually lose their leaves each fall and grow new ones in the spring.

Three-fourths of the total volume cut was in sawtimber-size trees — hardwoods 11 inches and larger at breast height and softwoods 9 inches and larger. The remaining cut was from poletimber-size trees (trees below sawtimber size but not less than 5 inches in diameter). On a volume basis, the total cut from growing stock was distributed as follows:

	Million cords
Softwood sawtimber trees	1.71
Hardwood sawtimber trees	.51
Softwood poletimber trees	.40
Hardwood poletimber trees	.40

Although timber was cut in every county in Maine during 1958, more than one-half of the volume was cut in the four northern counties. Aroostook County led all others in both pulpwood and sawlog production. But in relation to the forest volume, timber was cut more heavily in the southwestern counties.

During the past decade, there has been a change in the proportions of timber species cut. The proportion of spruce and fir cut for pulp decreased 5 percent to the present 65 percent of total pulpwood output; the hardwood proportion increased 5 percent. White pine continues to be the principal species cut for lumber, but its relative importance has declined from 50 percent of the total to about 44 percent. The proportions of spruce and hardwoods cut for lumber increased accordingly.



Timber is the most valuable product of Maine's forests. In 1958 spruce and fir together accounted for more than 40 percent of all the timber cut,

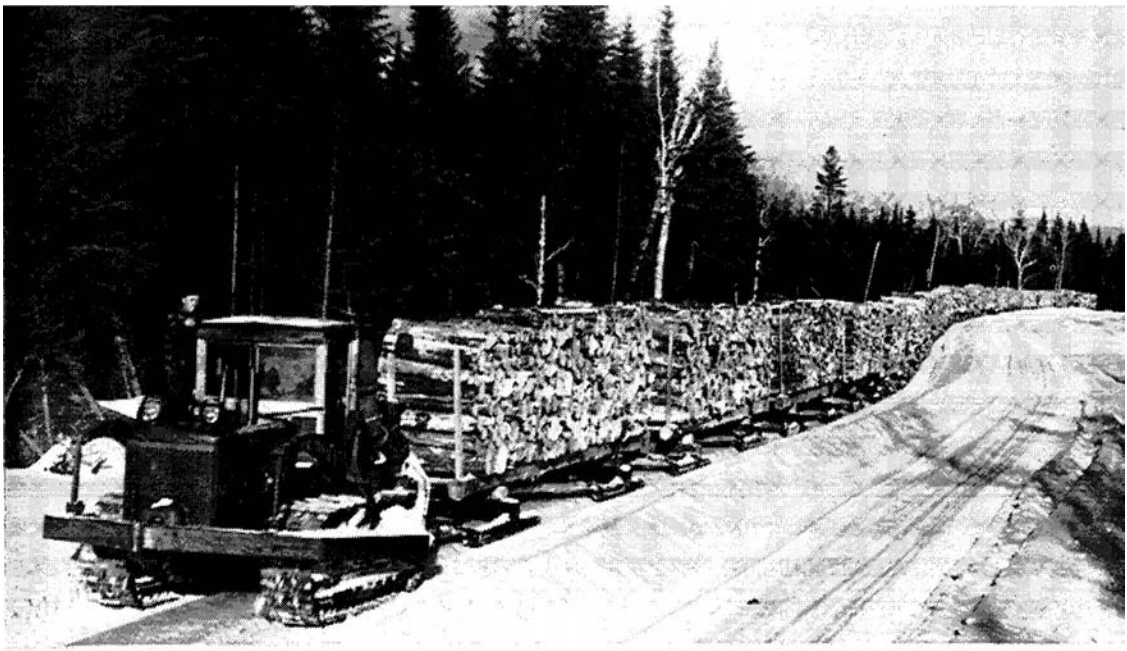
PULPWOOD

Pulp and paper is Maine's most important industry in value of manufactured products. The pulp mills require more raw wood material than do all other wood-using industries combined. At the end of 1958 the State's 28 pulp mills (19 plants) had a 24-hour capacity of 5,995 tons — 7.3 percent of the Nation's total (21). Only three states — Florida, Georgia, and Washington — have a greater plant capacity for producing pulp.

Paper and allied products accounted for 27 percent of the value of all products manufactured in Maine in 1958, a total of some 364 million dollars (9). If the lumber and wood industry (fifth largest manufacturing industry) is included, the combined forest-products industry would account for 35 percent of the value of all manufactured products.

Maine's pulpwood production amounted to nearly 1.7 million cords in 1958. Expressed in cubic feet, this was 57 percent of the total timber-product output. This excludes 35,255 cords of plant residues that were used for pulp during the year. These residues (principally from softwood species) consisted mostly of slabs, edgings, trimmings, and unmerchantable boards resulting from the sawing of debarked logs.

For many years hardwoods were not used much for paper making. But with the development of new pulping processes, they now make up about 22 percent of the pulpwood harvest in Maine. In 1958 the cut of hardwood pulpwood



Pulpwood, the raw material for Maine's most important wood-using industry, flows from forest to mill. This tractor sled-train is carrying 131 cords of softwood bolts from forest to water.

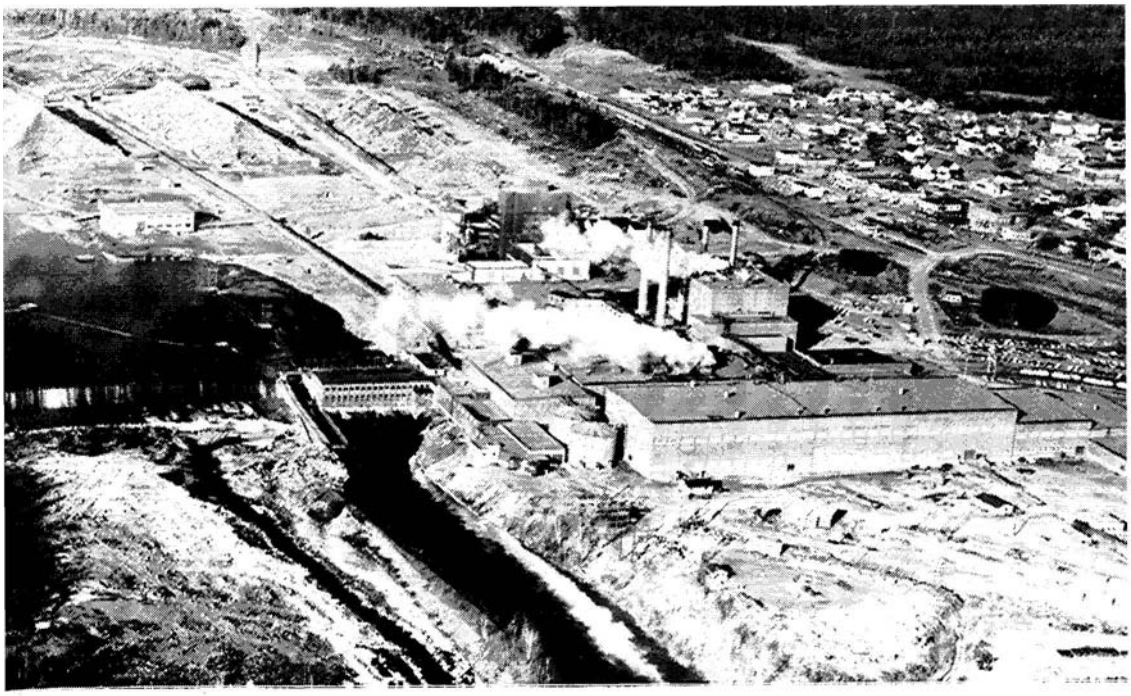
Great Northern Paper Co. photos

Some pulpwood comes from farm woodlands — an annual source of income for the owner. Right, pulpwood piled on the ice waiting for the spring breakup, when it will be floated downstream to the mill.

Pulpwood ready for the spring drive to the mill.

Great Northern Paper Co. photos

Driving pulpwood down a small stream in northern Maine.



Great Northern Paper Co. photo

One of the pulpmills in Maine. This mill at Millinocket is the largest newsprint mill in the United States.

amounted to 285,000 cords, as compared with approximately 1,278,000 cords of softwood (excluding chips from plant residues). Sugar maple, red maple, beech, birch, oak, and aspen are the principal species used. Spruce and balsam fir are the principal softwood pulpwood species; lesser amounts of white pine, hemlock, and larch are used.

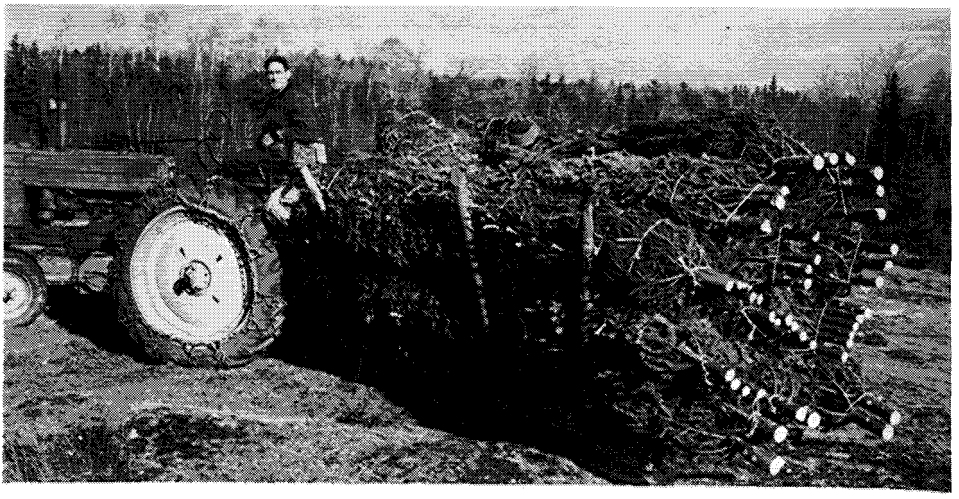
Pulpwood can be obtained from both sawtimber- and poletimber-size trees. More than two-thirds of the softwoods and about one-third of the hardwood pulpwood in Maine comes from sawtimber-size trees. Often it costs less to make pulpwood from large trees than from small trees.

LUMBER

Production by the lumber industry in Maine reached a postwar high of 480 million board-feet in 1949, and has been somewhat less than that since then. The volume of lumber produced in 1958 amounted to 424 million board-feet. Volume of growing stock cut for sawlogs was 38 percent of the total cut. Lumber and wood products — Maine's fifth largest manufacturing industry — accounted for 8 percent of the value of all products manufactured, a total of 110 million dollars.

Maine's lumber industry is composed of many small companies. In 1958 there were 669 sawmills and 131 bolter mills in the State (24). (Bolter mills are small sawmills equipped to cut logs less than 8 feet long.) Some of these sawmills and bolter mills operate only intermittently. Almost all of them are small. Only five mills produced more than 5 million board-feet of sawed lumber during the year. Another 99 mills cut more than 1 million board-feet each, all but 18 of them concentrating on softwood species.

Truck transport of pulpwood from forest to mill, over a company-owned road. This road is kept open to the public throughout the year.



Maine Forest Service photo

Another crop harvested annually from Maine forests — Christmas trees.

Both softwoods and hardwoods are used by the lumber industry. Hardwood lumber is used for assembled furniture, furniture blanks, toys, novelties, pallets, cabinet work, thread spools, dowels, woodenware, toboggans, and many other items. Softwood lumber is used for construction; small quantities go into millwork, boxes and crates, boats, furniture, fencing, and other items (7).

OTHER TIMBER PRODUCTS

Ninety percent of the timber cut from Maine's forests in 1958 was used to manufacture pulp and lumber. The remaining 10 percent was used in the production of veneer, fuelwood, and other products. In 1958 there were 341 Maine firms that manufactured wooden items other than construction lumber and pulp and paper. Some 360 different wood products are manufactured in the State.

Five percent of the timber cut was used to manufacture veneer. Production by the veneer industry has declined in recent years: only 43 million board-feet of veneer logs and bolts were used in 1958. About twice this amount was used 20 years ago, but since then supplies of high-quality veneer logs have declined. Then too, imports of hardwood plywood from abroad have increased greatly; and more than 97 percent of the timber cut today for veneer use in Maine is hardwood—largely paper birch, yellow birch, and sugar maple.

The veneer industry in Maine consists of eight veneer mills and three plywood plants. The veneer mills produce thin sheets of wood by either turning short logs or bolts against stationary knives on rotary lathes or by slicing off thin sections from specially prepared blocks or cants. Stamped from this veneer are astronomical numbers of small wooden products known as flatware — popsicle sticks, tongue depressors, cocktail forks, flat spoons, glue paddles, and applicators.

Plywood is another product made from veneer. Plywood is made from three or more layers of veneer glued together in large sheets. Hardwood plywood is used for furniture, cabinetmaking, wall paneling, doors, toys, boats, and many items for which an attractive, strong, durable wood is needed.

A large portion of the veneer logs cut in Maine in 1958 were exported to other states and Canada for processing, and a small quantity was cut for shipment from Canada to England.

Four percent of the timber cut in

Maine in 1958 was used for fuel. At one time wood was the only fuel available for cooking, heating, and steam plants. Now electricity, coal, oil, and gas have replaced wood for most of these uses. The 1958 use of fuelwood amounted to 264 thousand cords, almost entirely hardwood. About 21 thousand cords were from the tops, limbs, and cull sections of trees and 108 thousand cords from plant residues. Only about half the fuelwood (135 thousand cords) was cut from growing stock.

The timber cut for all other products amounted to about 1 percent of the total cut. Included in this category are piling, poles, posts, hewn ties, wooden fencing, chemical wood, lobster traps, fish weirs, and other miscellaneous items.

Some cedar is used in making slack cooperage, principally barrels for potatoes, fish, poultry, and vegetables. Some 1½ million board-feet were cut for this purpose in 1958. Small quantities of cedar are also used in the manufacture of shingles.

The Maine forests contain an abundance of fir, which is preferred for Christmas decorations. Some spruce is also cut for this use. Their harvest has been an annual source of Christmas funds for the Maine people for many years. In 1958 the Christmas-time harvest included 855,000 trees, 6,900 bundles of softwood boughs, and 271,000 wreaths (24).

All in all, the forests of Maine provide raw material for the wood-using industries; they are the base for a growing recreation industry; and they are instrumental in the conservation of soil and water. In short, Maine's forests are a cornerstone of the state economy. Their productivity affects the welfare of everyone in the State.

The Timber Resource

NOW let's consider the present condition of Maine's forests. How much timber is there in Maine that can be used for making paper, lumber, veneer logs, and other products? What did the Forest Survey reveal?

In discussing the timber used by various industries, we referred to sawlogs, veneer logs, and pulpwood. These terms refer to tree segments that have been cut for a specific product. But in conducting an inventory of timber we must measure trees. And although the inventory must be made in terms of the forest resource's usefulness for specific products, there is no sure way of determining what product or products will be cut from each tree. For example, a tree 16 inches in diameter may be well suited to making pulpwood, sawlogs, one or more veneer bolts, or some combination of these products. How then should we measure this tree?

If we measured the standing timber so as to estimate how much pulpwood could be cut from it, the information would have greatest interest for those who operate pulp mills. But this would leave sawmill operators with only a very poor idea about how much of the timber inventory is suitable for lumber manufacture.

To solve this dilemma we classified the trees twice, using specifications for the two major products that are being cut from Maine's timber — lumber and pulpwood.

First we looked at the trees to determine their suitability for making sawlogs and lumber. Measurements were taken to

Maine Forest Service photo

estimate each tree's volume in terms of board-feet. The sawtimber stock thus consists only of the board-foot volume of those trees that met minimum size and quality specifications for making sawlogs.

Poletimber-size trees were classified, and their volume is given in cubic feet and cords. As they add growth, poletimber trees are expected to become sawtimber. The cubic-foot volume of wood in both sawtimber and poletimber trees is called *growing-stock volume* in this report. Trees 5.0 inches and larger that do not meet minimum specifications for either sawtimber or poletimber are referred to as culls.

Next our field crews completely reevaluated each tree to see if it met the minimum specifications for a pulpwood tree. If it did, the tree was also classified as a pulpwood tree; and an estimate was made of the volume, in cords, of pulpwood that could be cut from it. This decision was independent of whether it was a sawtimber cull. Thus, this report contains three kinds of volume estimates:

- The volume of sawtimber, in board-feet: an estimate of the volume of lumber that could be cut from all trees that are suitable for making sawlogs.
- The volume of growing stock, in cubic feet: an estimate of the present volume of current and potential sawtimber trees.
- The volume of pulpwood trees, in cords: an estimate of the volume of pulpwood that could be cut from growingstock and *non*-growingstock trees that meet pulpwood-tree specifications.

Note that these three estimates are merely different ways of inventorying the same trees. A great deal of the same volume appears in all three estimates. For example, all sawtimber volume is in-

A typical spruce stand, a valuable source of both pulpwood and lumber.

Maine Forest Service photo

A typical second-growth white pine stand. This stand is growing enough wood on each acre every 10 years to build a 5-room house.

cluded in the growing-stock estimates, and most of it also appears in the pulpwood estimates. Thus one must not add a pulpwood estimate to a sawtimber estimate, for this would be double-counting.

205 MILLION CORDS OF PULPWOOD

Pulpwood in Maine is normally harvested in 4-foot sections from the boles of trees. Trees that are suitable for cutting into pulpwood are called pulpwood trees. And in this inventory, a pulpwood tree was defined as any tree of commercial species that is at least 5 inches in diameter at breast height and meets certain other specifications, such as having at least 8 continuous feet of its stem usable for pulpwood.

The pulpwood estimate consists of the net volume of pulpwood in pulpwood trees. Thus, in terms of pulpwood, the 1958 inventory of timber in Maine amounted to 205,500,000 cords.

This wood is distributed among many species, but spruce and balsam fir are the most abundant. Spruce accounts for about 22 percent and balsam fir for 20 percent. They are followed in order by white pine, northern white-cedar, and red maple. All hardwood species combined make up one-third of the volume suitable for pulpwood.

Not all the wood in trees cut for pulpwood is used for pulping; some of it is uneconomical to use and some is not good enough. Limbwood, very knotty wood, and pieces less than 4 inches at the small end are generally not used. Neither are pieces that contain excessive rot or charred wood. These would cause weak spots, holes, or discoloration in the finished paper, and would require excessive

amounts of bleaching chemicals in the paper-making process. Also excluded are pieces that are excessively hollow and those that have wire or nails imbedded in the wood.

Of the total volume suitable for pulping, about 94 percent is in trees that are currently or prospectively suitable for sawtimber, and 6 percent is in trees that would be called cull for sawtimber use.

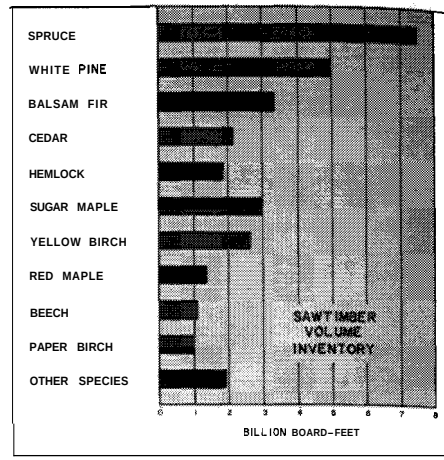
Nearly 60 percent of the pulpwood volume is found in stands that have 15 cords or more per acre. These heavier stands, which are more economical to harvest than thinner stands, occupy about one-third of the commercial forest land area:

Volume-per-acre class	*Thousand acres*	*Million cords*
Less than 5 cords per acre	4,003	9.1
5 to 15 cords per acre. . . .	7,628	76.9
More than 15 cords per acre	5,538	119.5
Total	17,169	205.5

30 BILLION BOARD-FEET OF SAWTIMBER

Sawtimber volume is measured in board-feet, that is, the estimated volume of lumber that could be cut from logs and sawtimber trees. A board-foot is a section of lumber 1 foot square and 1-inch thick before planing, or its equivalent.

As a basis for measuring sawtimber volume, we used the International ¼-inch log rule for softwood trees 9.0 inches in diameter and larger and hardwood trees 11.0 inches in diameter and larger. Trees on sample plots were recorded by species, diameter at 4½ feet above ground (diameter at breast height = d.b.h.), and height in 16-foot logs. Top log can be 8 feet long, although sawlogs are cut in various lengths, usually



About 65 percent of Maine's sawtimber volume is in softwoods. White pine accounts for about 15 percent of the total volume.

in multiples of 2 feet, such as 10, 12, 14, and 16 feet. Sixteen feet is a common length, and logs are seldom cut longer than this in Maine.

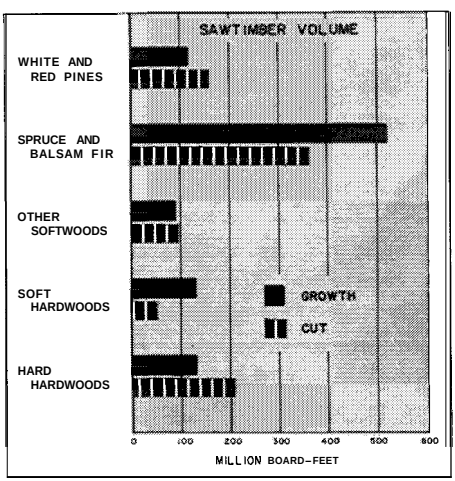
The net volume of standing trees that meet minimum specifications for sawtimber amounts to 30 billion board-feet. Although about three times more lumber is now being cut from white pine than from any other species in Maine, spruce leads all species in standing sawtimber volume — about 7½ billion board-feet, or 25 percent of the total. The volume of white pine sawtimber amounts to 5 billion board-feet. The white pine is found principally in the southwestern part of the State. All hardwood species combined make up almost 35 percent of the total.

But quantity is only one measure of the sawtimber resource. Quality is another especially important consideration. Timber quality is expressed in terms of log grades. For both hardwoods and white pine there are three standard lumber log grades; and for hardwoods there is an additional grade: tie and timber logs.

Tree sections that do not meet the minimum specifications for any of these are considered culls for lumber manufacture.

Over the long period of time since timber cutting began in Maine, the proportion of high-quality sawlogs has decreased. Only 12 percent of the white pine sawtimber volume is now found in grade 1 logs. Of the hardwood volume, about 17 percent is in grade 1 logs.

There are several reasons why there is so little high-quality sawtimber in Maine. When the original forests were cut over, only the tallest, straightest, and finest trees were taken. In subsequent cuttings the larger and better trees usually made up most of the cut. The trees left were often defective and of poor quality. Destructive forest fires, insects, and diseases have also reduced the quality of trees that escaped being killed. A large part of today's sawtimber volume is in relatively small trees, and smallness also limits quality. About 44 percent of the board-foot volume now is found in trees less than 14 inches in diameter. Trees below this size do not produce logs large enough to meet grade 1 requirements.



Relationships between growth and cutting of sawtimber-size trees.

Concentration of sawtimber volume is another important consideration. If all other factors were equal, logging would cost less in timber stands that have large volumes per acre. A stand that has only a small volume per acre is expensive to cut. Very few woodsmen would be willing to cut sawtimber in stands of widely scattered trees. In our inventory, if a stand does not have at least 1,500 board-feet of sawtimber per acre, it is called either a poletimber stand or a seedling-and-sapling stand rather than a sawtimber stand.

Sawtimber stands occupy some 6,777,000 acres — about 40 percent of the commercial forest area in the State. These stands contain about 80 percent of the sawtimber volume. The other 20 percent of the sawtimber volume is distributed within poletimber stands, seedling-and-sapling stands, and poorly stocked areas.

CURRENT TIMBER GROWTH

The date of the timber inventory in Maine is January 1, 1959. This inventory will change from one year to the next according to how much timber is cut and how fast the timber grows. Growth information was obtained in the Forest Survey by interpreting increment cores. Sample trees on forest-survey plots throughout the State were bored for small cores of wood showing annual growth rings. Measurements of these were used in the calculation of net annual growth.

Net annual growth is composed of several parts, which must be explained before growth figures can be properly understood. Trees that already meet survey specifications grow in diameter and height. Their increase in volume is added to the timber inventory. Other trees are designated as *ingrowth* if they reach specified minimum size during the year—for example, trees less than 5.0 inches at

the beginning of the year that become larger than 5.0 inches during the year are ingrowth. Also, some trees die during the year; their volume is negative growth, so it is subtracted from the inventoried volume. Growth is thus computed as follows: Net annual growth = (increases in the volume of trees that are already part of the timber inventory) + (volume of ingrowth trees) — (volume of trees that die).

Net annual growth of Maine's growing stock in 1958 was 7,176,000 cords. Spruce and fir accounted for about 55 percent of this growth, all other softwoods 15 percent, and hardwoods 30 percent. The volume of poletimber is greater than that of sawtimber. This is perhaps one reason why growth is larger for the poletimber class in both softwoods and hardwoods:

NET ANNUAL GROWTH

	Softwoods (thousand cords)	*Hardwoods (thousand cords)*
Sawtimber	2,274	760
Poletimber	2,775	1,367

Net annual growth of sawtimber in Maine in 1958 was 962,600,000 board-feet. Softwood species made up about three-fourths of this total. More than one-third of the gross board-foot volume (growth on inventory plus ingrowth volume) was lost in trees that died.

NET ANNUAL SAWTIMBER GROWTH

	Softwoods (million board-feet)	*Hardwoods (million board-feet)*
Growth on inventory	476	174
Ingrowth	+586	+230
Gross growth	1,062	404
Mortality	—351	—152
Net annual growth	711	252

To Increase the Benefits

THOUGH the forests of Maine now support the State's largest industry, and seem likely to continue doing so, they are producing at a rate much below their potential. Increased timber production would mean more and possibly better material for forest industries. This might lead to expanded production and greater manufacturing income, increased employment and wages, additional income to forest-land owners, and an expanded tax base.

But the results of improved forest practices do not develop overnight. Many years must pass before today's improved forest management will appear as bigger and better-quality woodpiles at the sawmill, pulpmill, or manufacturing plant. More intensive management must start before shortages are actual. Therefore it is wise to consider such practices now, even though Maine's forests are now growing more wood than is being cut. An increased demand for raw material through improved markets and expanded manufacturing facilities is expected. And a heavy loss of standing timber by fire, wind, or forest pests could quickly reverse the present trend toward larger timber volumes.

The forests of Maine could be made more productive and useful in several ways. They could be managed so as to grow a greater volume of marketable wood. They could, through judicious forest practices, produce wood of a higher quality and of a more desirable kind. And they could be operated in a way that

would prevent the indiscriminate cutting of immature trees or stands but at the same time provide for the orderly harvest of mature trees before they become defective or die. Losses through fire, insects, diseases, and climate could be held to a minimum. Then too, management and harvesting costs could be reduced and the volume of usable products could be increased through more efficient utilization of the forest crop.

Many different measures are possible to achieve these objectives. Six appear to be of particular importance: greater utilization, improved cutting practices, more timber-stand improvement, increased protection, accelerated planting of idle and understocked lands, and additional forestry research.

GREATER UTILIZATION

Improved utilization practices could increase benefits from the timber resource in two ways: first, by increasing the amount of timber products harvested; second, by more complete and efficient use of the cut trees.

Increasing the Timber Harvest

Since timber must be harvested to be used, an increased timber harvest would probably mean that Maine's forests would be more useful — if this harvest could be sustained. But excessive harvesting can lead to a serious reduction in growing stock, the timber capital that is necessary to produce high-value timber products.

Let's briefly examine the present trend of the standing timber in Maine. If net timber growth exceeds timber cut, then the inventory is increasing, and, either now or eventually, a heavier cut could be sustained.

In 1958, the total cut of both hardwood and softwood species amounted to about 43 percent of the growth. As a result, Maine's forests were growing more than twice as much wood as was harvested: growth amounted to 7.2 million cords and cut to 3.0 million cords. The difference, some 4.2 million cords of growth, was added to the growing-stock volume. Although the total volume is increasing, the amount of high-quality timber is not increasing as rapidly.

An additional 3.4 million cords (about one-third of gross growth) is being lost through mortality each year. Thus a greater volume of trees died during 1958 than were harvested. Improved accessibility and shorter cutting cycles could substantially reduce the mortality losses and provide a greater net growth available for cutting.

The cut of sawtimber trees of all species amounted to 81 percent of the total growth in trees of this class (softwoods 82 percent and hardwoods 80 percent). But the difference between growth and cut in sawtimber varies considerably among species groups. The cut of hard-hardwood sawlogs (mainly sugar maple, yellow birch, white birch, and beech) was almost 25 percent more than the amount added by growth. The cut of white and red pine sawlogs exceeded growth of these species by 41 percent.

From this it is evident that the main increase in volume is in poletimber-size softwood trees, in the spruce-fir, spruce-fir - hardwood, and hardwood - spruce - fir types. In fact, the cut of poletimber trees was only about one-fifth as much as the growth in this class — amounting to about 15 percent for softwoods and 30 percent for hardwoods. Some increase is also occurring in certain soft-hardwood types, such as the aspen type.

When the cut is less than growth, the difference is not lost but is added to the timber inventory—the growing stock. Up to a point, this improves the forest stands

and provides a bigger and better base for future growth. In some cases this is highly desirable; in others it results in increased loss of timber volume through mortality or increased cull as trees become overage and defective and either die or develop rot and other defects. Some trees, like balsam fir and aspen, are short-lived; they die or deteriorate rapidly after reaching maturity.

Though there are opportunities in Maine for increasing utilization through a larger harvest of timber, careful consideration must be given to the location of the increased cut and to the species involved.

The forest survey shows that 2½ million acres (1/7 of the total commercial forest land) have less than 1½ cords of growing stock per acre. And about 3½ million acres (43 percent of all stands classified as poletimber) have an average stocking of only 5 cords per acre. Clearly, growth must exceed cut in all such stands.

Complete Utilization

Utilization of the forest resource can be a wasteful business. At times more volume is left in the woods in tops, branches, and unmerchantable material than is utilized. With good utilization, each tree harvested is cut into the highest-value products possible. This in turn increases the timber yield and income and gives the same result as increasing the growth rate of the forest stand. In Maine, as elsewhere, the degree of utilization is also influenced by markets, accessibility, species, quality of trees, supervision given the cutting crews, and management policies.

Pulpwood cuttings utilize material in 4-foot lengths down to 4-inches in diameter, ordinarily giving reasonably efficient utilization of the cut trees. Reasonably good utilization is generally attained with softwood trees in Maine, but greater use of the associated hardwood species is needed. Exceedingly large volumes of potential hardwood products are often left after the conventional pulpwood operation, generally for good reasons: the dense hardwoods do not float and cannot be water-driven to the mill with the lighter softwoods; hardwoods are heavy and expensive to haul for long distances; the current market for hardwood pulpwood is limited to about 25 percent of the total pulpwood consumption, and the present mill price for hardwood pulpwood is relatively low. Cedar and aspen also are often left for lack of adequate markets.

Again the importance of a well-developed network of roads is evident. Better roads mean cheaper logging, and lower logging costs are important to achieving more complete utilization.

IMPROVED CUTTING PRACTICES

Timber from Maine forests is usually barvested according to one of several 'methods of cutting, including clearcutting, shelterwood cutting, diameter-limit cutting, or a variation of selection cutting.

Clearcutting is a method of harvesting timber that is designed to remove all of the merchantable trees in one operation. This method is commonly used when cutting remote areas to which the timber operator can not or does not plan to return for many years. It is also a practical method of reproducing those tree species that require full sunlight to become established and grow well. Some disadvantages of clearcutting are the long period of time between cuttings, the untimely removal of many vigorous and fast-growing trees, mortality of seedlings and saplings during and after logging, and usu-

ally a lower quality of harvested products.

Shelterwood cutting is a method of removing mature timber in a series of cuttings extending over a number of years. Cutting according to this method is usually divided into three or more phases, including a preparatory cutting, a seed cutting, and a final or removal cutting. This method of cutting mature stands is used with species that require partial to full sunlight to become established and grow.

Selection cutting is a method by which trees are selected for harvesting on the basis of their vigor, spacing, species, and size. The method has several variations: the two most common are single-tree selection and group selection — removing single trees or groups of trees at relatively short intervals of 5 to 20 years. Selection cutting is an ideal method to use on species that become established and grow under partial or full shade. When properly employed, this type of cutting usually leaves a well-stocked stand of the most vigorous, fast-growing, and well-formed trees in all size classes. Selection cutting is an ideal method for the management of small woodlands where the owner is interested in cutting at fairly frequent intervals.

A diameter-limit cutting is the harvest, in one cut, of all trees above a specified diameter. By having different diameter limits for different species, the cuttings can be modified to remove certain species and leave others. The diameter-limit cutting is a sort of compromise between clearcutting and some type of partial cutting. Thus it may have some of the advantages and disadvantages of clearcutting, shelterwood cutting, and selection cutting in some degree.

Most foresters in Maine favor some type of selection cutting over the other cutting methods. However, each method has certain advantages and disadvantages according to the species, forest conditions, product objectives, and needs of the landowner. And because of these many factors that must be considered, it is advisable that the services of a forester be utilized in the management and harvesting of forest stands.

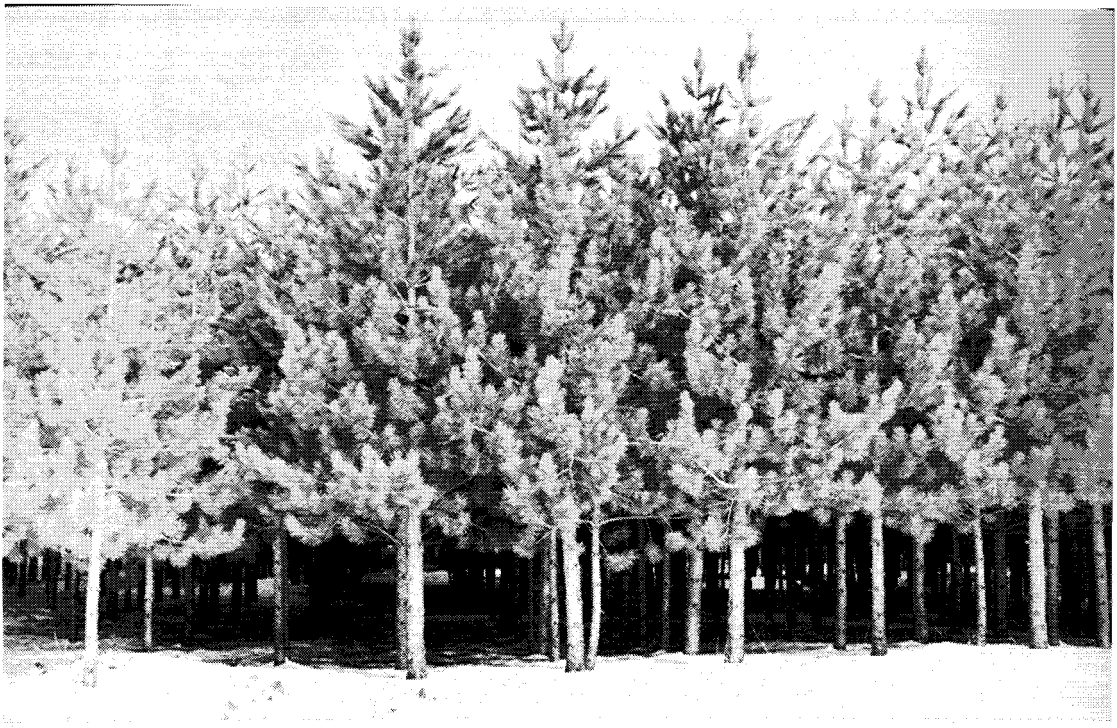
TIMBER-STAND IMPROVEMENT

Timber-stand improvement includes such measures as removal of undesirable trees, thinning, and pruning. These measures are used to increase net growth and to improve the quality of existing stands.

Trees may be undesirable because they are too crooked, too limby, or too defective to be converted into timber products. They may be of a species that has a low market value. These trees occupy space in the forest; yet they contribute little or nothing in the way of usable timber. Removing them provides additional space for more useful trees.

There is considerable opportunity in Maine to improve the forest yields by removing or deadening cull trees, particularly the worthless hardwoods left after cutting in softwood stands and mixedwood stands. Some cull trees may persist in these stands for many years. Some become huge wolf trees, occupying a great deal of valuable growing space. Over a period of time these trees are responsible for a sizable loss in timber production.

The need for removal of cull trees is perhaps most apparent in hardwood stands of central and southern Maine. These lands have been cut more often, and some of them more unwisely, than forests in other sections of the State. Diseases, insects, and climatic factors have also reduced the productivity of these forests.



Maine Forest Service photo

A pine plantation ready for thinning, a practice that increases growth and improves tree quality. The pulpwood harvested in thinning this plantation should more than pay the costs of the operation.

Unwanted trees can be removed by cutting, or they can be killed by girdling[5] or by application of chemical silvicides to their trunks or foliage. In some instances undesirable brush and small worthless hardwoods can be eliminated through aerial application of silvicides. This method is particularly useful for releasing pine seedlings that are found on some of the brushy, previously burned areas in southern Maine.

Thinning involves cutting some of the less promising trees in crowded stands. This provides more growing space for the residual trees and allows them to grow more rapidly and reach maturity sooner. This way the productive capacity of the soil used to concentrate growth on the higher quality trees and on trees of the most desirable species.

Thinning could be applied to many white pine stands and balsam fir thickets in Maine. These often contain many times more trees than are needed, and the trees go through a long period of extremely slow growth before reaching merchantable size. These stands would benefit from thinning at almost any stage of their development.

Pruning is another timber-stand-improvement practice that could increase the future value of softwood timber stands. Pruning white pine or red pine crop trees will produce a greater volume of clear lumber at harvest time.

INCREASED PROTECTION

As every resident of Maine knows, forests are subject to destruction by fire, insects, and tree diseases. A completely

[5] Severing the cambium, a thin layer located just under the bark, b~ removing a narrow but continuous strip of bark around the circumference of the tree.

effective protection program would hold losses from these to a minimum.

Historically, wildfires have been the greatest enemy of Maine's forests. Serious fires have occurred in the past and are a constant threat, particularly in the southern section of the State and on areas of heavy slash created by cutting in the northern part of the State. In 1947 wildfire burned over more than *200,000* acres in Maine, and caused an estimated damage of 12 million dollars *(24)*.

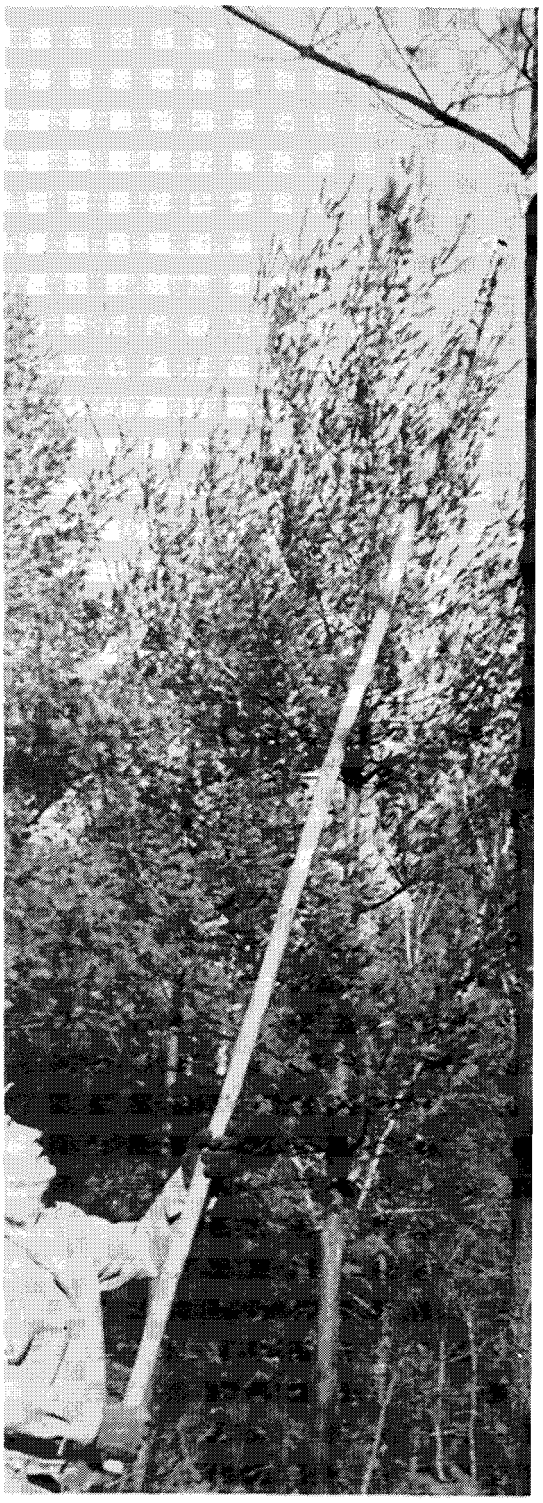
Wildfire not only causes complete loss of timber; it also kills fish and game, temporarily ruins their habitat, destroys recreational assets, impoverishes communities dependent on the forest resource, damages forest soils, and may temporarily destroy the water supply.

The expanding recreational use of the forests and the construction of hundreds of miles of all-weather roads into formerly remote areas is increasing the risk of fire. About 85 percent of the fires in Maine during 1958 were man-caused *(24)*. Therefore every citizen can contribute to the prevention and control of forest fires. He should be careful with all causes of fire in the woods, build campfires only at prescribed places, obtain fire permits as required, and assist in the control of fires wherever his services are required.

New roads are making protection easier. Control efforts are sometimes less costly and more effective because of increased accessibility. And value losses are reduced if immediate salvage logging is possible after serious fire, insect, or disease damage.

Protecting the forests from insects and diseases is often extremely difficult and

Maine Forest Service photo



Pruning white pine to increase the proportion of clear lumber in the tree. Branches are removed to a height of about 17½ feet.

expensive, yet these destructive agents cause large losses in forest growth. Early detection is one important key to effective control. The Maine Forest Service currently has a good detection program. Another way insect and disease losses can be minimized is by maintaining the forests in a healthy, vigorous condition.

The spruce budworm and balsam woolly aphid are capable of causing great losses in forest growth. Both insects are firmly established in the State. The balsam woolly aphid is the least spectacular of the two, but it takes a sizable toll of balsam fir in southern and eastern Maine. The spruce budworm occurred in epidemic proportions in Maine in 1807, 1878, again from 1910 to 1919 (3), and built up to near-epidemic proportions in northern Maine in 1958. The 1910-19 outbreak is estimated to have killed 40 percent of the spruce and balsam fir in the State — some 27½ million cords!

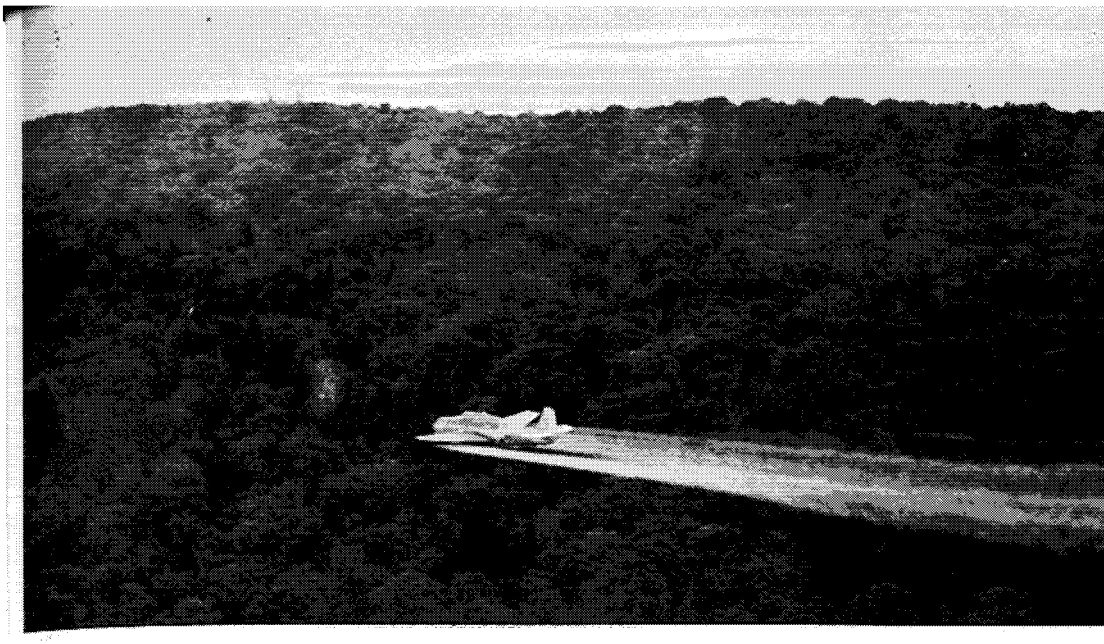
The white-pine weevil, the most serious of all pests of the eastern white pine, frequently determines the final character of stands seeded on old fields or clearings. Mixed stands of white pine and hardwood are rarely injured badly, but adjacent pure pine stands may be attacked so heavily that their future value for lumber is destroyed. The annual reduction in the value of white pine lumber because of knottiness and crookedness due to attacks by this insect is enormous (19). A recent study in New Hampshire revealed that the white-pine weevil had caused an average growth loss of 13 percent in poletimber-size trees and 40 percent in sawtimber-size trees (23).

White pine blister rust is a destructive disease. It cannot spread directly from pine to pine, but must have pine and Ribes (all varieties of currant and gooseberry) growing in close association. Its control is based on this fact. When the Ribes are removed from the white pine stand and a surrounding protective zone, the disease cannot spread. At the end of 1958, the acreage of white pine considered for protection in Maine totaled 932,935 acres (24). The control program is financed jointly by the State of Maine, the U. S. Forest Service, the towns and cities of Maine, and in a few cases by individual landowners.

Forest owners and others can help control these losses by reporting sudden in-

Prevention of fire is one way in which everyone can help to conserve forest values. This Maine Forest Service crew is mopping up the result of someone's carelessness.

Maine Forest Service photo



Maine Forest Service photo

The damage that insects do is not sudden and dramatic as a forest fire, yet insects cause tremendous losses in Maine forests. This plane is spraying insecticide in an effort to combat the ravages of the spruce budworm.

sect and disease buildups to the Maine Forest Service, and by supporting research and programs aimed at their control.

ACCELERATED PLANTING

Maine is estimated to have 100,000 acres of idle land that needs reforestation **(22).** Some of this land was formerly in farms. Some was barren when the first settlers arrived. And some is the result of fire and other catastrophes. The volume of forest products and income from the forest resource could be materially increased by planting these areas to trees. Pulpwood, sawtimber, or Christmas trees could be grown on these lands, according to the wishes of the owner.

Red and white pine, Norway and white spruce, and small amounts of balsam fir, Douglas-fir, paper birch, and Scotch pine are the principal species planted in Maine. Because each tree species does best under certain conditions of soil, drainage, and other factors, landowners should consult with a forester before ordering trees for a particular area.

Careful planting and subsequent plantation care are equally important in attaining good survival and growth. Improperly planted trees die; lack of afterplanting care may also result in losses and reduced growth of the surviving trees. Established plantations usually require protection from animals, insects, diseases, and competing vegetation.

ADDITIONAL RESEARCH

Foresters know a great deal about how to manage forests to increase the production of timber and other forest benefits. However, there are some things they don't know, and many things about which they would like to know more. Additional forestry research would fill these gaps in our professional knowledge of how to manage forest land most wisely.

Additional research in forest management in Maine might be designed to answer some of these questions, for exam-

Maine Forest Service photo

Planting to reforest idle land. This crew can plant about eight acres a day—about 10,000 trees. Maine has some 100,000 acres of idle land that need reforestation.

ple: How dense should spruce-fir forests be in order to grow the greatest quantity and the highest quality of timber? At what size should dominant hardwood and softwood trees be harvested? How do we regenerate some of our more desirable hardwoods and conifers? What is the best way to release young white pine seedlings that are being suppressed by brush on the burned-over areas in southern Maine? What are the financial returns from pruning young pine, spruce, and hardwoods?

Additional research in forest insects and diseases might be designed to find better ways of controlling the white-pine weevil, such as by aerial spraying; more efficient techniques for controlling the spruce budworm; more deadly predators to attack the balsam woolly aphid and other insects; and more effective ways of controlling blister rust, heart rots, and other diseases.

Research in forest utilization might be designed to develop new chemical processes that would make possible the utilization of some of the lower-grade trees in Maine's forests; to produce and test new logging and harvesting techniques for handling small trees more efficiently; and to develop new products to be manufactured from those tree species that are abundant in Maine.

Forest fire research might be expanded to enable foresters to predict when weather conditions are such that fires of catastrophic proportions are likely to occur, so that special precautions can be taken. Had such knowledge been available years ago, some of Maine's disastrous fires might have been prevented.

Research in forest recreation, wildlife, watershed protection, soils, tree physiology, and other related fields might also help foresters to increase the benefits that Maine's people will derive from their forests.

Current Programs To Improve Management

SINCE less than 1 percent of Maine's commercial forest area is in public ownership, most of the improvement in forestry practices must take place on private lands. Some measures are already used by many landowners. Interest in better forest management is increasing among all classes of owners, particularly among industrial concerns that depend upon forests for their raw material.

A number of public and privately sponsored programs such as professional forestry services, cost-sharing programs, and protection programs are aimed at improving the forest resource. These programs are available to all owners, from the largest industrial concern to the individual owner who has a few acres of woodland.

PROFESSIONAL FORESTRY SERVICES

Long-term returns from forests are closely related to the skill and intensity of the management these forests receive. Most of the large landowners in Maine employ professional foresters to plan the overall management of their forests and to supervise harvest cuttings and related treatments. As a result, most of the large industrial forests are being managed under long-term management plans. Management of these forests is becoming more intensive year by year.

But most of the people who own forest land in Maine hold tracts so small that they do not require the full-time services of a professional forester. These owners can get limited advice from the State Extension Forester, they can employ a consulting forester on a part-time basis, they can obtain the services of an industry forester, or they can get assistance from the Maine Forest Service.

When a landowner asks for this latter service, a State-employed forester goes over the woodland with him. The forester then prescribes a forest-management plan that fits the particular woodland and the owner's personal needs. The management plan may include harvest cuttings; tree planting; protection from fire, insects, diseases, and grazing; and stand-improvement practices.

Working with the owners, these State-employed foresters assist in marking trees to be cut. They help the owner find timber operators who are skilled in cutting on a marked-tree basis. They provide marketing information, and they can help the owner arrange for sale of timber according to the management plan recommended for the woodland.

This service is free. The 18 State-employed service foresters in Maine gave assistance to nearly 5,000 landowners in 1958 (24). More than 35 million board-feet of timber was harvested under their supervision during the year, bringing the owners a gross return of $720,000.

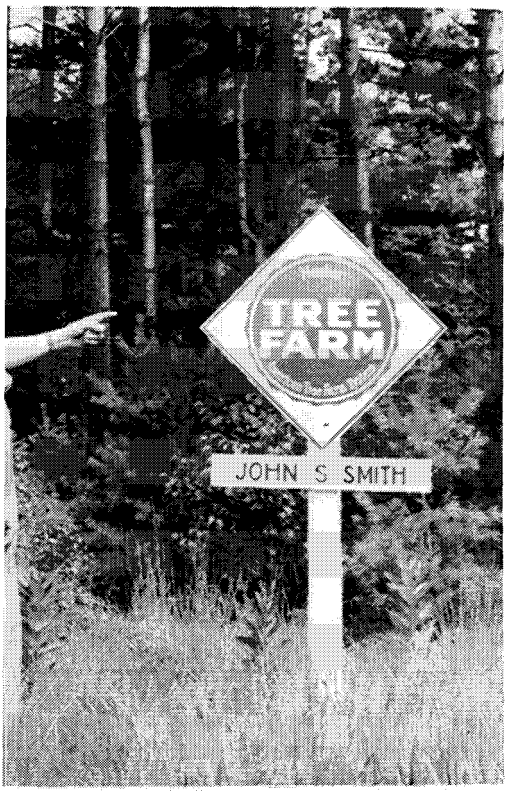
Requests for assistance from a service forester can be made to the Maine Forest Service, the County Agricultural Extension Service, and the Soil Conservation Service.

The Maine unit of the nationwide Tree-Farm Program, sponsored by the American Forest Products Industries in cooperation with the Maine Forest Service, actively promotes improved forest practices. Owners who manage their

woodlands according to established standards receive certificates and roadside signs stating that the woodlands have met Tree-Farm standards. In Maine, woodlots of 5 acres or more that are managed for commercial wood products on a sustained-yield basis are eligible for membership in this program. Subsequent forest operations and practices on these areas must meet Tree-Farm standards, or the certification is withdrawn.

By the end of 1959, more than one-quarter million acres of woodland had been certified in 396 active Tree Farms in the State. Any landowner, large or small, may apply for membership. Requests for additional information can be directed to the Maine Forest Service or any large wood-using company in the State.

Maine Forest Service photo



The Tree Farm program is one of the current activities to promote better forest practices. There me now about 400 Tree Farms in Maine.

Recognizing the benefits of improved cutting practices, some wood-using industries have sponsored the Tree Farm Family program in the Portland, Rumford, and Waterville areas. At present the Oxford Paper Company, S. D. Warren Paper Company, Scott Paper Company, and the Diamond National Corporation employ full-time company foresters to assist woodland owners who are members of their respective Tree Farm Families. These foresters provide services similar to those of State-employed service foresters. People owning woodlots within the purchasing area of a sponsoring company can apply to the company for assistance in woodland management.

Similar assistance from industrial foresters is available in other areas, even though formalized Tree Farm Families have not been established.

COST-SHARING PROGRAMS

Farm woodland owners who plan timber-stand-improvement measures for their woodlands may qualify for cost-sharing payments under the Agricultural Conservation Program (18). Federal cost-share payments are available for improvement cuttings in older stands from which non-merchantable or inferior trees are marked and removed. Payments are also available for weeding to improve young stands. This weeding program includes the removal of undesirable and non-merchantable trees in young stands, leaving 200 to 800 well-distributed future crop trees per acre. Also payments are available for pruning white or red pine. At least 100 well-distributed red or white pine future crop trees must be pruned on each acre, after proper weeding and thinning, to qualify for the cost-sharing payment.

Federal cost-sharing payments for any combination of forest-improvement practices on farmland are now limited to a maximum of $25 per acre. Stand improvement must be conducted under the direction and advice of a forester. No Federal cost-sharing payments is allowed for any area from which merchantable products are harvested in the process of carrying out the practice, unless the primary purpose of the operation is to improve the residual stand of trees.

The Agricultural Conservation Program changes somewhat from year to year. Individuals may obtain up-to-date information on this program through the Maine Forest Service, the County Agricultural Extension Service, the Soil Conservation Service, or local Agricultural Conservation Program offices.

Several Government programs offer assistance to landowners who are interested in planting trees for timber production. Trees are available at or below cost from the Maine Forest Service nursery at Greenbush. In 1959, three-year-old red pine, white pine, Norway spruce, and white spruce seedlings cost $11 per thousand, delivered. Nursery production is aimed at 8 to 10 million seedlings annually. Planting stock may also be obtained from a privately owned nursery at Fryeburg, or from out-of-state sources.

Under the Soil Bank Program, landowners may enter contractual agreements with the Federal Government for planting cropland and hayland to trees for a period of 10 years. The Government reimburses the landowner for the initial planting cost at specified rates according to the number of trees planted per acre. The owner is also paid an annual rental for each acre planted under contract. The rental rate for each planting is determined by the productivity rating of the planted area. At the end of 1959, 17,000 acres of former cropland were enrolled in this program.

Service foresters from the Maine Forest Service examine all land entered under the tree-planting phase of the Soii Bank Program, and recommend the number and kind of trees to be planted. They also arrange for the planting stock and, in most cases, arrange for planting machines and crews. As a rule, they also train and supervise the planting crews.

Cost sharing is also available to owners planting forest trees on farmland under the Agricultural Conservation Program (18). The maximum Federal cost-share is based on the number of trees planted per acre, and whether or not brush and scrub trees had to be cleared from the planted areas. No Federal cost-sharing is allowed for clearing by aerial spraying or for clearing a stand of merchantable timber or pulpwood.

PROTECTION PROGRAMS

The Maine Forest Service is responsible for fire protection on forest lands within the State. This service cost approximately 5½ cents an acre on the 17 million acres protected during the 1957-58 biennium, one of the lowest per-acre costs in the country.

The State is divided into two organizational set-ups for fire-protection purposes: (1) the Maine Forestry District; and (2) the organized towns. The Maine Forestry District contains 10,356,042 acres held by 657 owners in the unorganized towns of the State. The forest area protected in the organized towns encompasses 6,616,958 acres owned by 76,822 individuals or industrial concerns. The State protection force consists of 264 people, with another 2,100 on call.

Landowners can obtain assistance or advice on fire protection problems from

the Division of Forest Fire Control of the Maine Forest Service. State Fire Wardens issue campfire and burning permits for the Maine Forestry District.

A total of 99 lookout stations are strategically located throughout the State, 73 of them in the Maine Forestry District. Volunteer fire companies throughout the State are also available for fire-control work.

The Maine Forestry District fire-control budget for the *1957-58* biennium amounted to *$1,434,465,* approximately three-fourths coming from a tax on the private landowners and one-fourth from the Federal Government *(24)*. The budget for the organized towns amounted to *$824,487* for the same period, about one-fourth coming from the Federal Government and the balance from State appropriations and miscellaneous taxes and licenses.

Protecting the State's woodlands from insects is also a responsibility of the Maine Forest Service, with assistance from the U. S. Forest Service and other agencies. The program comprises detection and assessment surveys, research, and control of insect outbreaks. Six forest-insect rangers conduct periodic surveys of forest areas for insect damage.

Measures are taken when necessary to control outbreaks threatening the forests. In *1958* about 300,000 acres of forest in northern Aroostook County were sprayed from the air to control a dangerous build-up of the spruce budworm, which threatened to destroy the spruce and balsam fir in that area. Though the spraying program destroyed *96* percent of the budworm population in the sprayed area, the outbreak has continued in other areas, and another *175,000* acres are scheduled for spraying in *1960*. State, private, and Federal funds are used for this work. Aerial spraying is also used to control cankerworms, gypsy moth, and other insects as needed.

Predacious insects (which prey upon other insects) have been reared and liberated to control destructive forest insects. And recently a test was conducted with insects that were imported from Germany.

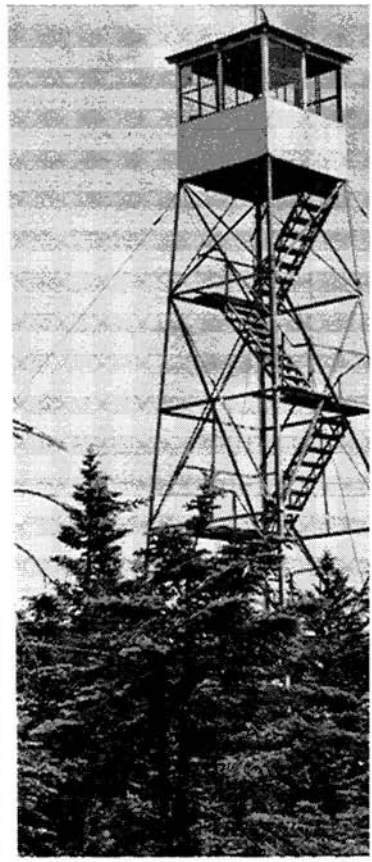
The State program for controlling forest diseases is limited mainly to protecting eastern white pine from the blister rust. This disease can be controlled by eliminating gooseberry and currant bushes in and near stands that contain white pine. Some *$177,000* of cooperative funds was spent for blister rust control in Maine in *1957* and *1958 (24)*.

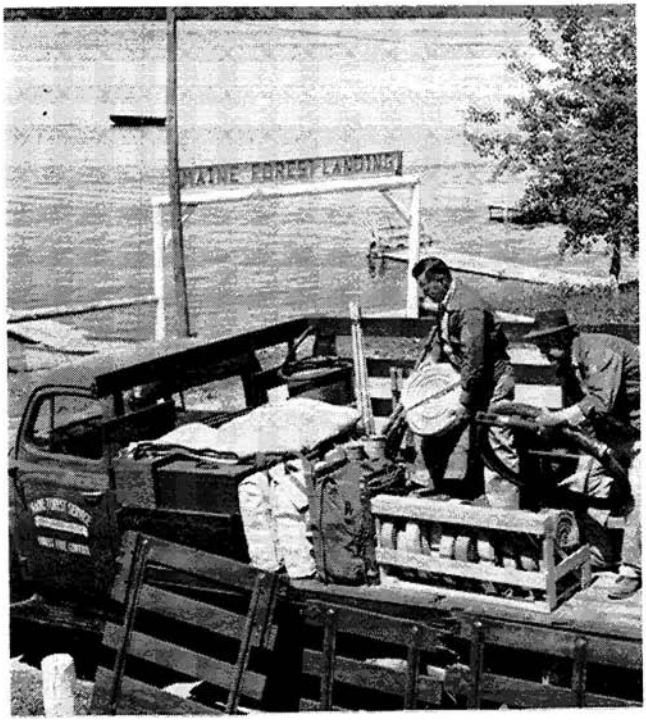
Questions and requests for assistance in controlling forest pests may be directed to the Maine Forest Service. This service is free.

RESEARCH AND EDUCATION

A considerable amount of forestry research is already being conducted in Maine. Leaders in such research are the Northeastern Forest Experiment Station of the U. S. Forest Service, with field headquarters and experimental forests at Bangor and Alfred; the School of Forestry and Agricultural Experiment Station of the University of Maine, in Orono; and the Maine Forest Service, with headquarters at Augusta. Major research efforts by these agencies in Maine are concentrated in forest management, forest entomology, and wildlife management.

The Maine Forest Service and the organized towns work to prevent and combat forest fires. Protection forces are headquartered at small stations throughout the forest areas; and men and equipment are dispatched to fires by road, air, and water.

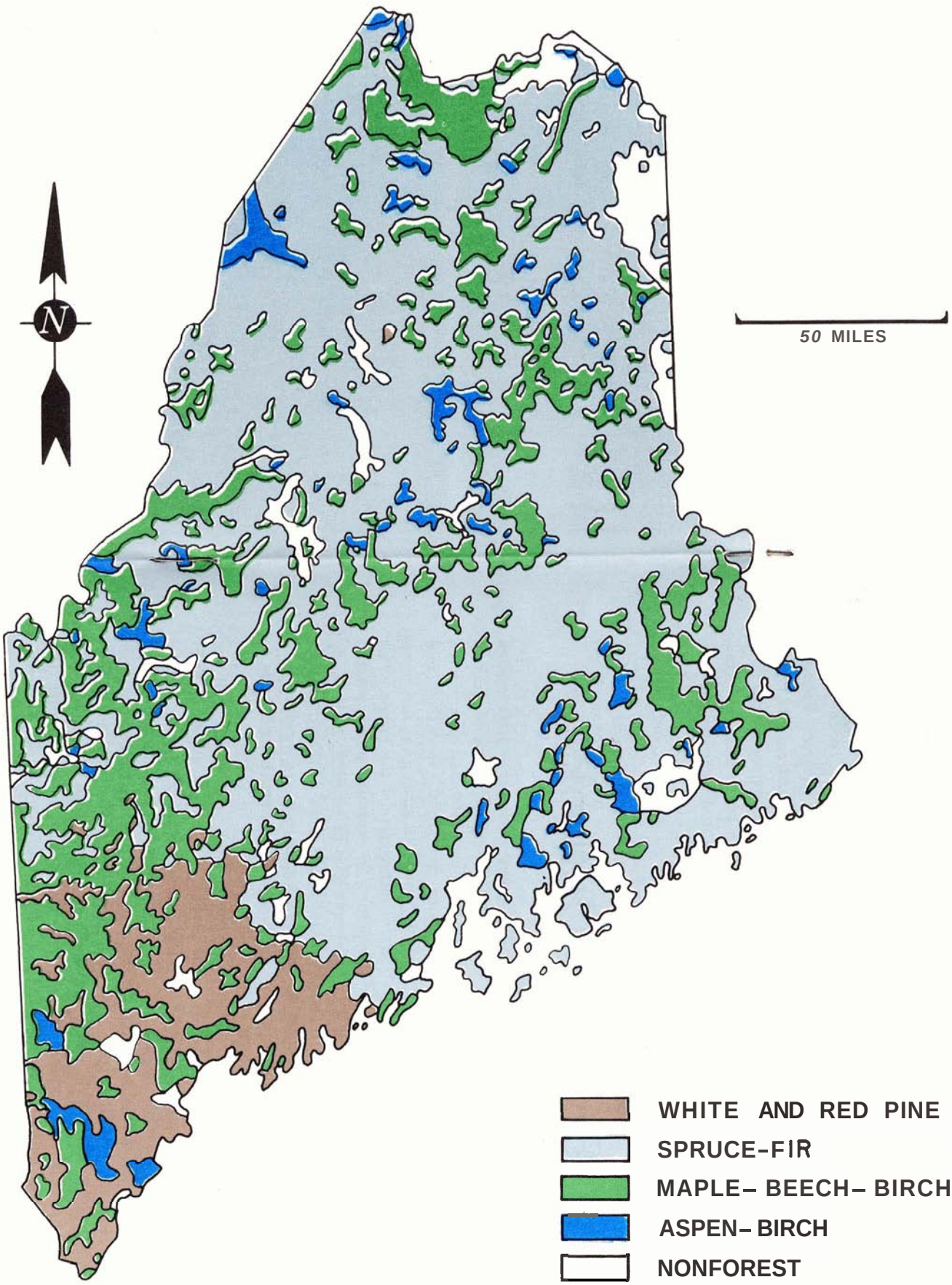




Maine Forest Service photos

THE MAJOR FOREST TYPES IN MAINE

1960



A number of the larger forest-owning companies are also engaged in forestry research. Part of their research is done independently, and part is done in cooperation with these three public agencies. Timber-growth studies, a timber-quality study, and the forest survey upon which this report is based, are recent examples of cooperative research between industry and public agencies.

In Maine, education in forestry is the primary responsibility of the University of Maine and the Maine Extension Service, although all of the forestry programs that have been mentioned have educational aspects. The University of Maine School of Forestry, one of the oldest in the Northeast, trains students who upon graduation become professional foresters eligible for membership in the Society of American Foresters.

Forestry education through the Extension Service is closely connected with the University's forestry program. Extension foresters are headquartered at Orono. Their function is to convey the results of forestry research to foresters and landowners through demonstrations and various other media.

A Favorable Outlook

MAINE is a forest state. Forests cover 87 percent of its land area. More than 17 million acres of commercial forest land are within its boundaries. This amounts to 18 acres of forest for every person in the State — more than six times the national average.

These forests are Maine's greatest natural resource. They provide raw material for a large lumber industry. They support a large and expanding pulp and paper industry. And in addition they provide a steady water supply, plentiful fish and game, and an ever increasing amount of outdoor recreation.

Maine's forests at present support a timber inventory of more than 200,000,000 cords. However, not all of this is immediately usable. Some of it is too small, some is too remote, some is in species not presently desired by industry, and some is too scattered to be harvested economically. But all of it is growing and will enable greater timber harvests to be made in the future.

This timber inventory is large enough to supply the present needs of Maine's wood-using industries. And since Maine's forests are now growing more than twice as much wood as is being cut, the inventory is increasing and the prospects for supporting an expansion of these industries appear to be excellent. Such an expansion would mean additional employment, a higher value of products produced in the State, and other benefits to Maine's people.

However, such achievements will not be possible without adjustments in utilization and management practices. The forestry picture has its dark clouds. One is that, in some of the more desired species and sizes of trees, the inventory is declining. The cut of pine sawlogs in 1958 exceeded growth by 41 percent. The cut of hard-hardwood sawlogs exceeds growth by almost 25 percent. In many cutting operations only the better quality trees are cut, leaving behind the less desirable sizes, grades, and species.

Another problem is the huge annual loss through mortality to insects, diseases, fire, and other causes. The volume of trees that die from these causes is greater than the volume that is currently being used by the wood-using industries.

But these problems can also be viewed as opportunities, for each of these difficulties has a solution. And if forestry research, utilization, and management are expanded, Maine's people can expect an even greater harvest of values from Maine's forests in the future.

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APPENDIX

FOREST SURVEY DATA

Tables of forest statistics were compiled from the findings of the Forest Survey of Maine, which began, in Hancock County in 1946. Many of the field plots established at that time were remeasured in 1958, and the original volumes[6] were then brought up to date. The inventory date for the State is January 1, 1959. Timber growth and cut statistics are for 1958. These data are grouped as follows:

Timber growth and cut—tables 1 to 6 and 31.

Timber inventory volume—tables 7 to 15 and 26 to 29.

Area, condition, and ownership of forest land—tables 16 to 25, 30, and 31.

Wherever cubic-foot volume is shown, the cordwood equivalent can be obtained by multiplying by 0.0125. This converting factor is based upon an average of 80 cubic feet of wood to 1 cord of unpeeled bolts.

INDEX TO TABLES

To facilitate compilation of Forest Survey data for any group of states, region, or the Nation as a whole, a set of 10 standard tables is presented in U. S. Forest Service Forest Survey statistical reports. In this report these tables are designated by an asterisk.

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[6] Forest statistics for Hancock County, Maine. U. S. Forest Serv, Northeast. Forest Exp. Sta., Forest Survey Release 4. 30 pp., 1949.

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DEFINITION OF TERMS

FOREST AREA

***Forest** land area.* — This includes: (a) lands that are at least 10 percent stocked with trees of any size and are 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 that 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 of wood (usually sawtimber); (b) economically available now or prospectively; and (c) not withdrawn from timber utilization through statute, ordinance, or administrative order.

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, or so physically inaccessible as to be unavailable economically in the foreseeable future.

FOREST COVER TYPES

The forest cover types are classified according to the predominant species or species group, as indicated by cubic volume for sawtimber and poletimber stands, and number of trees for seedling-and-sapling stands. All local forest types in Maine are keyed to the following five major types:

White pine-red pine. — Forests in which 50 percent or more of the stand is eastern white pine or red pine, singly or in combination. In Maine it includes the white pine and hemlock types. A negligible acreage of the pitch pine type is also included.

Spruce-fir. — Forests in which 50 percent or more of the stand is spruce and fir. In Maine it includes the spruce-fir, spruce-fir-hardwood, and cedar-tamarack-spruce types.

Oak-hickory. — Forests in which 50 percent or more of the stand is made up of various species of oak.

Elm-ash-cottonwood (swamp hardwoods). — Forests in which 50 percent or more of the stand is in red maple, elm, ash, or associated species, singly or in

(Continued on page 69.)

Table 1.--Output of timber products and annual cut of live sawtimber and growing stock in Maine, 1958

Product	Output of timber products*					Annual cut of sawtimber			Annual cut of growing stock		
	Volume in standard units		Roundwood volume								
	Standard units	Number	Soft-woods	Hard-woods	Total	Soft-woods	Hard-woods	Total	Soft-woods	Hard-woods	Total
			M cubic feet			M board-feet			M cubic feet		
Sawlogs	M board-feet**	424,403	61,587	14,942	76,529	309,705	91,369	401,074	64,779	26,967	91,746
Veneer logs and bolts	M board-feet	42,580	--	7,903	7,903	996	58,944	59,940	288	12,448	12,736
Cooperage logs and bolts	M board-feet***	1,633	295	--	295	1,488	--	1,488	325	2	327
Pulpwood	Standard cords	†1,687,580	102,703	29,483	132,186	265,766	30,678	296,444	102,254	22,793	125,047
Fuelwood	Standard cords	*264,343	130	12,357	12,487	188	21,132	21,320	111	10,723	10,834
Piling	M linear feet	131	57	21	78	286	101	387	59	22	81
Poles	M pieces	16	242	10	252	1,018	--	1,018	242	10	252
Posts	M pieces	123	122	28	150	19	96	115	127	28	155
Hewn ties	M pieces	12	32	--	32	396	--	396	39	--	39
Miscellaneous**	M cubic feet	1,272	1,064	208	1,272	1,319	--	1,319	725	205	930
Total	--	--	166,232	64,952	231,184	581,181	202,320	783,501	168,949	73,198	242,147

* Includes material from growing stock and other miscellaneous sources.

** International ¼-inch rule.

*** Rough wood basis.

† Includes 35,255 cords from plant residues used for pulp.

* Includes 108,247 cords from plant residues used for domestic and industrial fuel.

** Includes shingles, rustic and snow fences, chemical wood, lobster traps, and fish weirs.

Table 2.--Net volume of growing stock and sawtimber cut from Maine forests, by species, 1958

Species	Growing stock cut		Live sawtimber cut
	Million cu.ft.	Equivalent in thousand cords	Million bd.ft.
Softwoods:			
Spruce	66	825	232
Balsam fir	40	500	106
White pine	38	475	153
Hemlock	20	250	72
Cedar	4	50	13
Other softwoods	1	12	5
All softwoods	169	2,112	581
Hardwoods:			
Sugar maple	23	288	63
Beech	16	200	35
Yellow birch	12	150	34
Paper birch	11	137	40
Red oak	5	63	19
Other hardwoods	6	75	11
All hardwoods	73	913	202
All species	242	3,025	783

Table 3.--Net annual growth, annual mortality, and annual cut of live sawtimber and growing stock on commercial forest land in Maine, by species group, 1958

Item	Sawtimber			Growing stock		
	Soft-woods	Hard-woods	Total	Soft-woods	Hard-woods	Total
	Million board-feet			Million cubic feet		
Net annual growth	711	252	963	404	170	574
Annual mortality	351	152	503	189	83	272
Annual cut						
Timber products	565	164	729	156	56	212
Logging residues	16	38	54	13	17	30
Total	581	202	783	169	73	242

Table 4.--Net annual growth and timber cut of live sawtimber and growing stock on commercial forest land, by species group, Maine, 1958

Species group	Net annual growth	Timber cut
LIVE SAWTIMBER		
Million board-feet		
White and red pine	107.7	152.6
Spruce and fir	513.2	338.4
Other softwoods	89.7	90.2
Soft hardwoods	124.8	45.6
Hard hardwoods	127.2	156.7
All species	962.6	783.5
GROWING STOCK		
Million cubic feet		
White and red pine	31.5	37.9
Spruce and fir	319.0	105.8
Other softwoods	53.4	25.2
Soft hardwoods	112.6	15.5
Hard hardwoods	57.6	57.7
All species	574.1*	242.1**
Thousand cords		
White and red pine	394	474
Spruce and fir	3,987	1,322
Other softwoods	668	315
Soft hardwoods	1,407	194
Hard hardwoods	720	721
All species	7,176	3,026

*Net annual growth sampling error is ± 9.1 percent.
**Timber cut sampling error is ± 9.2 percent.

Table 5.--Components of net annual growth of growing stock on commercial forest land, by species group, Maine, 1958

Item	Softwoods	Hardwoods	All species
	In thousand cords		
Growth on initial growing stock	4,010	1,955	5,965
Ingrowth--saplings that became poletimber trees during 1958	+3,403	+1,213	+4,616
Gross growth	7,413	3,168	10,581
Annual mortality	-2,364	-1,041	-3,405
Net annual growth of growing stock	5,049	2,127	7,176
	In cords per acre*		
Growth	0.23	0.11	0.34
Ingrowth	+ .20	+ .07	+ .27
Gross growth	.43	.18	.61
Annual mortality	- .14	- .06	- .20
Net annual growth	0.29	0.12	0.41

*The difference in rates between "growing stock" and "volume suitable for pulpwood" is negligible (a difference of 0.01 cord net growth for total of all species).

Table 6.--Components of net annual growth of sawtimber on commercial forest land, by species group, Maine, 1958

(In millions of board-feet)

Item	Softwoods	Hardwoods	All species
Growth on initial sawtimber inventory	476	174	650
Ingrowth-poletimber trees that became sawtimber trees during 1958	+ 586	+ 230	+ 816
Gross growth	1,062	404	1,466
Annual mortality	- 351	- 152	- 503
Net annual growth	711	252	963

Table 7.--Net volume of live sawtimber and growing stock on commercial forest land, by species, Maine, 1959

Species	Sawtimber	Growing stock	
	Million bd.-ft.	Million cu.ft.	Equivalent in million cords
Softwoods:			
Spruce	7,482	3,633	45.4
White pine	5, 000	1,468	18.4
Balsam fir	3,340	3,249	40.6
Cedar	2,063	1,350	16.9
Hemlock	1,833	892	11.1
Other softwoods	232	154	1.9
All softwoods	19,950	10,746	134.3
Hardwoods:			
Sugar maple	3,019	945	11.8
Yellow birch	2,615	940	11.8
Red maple	1,248	1,137	14.2
Beech	1,013	644	8.0
Paper birch	938	817	10.2
Aspen	529	605	7.6
Ash	395	279	3.5
Northern red oak	390	203	2.5
Other hardwoods	346	198	2.5
All hardwoods	10,493	5,768	72.1
All species	30,443	16,514	206.4

Table 8.--Quality of white pine and hardwood sawtimber on commercial forest land, Maine, 1959

(In millions of board-feet)

Species	Standard lumber logs			Tie and timber logs*	Total
	Grade 1	Grade 2	Grade 3		
White pine**	605	2,415	1,980	(***)	5,000
Sugar maple	580	996	969	474	3,019
Yellow birch	745	722	868	280	2,615
Red maple	99	377	656	116	1,248
Paper birch	142	252	371	173	938
Aspen	23	140	260	106	529
Ash	90	158	122	25	395
Northern red oak	55	78	193	64	390
Other hardwoods	46	323	706	284	1,359
All hardwoods	1,780	3,046	4,145	1,522	10,493

* Meet minimum specifications for tie and timber logs but not for standard lumber logs (See Appendix for specifications).

** Other softwoods not graded.

*** Not applicable to white pine.

Table 9.--Net volume of live sawtimber and growing stock on commercial forest land and area occupied, by stand-size class, Maine, 1959

Stand-size class	Area	Sawtimber volume	Growing stock	
	Thousand acres	Million bd.-ft.	Million cu.ft.	Equivalent in million cords
Sawtimber stands:				
More than 5,000 board-feet per acre	1,416	9,482	2,981	37.2
1,500 to 5,000 board-feet per acre	5,361	15,469	7,192	89.9
All sawtimber stands	6,777	24,951	10,173	127.1
Poletimber stands	7,933	5,222	6,057	75.7
Seedling-and-sapling stands	1,900	171	239	3.0
Nonstocked and other areas not elsewhere classified	559	99	45	.6
All stands	* 17,169	** 30,443	*** 16,514	206.4

* Standard error = 0.4 percent.

** Standard error = 2.4 percent.

*** Standard error = 1.4 percent.

Table 10.--Net volume of live sawtimber and growing stock on commercial forest land, by ownership class, Maine, 1959

Ownership class	Sawtimber	Growing stock	
	Million bd.-ft.	Million cu.ft.	Equivalent in million cords
Federal:			
National forest *	122	59	0.7
Other Federal	46	24	.3
Total Federal	168	83	1.0
State	109	62	.8
Municipal	127	73	.9
Private:			
Farm	3,492	1,881	23.5
Forest industry	12,789	6,837	85.5
Other private	13,758	7,578	94.7
Total private	30,039	16,296	203.7
All ownerships	30,443	16,514	206.4

* Volumes for National forest ownership are for the 45,862 acres in the White Mountain National Forest and 3,694 acres in the Massabesic Experimental Forest.

Table 11.--Net volume of live sawtimber on commercial forest land, by diameter-class group and species, Maine, 1959

(In millions of board-feet)

Species	Diameter-class group (in inches)						Total
	10	12	14	16	18	20+	
White and red pine	581	875	754	710	467	1,613	5,000
Other eastern softwoods	5,296	3,958	2,448	1,621	659	968	14,950
Total softwoods	5,877	4,833	3,202	2,331	1,126	2,581	19,950
Northern red oak	--	99	99	64	46	82	390
Yellow birch	--	429	459	470	369	888	2,615
Sugar maple	--	406	463	583	583	984	3,019
Beech	--	409	330	177	79	18	1,013
Other eastern hardwoods	--	1,290	933	653	297	283	3,456
Total hardwoods	--	2,633	2,284	1,947	1,374	2,255	10,493
All species	5,877	7,466	5,486	4,278	2,500	4,836	30,443

Table 12.--Net volume of live growing stock on commercial forest land, by diameter-class group and species, Maine, 1959

(In thousands of cords)

Species	Diameter-class group (in inches)								
	06	08	10	12	14	16	18	20+	Total
Softwoods:									
Spruce	11,151	11,117	7,524	6,144	4,232	2,722	1,144	1,380	45,414
Balsam fir	16,247	13,858	6,397	2,780	862	431	38	--	40,613
White pine	1,310	2,403	2,121	2,694	2,259	2,046	1,295	4,224	18,352
Cedar	3,864	4,663	3,054	2,191	1,380	720	430	570	16,872
Hemlock	1,764	2,314	1,923	1,732	1,229	1,011	386	795	11,154
Other softwoods	463	550	294	221	177	64	29	118	1,916
All softwoods	34,799	34,905	21,313	15,762	10,139	6,994	3,322	7,087	134,321
Hardwoods:									
Red maple	3,453	3,662	3,071	1,656	1,154	813	177	223	14,209
Sugar maple	1,050	1,048	1,233	1,336	1,349	1,653	1,537	2,603	11,809
Yellow birch	1,077	1,542	1,539	1,496	1,386	1,358	1,047	2,309	11,754
Paper birch	2,748	2,690	1,915	1,230	748	431	253	196	10,211
Beech	1,563	1,616	1,908	1,279	952	479	206	45	8,048
Aspen	1,809	2,178	1,949	802	477	204	114	33	7,566
Ash	658	830	792	437	318	216	156	83	3,490
Red oak	353	435	497	380	327	201	124	218	2,535
Other hardwoods	372	550	597	262	168	161	137	229	2,476
All hardwoods	13,083	14,551	13,501	8,878	6,879	5,516	3,751	5,939	72,098
All species	47,882	49,456	34,814	24,640	17,018	12,510	7,073	13,026	206,419

Table 13.--Number of growing stock trees* on commercial forest land, by diameter-class group and species, Maine, 1959

(In millions of trees)

Species	Diameter-class group** (in inches)											
	2	4	6	8	10	12	14	16	18	20	22	24
Spruce	1,680	752	337	151	57	29	13	6	2	1	1	-
Balsam fir	4,515	1,442	505	191	47	13	3	1	--	--	--	--
White pine	139	87	42	32	17	14	8	5	3	1	1	2
Hemlock	213	106	58	38	17	9	4	3	1	1	--	--
Other softwoods	686	312	153	91	34	16	7	3	1	--	--	--
Sugar maple	473	96	33	16	10	7	5	5	3	2	1	1
Beech	512	131	47	23	15	6	3	1	1	--	--	--
Yellow birch	252	67	34	24	14	9	6	4	2	1	1	1
Paper birch	280	131	77	37	15	6	3	1	1	--	--	--
Red oak	34	17	12	7	4	2	1	1	1	--	--	--
Other hardwoods	1,536	496	188	99	50	17	8	3	--	--	--	--
All species	10,320	3,637	1,486	709	280	128	61	33	***14	***7	4	4

* Includes saplings that will qualify as poletimber when they grow into the 6-inch diameter class.

** Number of trees shown in largest diameter class may include larger trees.

*** These totals are correct for all species and are not the same as the summations, which include more than one diameter class.

Table 14.--Net volume of all timber on commercial forest land, by class of material and species group, Maine, 1959

(In millions of cubic feet)

Class of material	All species	Softwoods	Hardwoods
Growing stock:			
Sawtimber trees			
Sawlog portion	6,721	4,573	2,148
Upper-stem portion	881	556	325
Total	7,602	5,129	2,473
Poletimber trees	8,912	5,617	3,295
Total growing stock	18,514	10,746	5,768
Other material*			
Sound cull trees	1,591	1,028	563
Rotten cull trees	1,249	424	825
Hardwood limbs	1,018		1,018
Total other material	3,858	1,452	2,106
Total, all timber	20,372	12,198	8,171

*The item "salvable dead trees" is not included here because there is only negligible volume of this class of material in Maine.

Table 15.--Net volume suitable for pulpwood* on commercial forest land, by species, Maine, 1959

Species	Volume suitable for pulpwood
	Million cords
Softwoods:	
Spruce	44.5
Balsam fir	41.0
White pine	18.5
Cedar	18.3
Hemlock	10.7
Other softwoods	1.9
All softwoods	134.9
Hardwoods:	
Red maple	14.2
Yellow birch	11.1
Sugar maple	11.0
Paper birch	10.0
Beech	8.1
Aspen	7.4
Ash	3.4
Red oak	2.4
Other hardwoods	3.0
All hardwoods	70.6
All species	205.5

*The volumes shown in this table are slightly different from those shown for growing stock (table 7) because they exclude certain portions of growing-stock trees and include some volume of cull trees.

Table 16.--Land area of Maine, by major classes of land, 1959

Class of land	Area	
	Thousand acres	Percent
Forest:		
Commercial	17,169	86
Noncomercial:		
Productive but reserved	158	1
Unproductive	98	(*)
All forest land	17,425	87
Nonforest **	2,441	13
All land	19,866	100

* Less than ½ percent.

** Includes 188,000 acres of water according to Forest Survey standards of area classification but defined by the Bureau of Census as land.

Table 17.--Area of commercial forest land, by major forest types, Maine, 1959

Forest type	Area
	Thousand acres
White-red-jack pine:	
White pine*	1,224
Hemlock	415
	1,639
Spruce-fir:	
Spruce-fir	4,764
Spruce-fir-hardwood	2,297
Cedar-tamarack-spruce	1,322
	8,383
Oaks**	287
Swamp hardwoods:	
Ash-elm-maple	303
Red maple	202
	505
Maple-beech-birch:	
Sugar maple-beech-yellow birch	2,836
Hardwood-spruce-fir	2,076
Hardwood-white pine	200
	5,112
Aspen-birch:	
Aspen	485
Gray birch-pin cherry	422
Paper birch	336
	1,243
All types	17,169

*Includes 15,000 acres of the pitch pine and jack pine types.

**This type would be combined with the oak-hickory type for regional totals.

Table 18.--Commercial forest-land area, by forest-type group and stand-size class, Maine, 1959

(In thousands of acres)

Forest-type group	Sawtimber stands		Poletimber stands		Seedling and-sapling stands and other areas	Total
	More than 5,000 board-feet per acre	1,500 to 5,000 board-feet per acre	More than 600 cubic feet per acre	200 to 600 cubic feet per acre		
Spruce-fir	424	1,534	1,480	812	514	4,764
Spruce-fir-hardwood	146	823	714	440	174	2,297
Other softwood types	309	1,077	711	512	352	2,961
All softwood types	879	3, 434	2,905	1,764	1,040	10,022
Sugar maple-beech-yellow birch	315	897	606	712	306	2,836
Hardwood-spruce-fir	203	759	596	380	138	2,076
Other hardwood types	19	271	426	544	975	2,236
All hardwood types	537	1,927	1,628	1,636	1,419	7,147
All types	1,416	5,361	4, 533	3,400	2,459	17,169

Table 19.--Commercial forest land area, by drainage areas and stand-size class, Maine, 1959

(In thousands of acres)

Drainage area	All stands	Sawtimber stands	Poletimber stands	Other stands and areas
Androscoggin River	1,788	517	865	406
Aroostook River	1,666	654	853	159
Coastal Rivers	1,306	427	726	153
Kennebec River	3,160	1,089	1,584	487
Penobscot River	5,490	2,305	2,605	580
Saco River	945	262	397	286
St. John's River	2,814	1,523	903	388
All drainages	17,169	6,777	7,933	2,459

Table 20.--Commercial forest land area, by ownership and stand-size class, Maine, 1959

(In thousands of acres)

Ownership class	All stand-size classes	Sawtimber stands	Poletimber stands	Seedling-and-sapling stands	Nonstocked areas
Federal: *					
National forest	50	26	22	2	--
Other Federal	27	10	11	4	2
Total	77	36	33	6	2
State**	64	25	33	6	--
Municipal***	75	28	38	8	1
Private:					
Farm	†1,992	771	896	241	84
Forest Industry	6,521	2,875	3,169	437	40
Other private	8,440	3,042	3,764	1,202	432
Total private	16,953	6,688	7,829	1,880	556
All ownerships	17,169	6,777	7,933	1,900	559

* National forest ownership as of December 9, 1958. (White Mountain National Forest acreage is 45,862 acres; remainder is in the Massabesic Experimental Forest.)

** State ownership as of November 28, 1958.

*** Municipal ownership as of April 20, 1959. (There is no county-owned forest land in Maine.)

† Census of Agriculture, 1954.

Table 21.--Number of private owners and total acreage of privately-owned commercial forest land, by size-of-holding class, Maine, 1959

Size-of-holding class (in acres)	Number of owners	Thousand acres
Less than 100	62,557	4,121
100 to 500	14,265	2,788
500 to 5,000	528	770
Total, small ownerships *	77,350	7,679
5,000 to 50,000	51	898
50,000 and over	23	8,376
Total, large ownerships **	74	9,274
Total, all ownerships	77,424	16,953

*Source: U. S. Forest Service, Timber Resources for America's Future, 1958. There is no recent estimate (since 1952) of the number of owners by size-of-holding class; however the acreages have been adjusted to conform with the 1959 data for large ownerships.

**Source: Maine Forest Service, 1959.

Table 22.--Land area and commercial forest land area, by counties, Maine, 1959

County	Land area	Commercial forest-land area	
	Thousand acres	Thousand acres	Percent
Androscoggin	306	230	75
Aroostook	4, 355	3,854	88
Cumberland	564	503	89
Franklin	1,099	919	84
Hancock	987	759	77
Kennebec	554	438	79
Knox	232	194	84
Lincoln	292	245	84
Oxford	1,334	1,068	80
Penobscot	2,181	1,971	90
Piscataquis	2,527	2,319	92
Sagadahoc	164	141	86
Somerset	2,527	2,155	85
Waldo	470	326	69
Washington	1,634	1,573	96
York	640	474	88
Total	19,866	17,169	86

Table 23.--Ownership of commercial forest land area, by county groups, Maine, 1959

(In thousands of acres)

Counties and groups	Ownership class						All ownerships
	Farm forest	Forest industries	Other private	Federal	State	Municipal	
Aroostook	343	1,608	1,851	4	(*)	48	3,854
Penobscot	231	558	1,160	(*)	17	4	1,970
Piscataquis	79	1,189	1,020	(*)	28	3	2,319
Somerset	198	1,340	614	(*)	(*)	3	2,155
Oxford-Franklin	294	753	883	**46	6	5	1,987
Washington-Hancock	222	1,059	1,024	22	4	1	2,332
York-Cumberland-Androscoggin	241	8	947	4	3	5	1,208
Sagadahoc-Kennebec-Lincoln-Knox-Waldo	384	6	941	1	6	6	1,344
All counties	1,992	6,521	8,440	77	64	75	17,169

*Less than 500 acres.

**White Mountain National Forest.

Table 24.--Commercial forest land area, by forest-type group and county groups, Maine, 1959

(In thousands of acres)

Counties and county groups	Forest types and forest-type groups						
	Spruce-fir	Spruce-fir-hardwood	Hardwood-spruce-fir	Cedar-tamarack-spruce	White pine*	Sugar maple-beech-yellow birch	Other hardwood types
Aroostook	1,315	563	547	367	101	630	331
Penobscot	672	288	280	187	52	322	169
Piscataquis	792	338	329	221	61	379	199
Somerset	624	283	280	176	162	392	238
Oxford-Franklin	384	201	190	118	370	429	295
Washington-Hancock	794	451	268	184	143	224	268
York-Cumberland-Androscoggin	48	65	58	27	425	326	259
Sagadahoc-Kennebec-Lincoln-Knox-Waldo	135	108	124	42	325	334	276
All counties	4,764	2,297	2,076	1,322	1,639	3,036	2,035

* White pine type includes 415,000 acres of the hemlock type and 15,000 acres of the pitch pine and jack pine types.

Table 25.--Commercial forest land area, by county group and stand size class, Maine, 1959

(In thousands of acres)

Counties and county groups	Sawtimber stands		Poletimber stands		Seedling-and-sapling stands	Other areas
	More than 5,000 board-feet per acre	1,500 to 5,000 board-feet per acre	More than 600 cubic feet per acre	200 to 600 cubic feet per acre		
Aroostook	330	1,348	1,035	708	347	86
Penobscot	168	690	529	361	178	44
Piscataquis	198	812	623	425	209	52
Somerset	178	690	568	426	234	59
Oxford-Franklin	172	550	496	403	288	78
Washington-Hancock	176	754	670	458	163	111
York-Cumberland-Androscoggin	106	242	277	269	244	70
Sagadhoc-Kennebec-Lincoln-&ox-Waldo	88	275	335	350	237	59
All counties	1,416	5,361	4,533	3,400	1,900	559

Table 26.--Net volume in live sawtimber on commercial forest land, by county groups and species, Maine, 1959

(In millions of board-feet)

Species	County and county groups							
	Aroostook	Penobscot	Piscataquis	Somerset	Oxford-Franklin	Hancock-Washington	York-Cumberland-Androscoggin	Sagadahoc-Kennebec-Lincoln-Knox-Waldo
Softwoods:								
Spruce	2,069	1,058	1,245	974	654	1,184	137	161
White pine	464	237	279	505	952	686	1,029	848
Balsam fir	988	506	595	463	315	336	69	68
Cedar	640	327	384	291	176	213	10	22
Hemlock	294	150	177	210	260	279	226	237
Other softwoods	29	15	17	26	37	32	36	40
All softwoods	4,484	2,293	2,697	2,469	2,394	2,730	1,507	1,376
Hardwoods:								
Sugar maple	947	484	570	434	282	225	41	36
Yellow birch	761	389	458	364	271	215	89	68
Red maple	272	139	164	160	148	145	95	125
Beech	283	144	170	137	101	111	33	34
Paper birch	238	122	144	124	88	131	31	60
Aspen	143	73	86	69	54	70	20	14
Ash	99	51	59	54	46	31	25	30
Other hardwoods	66	34	39	87	148	24	162	176
All hardwoods	2,809	1,436	1,690	1,429	1,138	952	496	543
All species	7,293	3,729	4,387	3,898	3,532	3,682	2,003	1,919

Table 27.--Net volume in live timber suitable for pulpwood, by county groups, and species, Maine, 1959

(In thousands of cords)

Species	County and county groups							
	Aroostook	Penobscot	Piscataquis	Somerset	Oxford Franklin	Hancock-Washington	York-Cumberland-Androscoggin	Sagadahoc-Kennebec-Lincoln-Knox-Waldo
Softwoods:								
Spruce	11,871	6,070	7,142	5,712	3,963	7,351	1,049	1,343
White pine	1,815	929	1,093	1,883	3,565	2,340	3,824	3,020
Balsam fir	11,714	5,989	7,047	5,586	3,736	4,955	817	1,187
Cedar	5,193	2,656	3,125	2,464	1,688	2,292	401	462
Hemlock	1,595	815	958	1,191	1,542	1,752	1,392	1,458
Other softwoods	297	152	178	225	272	256	241	282
All softwoods	32,485	16,611	19,543	17,061	14,766	18,946	7,724	7,752
Hardwoods:								
Sugar maple	3,237	1,654	1,947	1,551	1,078	881	279	334
yellow birch	2,996	1,531	1,802	1,505	1,235	989	556	500
Red maple	2,819	1,442	1,696	1,796	1,791	1,610	1,301	1,717
Beech	1,896	970	1,141	1,032	982	982	598	538
Paper birch	2,242	1,146	1,348	1,251	1,075	1,577	603	805
Aspen	1,823	932	1,097	929	699	1,286	274	369
Ash	759	388	457	433	408	373	260	287
Other hardwoods	619	317	374	632	1,035	264	1,080	1,065
All hardwoods	16,391	8,380	9,862	9,129	8,303	7,962	4,951	5,615
All species	48,876	24,991	29,405	26,190	23,069	26,908	12,675	13,367

Table 28.--Net volume of live sawtimber on commercial forest land, by stand-size class, species group, and county groups, Maine, 1959

(In millions of board-feet)

Counties and county groups	Stand-size class					
	Sawtimber stands		Poletimber stands		All other stands	
	Softwoods	Hardwoods	Softwoods	Hardwoods	Softwoods	Hardwoods
Aroostook	3,714	2,403	736	381	34	25
Penobscot	1,899	1,229	376	194	18	13
Piscataquis	2,234	1,446	442	229	21	15
Somerset	2,027	1,189	423	226	19	14
Oxford-Franklin	1,937	889	439	232	18	17
Washington-Hancock	2,226	791	476	154	28	7
York-Cumberland-Androscoggin	1,191	320	304	163	12	13
Sagadahoc-Kennebec-Lincoln-Knox-Waldo	1,090	366	279	168	7	9
All counties	16,318	8,633	3,475	1,747	157	113

Table 29.--Net volume of live growing stock on commercial forest land, by stand-size class, species group, and county groups, Maine, 1959

(In millions of cords)

Counties and county groups	Stand-size class					
	Sawtimber stands		Poletimber stands		All other stands	
	Softwoods	Hardwoods	Softwoods	Hardwoods	Softwoods	Hardwoods
Aroostook	20.7	10.6	11.2	6.0	0.4	0.3
Penobscot	10.6	5.4	5.7	3.1	.2	.2
Piscataquis	12.4	6.4	6.8	3.6	.2	.2
Somerset	10.8	5.5	5.9	3.7	.2	.2
Oxford-Franklin	9.4	4.5	4.9	3.7	.2	.2
Washington-Hancock	12.3	4.5	6.8	3.3	.3	.2
York-Cumberland-Androscoggin	4.9	2.1	2.4	2.7	.2	.2
Sagadahoc-Kennebec-Lincoln-Knox-Waldo	4.8	2.3	2.8	3.1	.2	.2
All counties	85.9	41.3	46.5	29.2	1.9	1.7

Table 30.--Commercial forest area and volume suitable for pulpwood, by county groups and volume-per-acre classes, Maine, 1959

Counties and county groups	Volume-per-acre class					
	0 to 400 cubic feet per acre		401 to 1,200 cubic feet per acre		1,201 and over cubic feet per acre	
	Thousand acres	Thousand cords	Thousand acres	Thousand cords	Thousand acres	Thousand cords
Aroostook	712	1,621	1,716	17,194	1,426	30,061
Penobscot	364	829	877	8,792	729	15,370
Piscataquis	428	975	1,033	10,345	858	18,085
Somerset	472	1,064	956	9,540	727	15,586
Oxford-Franklin	547	1,129	833	8,364	607	13,576
Washington-Hancock	566	1,509	1,136	12,051	630	13,348
York-Cumberland-Androscoggin	446	871	474	4,768	288	7,036
Sagadahoc-Kennebec-Lincoln-Knox-Waldo	468	1,071	603	5,893	273	6,403
All counties	4,003	9,069	7,628	76,947	5,538	119,465

Table 31.--Pulpwood and sawlogs harvested, by county and species groups, Maine, 1958

Counties and county groups	Pulpwood*			Sawlogs (for lumber)		
	Softwoods	Hardwoods	Total.	Softwoods	Hardwoods	Total
	Thousand rough cords			Million board-feet		
Aroostook	350	4	354	78	9	87
Penobscot	155	52	207	35	13	48
Piscataquis	152	7	159	10	5	15
Somerset	191	23	214	24	6	30
Oxford-Franklin	159	148	307	54	33	87
Washington-Hancock	190	11	201	27	4	31
York-Cumberland-Androscoggin	52	64	116	65	7	72
Sagadahoc-Kennebec-Lincoln-Knox-Waldo	94	36	130	47	7	54
All counties	1,343	345	1,688	340	84	424

* Includes chips, equivalent to 35,255 cords (all except 246 cords are from softwoods). Source: Maine Forest Service, Report of Timber Processed. County breakdowns based on general location of harvesting operations.

(Continued from page 44.)

combination. In Maine it includes the red maple and ash-elm-maple types.

Maple-beech-birch. — Forests in which 50 percent or more of the stand is sugar. maple, beech, or yellow birch, singly or in combination. In Maine, it includes the sugar maple - beech - yellow birch, hardwood - spruce - fir, and hardwood - white pine types.

Aspen-birch. — Forests in which 50 percent or more of the stand is aspen, paper birch, or gray birch, singly or in combination. In Maine it includes the aspen, gray birch-pin cherry, and paper birch types.

Class of Timber

Sawtimber trees.—Trees of commercial species that: (a) are of the following minimum diameters at breast height — softwoods 9.0 inches and hardwoods 11.0 inches; (b) contain at least one merchantable sawlog; and (c) contain at least 50 percent sound volume in the sawlog portion of the tree. (A merchantable sawlog is a portion of a live tree that meets the minimum log-grade specifications, as defined under log-grade classification. The sawlog portion is that part of the tree between stump and the top of the last merchantable sawlog.)

Poletimber *trees.* — Trees of commercial species that meet regional specifications of soundness and form, and 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 or rot, or because they are of undesirable species.

Hardwood limbs.—Limbs of hardwood sawtimber trees and sawtimber-size cull hardwood trees to a minimum diameter of 4.0 inches inside bark.

Pulpwood trees. — Live trees of commercial species, 5.0 inches d.b.h. and larger, including sawtimber, poletimber, and even cull trees that contain at least two contiguous pulpwood bolts and of which 50 percent or more of the main-stem volume is usable for pulpwood.

Stand-Size Classes

Sawtimber stands. — Stands with sawtimber trees having a minimum net volume per acre of 1,500 board-feet, International 1/4-inch rule.

Poletimber stands.—Stands that fail to meet the sawtimber stand specification, but that are at least 10 percent stocked with poletimber and larger trees (5.0 inches d.b.h. and larger), and have at least one-half 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 one-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; areas less than 10 percent stocked with trees of commercial species.

Timber Volume

Growing stock.—Net volume, in cubic feet, of live sawtimber trees and live poletimber trees from stump to a minimum 4-inch top (of central stem) inside bark. Net volume = gross volume less deduction for rot.

Live sawtimber volume. — Net volume in board-feet, International 1/4-inch rule, of merchantable sawlogs in live sawtimber trees of commercial species. Net volume = gross volume in terms of the International 1/4-inch rule less deductions for rot, sweep, and other defects affecting use for lumber.

Pulpwood volume. — Net volume in standard cords (including bark) of all trees that meet pulpwood tree specifications, regardless of whether or not these trees also meet sawtimber specifications. It includes the main stem from the stump to the point where the top breaks up into branches, or to a minimum top diameter of 4.0 inches (inside bark). Deductions are made for all portions of the stem that fail to meet pulpwood bolt requirements. The standard cord is a unit of measure for stacked wood, encompassing 128 cubic feet of wood, bark, and air space. Cord estimates are derived from cubic-foot measurements by applying a factor of 80 cubic feet of wood (inside bark) per rough cord

Product Specifications

The product specifications used in the forest survey for hardwood lumber logs, hardwood tie and timber logs, and white pine lumber logs are detailed in the following figures.

Pulpwood bolts. — ***A*** pulpwood bolt is a 4-foot section of the main stem of any commercial species tree 5.0 inches d.b.h. and larger; 4.0 inches or larger inside bark at the small end; free from any indication of rot, charred wood, metal, or hollow center; and contiguous to one or more other bolts that meet the same requirements. Crotches are excluded; sweep or crook in any section shall exclude the bolt if a line from center of top cut to center of bottom cut passes outside the wood at any point.

Annual Growth and Cut

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

Ingrowth of sawtimber. — **The *net*** board-foot volume of trees that first became sawtimber trees during the inventory year as measured at the end of the year.

Annual mortality of sawtimber. — The net board-foot volume removed yearly from live sawtimber on commercial forest land through death from natural causes.

Net annual growth of growing stock. —The yearly change (resulting from natural causes) in net cubic-foot volume of growing stock on commercial forest land.

Ingrowth ***of growing stock.*** — The total net cubic-foot volume of trees that first become a part of growing stock during the inventory year as measured at the end of the year.

Annual mortality of growing stock. — The net cubic-foot volume removed from growing stock during a year through death from natural causes.

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

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

FOREST SURVEY METHODS

Our estimates of forest area, timber volume, and growth are based upon information obtained from aerial photographs and from sample plots examined

HARDWOOD LUMBER LOGS

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)	[1]13-15	16-19	20+	[2]11	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 (feet)	7	5	3	3	3	3	3	2
Clear cuttings** on each of the 3 best faces — Max. number	2	2	2	2	2	2	3	--
Clear cuttings** on each of the 3 best faces — 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)	[3]40			[4]50				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. 01737.

"**" 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 51-60 percent cull can be No. 2.

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

Grade standards used for hardwood lumber logs in the forest survey of Maine.

on the ground. First, photo-interpretation plots were marked off on aerial photographs. These plots were distributed uniformly by mechanical means over photographs of the entire State. Each photo plot was then classified as either forest or non-forest. Forest plots were classified further according to volume class and broad forest type.

Field crews then inspected some of the photo plots on the ground. Enough plots were selected at random to attain specified levels of statistical accuracy. Species

TIE AND TIMBER LOGS

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.

The standards used for hardwood tie and timber logs in the forest survey of Maine.

and volume data were collected on these ground plots; and the classification of stand size was verified.

Growth was computed from measurements of radial growth on selected trees; these measurements were applied to the estimated number of trees by species and diameter class in the timber inventory. Radial growth was measured on increment cores extracted from sample trees. The final estimate was of average annual periodic net growth at the time the inventory was made.

Estimates of timber cut in Maine were based on production surveys made in co-

WHITE PINE LOG GRADES

GRADE	DIAMETER inside bark, small end (inches)	LENGTH without trim (feet)	TOTAL DEDUCTION PERMITTED[1] (percent)	SURFACE REQUIREMENTS
1	13+	8	0	Surface clear 100%
	13-16	12-16	25	Must be 2/3 surface-clear in lengths 8 feet long or longer or 50% surface-clear full length.
	17+	10-16	30	Must be 1/2 surface-clear in lengths 8 feet long or longer or 25% surface-clear full length.
2	9-16	10-16	30	Permits sound, tight knots not over 2% inches in diameter. Larger, sound, tight knots permitted only if 50% of full-length surface has no sound, tight knots larger than 2 inches in diameter.
	17+	8-16	40	Permits sound, tight knots not over 3 inches in diameter. Larger, sound, tight knots permitted only if 50% of full-length surface has no sound, tight knots larger than 2½ inches in diameter.
3	6-7	8-16	25	Permits sound knots not over 1 inch in diameter or live knots not over 2 inches in diameter.
	8-13	8-16	30	No surface requirements except logs with knots 4 inches or more in diameter in whorls less than 2 feet apart will not be accepted unless 15% or more of full length surface has no sound knots over 2 inches in diameter.
	14+	8-16	40	No surface requirements except that knots over 6 inches in diameter cannot be closer than 3 feet.

[1] Includes sweep, rot, and other cull.

The grade standards used for white pine logs in the forest survey of Maine.

operation with the Maine Forest Service and wood-utilization studies conducted by the Northeastern Forest Experiment Station. The production surveys yielded estimates of the output of all timber products. From studies conducted on all types of logging operations, estimates of logging residues were developed, which, when added to the volume of timber products, gave estimates of timber cut.

RELIABILITY OF THE ESTIMATES

The forest-area and timber-volume data presented in this report are based on a carefully designed sample of forest conditions throughout Maine. However, since not every tree in the State was measured, the figures in this report are estimates. A measure of the reliability of these estimates is given by the statistical "sampling error." Each estimate in this report has a sampling error, although not all of them have been computed.

Briefly, here is the way the sampling error indicates reliability. Our report of the total commercial forest area in Maine as 17,169,000 acres, has an associated sampling error of 0.4 percent (69,000 acres). This means that our best estimate of the commercial forest area in Maine is 17,169,000 acres. And if there are no errors in procedure the odds are 2 to 1 that if we repeated the survey, the new estimate of commercial forest area would be between 17,100,000 and 17,238,000 acres (17,169,000 $\pm$ 69,000). Similarly, the odds are 19 to 1 that it would be within 2 $\times$ 69,000 acres of the present estimate, and 300 to 1 that it would be within 207,000 acres of the present estimate.

Sampling errors for the various commercial-forest area and all-species inventory estimates in this report can be derived from the following tabulations. Sampling errors are somewhat higher for species, diameter, and other breakdowns of total volume or area.

Commercial forest area (thousand acres)	*Approximate sampling error (percent)*
17,169	0.4*
10,000	.5
5,000	.7
3,000	.9
2,000	1.2
1,000	1.6*
750	1.9
500	2.3
250	3.2
125	4.5

Sawtimber inventory (million bd.-ft.)	*Approximate sampling error (percent)*
30,443	2.4*
11,000	3.4
10,000	4.1
5,000	5.8
4,000	6.5
3,000	7.5
2,000	9.1
1,000	12.8
750	14.8
500	18.0

Pulpwood inventory (million cords)	*Approximate sampling error (percent)*
205.5	1.4*
100.	2.0
50.	2.8
25.	3.9
20.	4.4
15.	5.1
10.	6.0
7.5	7.1
5.0	8.7
2.5	12.2

*Computed sampling errors; others are estimated.

Another use of reliability information is when one wishes to know, with some specified degree of confidence, that the volume of timber in an area is "at least" so much. For example, the best survey estimate of the net volume of sawtimber in Maine is 30,443 million board-feet (sampling error for this statistic = 2.4 percent = 731 million board-feet). If there are no errors in procedure, the chances are 5 to 1 that if we conducted a similar inventory, the estimate we would obtain would be "at least" 29,712 million board-feet (30,443 minus 731) and 39 to 1 that it would be at least 28,981 million board-feet (30,443 minus 1,462).

Actually, even 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 the volume tables and errors in field measurements. However, the best volume tables available were used, and procedural errors were kept to a minimum by careful training of all personnel, frequent inspection of field work, and application of the most reliable survey methods.

SPECIES TALLIED

Only the tree species[7] found on forest survey sample plots in Maine are listed below. Other species that are found in Maine are not included.

SOFTWOODS

Spruce:	
Red spruce	*Picea rubens*
White spruce	*Picea glauca*
Black spruce	*Picea mariana*
White pine:	
Eastern white pine	*Pinus strobus*
Red pine	*Pinus resinosa*
Balsam fir	*Abies balsamea*
Northern white-cedar	*Thuja occidentalis*
Eastern hemlock	*Tsuga canadensis*
Other eastern softwoods:	
Pitch pine	*Pinus rigida*
Jack pine	*Pinus banksiana*
Tamarack	*Larix laricina*

SOFT HARDWOODS

Red maple:	
Red maple	*Acer rubrum*
Silver maple	*Acer saccharinum*
Paper birch	*Betula papyrifera*
Aspen:	
Bigtooth aspen	*Populus grandidentata*
Quaking aspen	*Populus tremuloides*
Other soft hardwoods:	
Black ash	*Fraxinus nigra*
American basswood	*Tilia americana*
Elm	*Ulmus* species
Black cherry	*Prunus serotina*
Balsam poplar	*Populus balsamifera*
Balsam poplar (Balm-of-Gilead)	*Populus balsamifera,* var. *balsamifera*

HARD HARDWOODS

Sugar maple	*Acer saccharum*
Yellow birch	*Betula alleghaniensis*
American beech	*Fagus grandifolia*
Ash:	
White ash	*Fraxinus americana*
Green ash	*Fraxinus pennsylvanica*
Northern red oak	*Quercus rubra*
Other hard hardwoods:	
White oak	*Quercus alba*
Hickory	*Carya* species

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

ACKNOWLEDGMENTS

MANY individuals and agencies contributed to the forest survey of Maine. The Maine Forest Service loaned aerial photographs for areas not already covered by suitable photography; and provided office space and quarters for forest-survey crews, airplane travel to otherwise inaccessible areas, financial assistance, information on forest-land ownership, and information on output of timber products.

The State of Maine Bureau of Taxation lent aerial photographs for a large part of Aroostook County. The Maine Public Service Company provided field quarters and house-trailer space for the forest-survey crews. The J. W. Sewall Company, forestry consultants, gave valuable help and advice.

The Forest Industries in Maine also were very cooperative. Some companies lent aerial photographs for a large part of the State. These companies are: Eastern Corporation (now Standard Packaging Corporation), Great Northern Paper Company, International Paper Company, Oxford Paper Company, Penobscot Development Company, Scott Paper Company, and S. D. Warren Company. Some companies—Eastern Corporation (Standard Packaging Corporation), Penobscot Development Company, Prentiss & Carlisle Company, and St. Regis Paper Company—remeasured forest-survey plots in Hancock County to bring the forest statistics up to date.

All this assistance is gratefully acknowledged.

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