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Ohio's Forests and Wood-Using Industries

O. Keith Hutchison
James T. Morgan

CENTRAL STATES FOREST EXPERIMENT STATION

Columbus, Ohio - W. G. McGinnies, Director

FOREST SERVICE
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DEPARTMENT OF AGRICULTURE

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Supervision and planning—R. K. Winters, R. N. Cunningham, J. T. Morgan.

Photo interpretation—K. E. Moessner, C. E. Jensen, P. L. Thornton.

Field work—M. E. Becker, K. L. Quigley, P. L. Thornton, R. A. Whitmore, W. B. Metcalf, J. D. Burton, A. R. Eschner, R. A. Harmon, E. F. Youngblood, W. R. Anderson, R. Hicks, E. F. Van Ohlsen, J. H. Richardson, I. Wade, K. Ching, J. Watson, A. Steelman, C. Nashland, W. D. Giffen, G. Kennedy, R. Moore, A. C. Morley, F. F. Staat, J. R. Seward.

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Ohio's Forests

and

Wood-Using Industries

by

O. KEITH HUTCHISON, *Forest Economist*
Central States Forest Experiment Station

and

JAMES T. MORGAN, *Forester*
Lake States Forest Experiment Station

UNITED STATES DEPARTMENT OF AGRICULTURE • FOREST SERVICE

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Preface

THIS REPORT presents the results of a survey of the forests in Ohio, as a part of the national survey of forest resources. The purpose of this survey is: (1) to make a field inventory of the present supply of standing timber, (2) to find out how fast this supply is being increased through growth, (3) to find out how much it is being diminished through industrial and domestic uses, fire, insects, disease, and other causes, (4) to determine the present consumption of forest products, and (5) to interpret and correlate these findings to aid in the formulation of private and public forest policies.

The estimates of forest area, timber volume, and growth reported here are higher than previous estimates indicated. Moreover, the statistics that follow show that Ohio timber stands are now growing faster than they are being cut.

The differences are partly due to inclusion of more lightly forested areas in the recent survey. Standards of merchantability have changed to include material that would not have been harvested 10 or 15 years ago. The differences also reflect the tree planting and the actual increase in timber volume during the period. Because of the changing standards this increase cannot be accurately measured.

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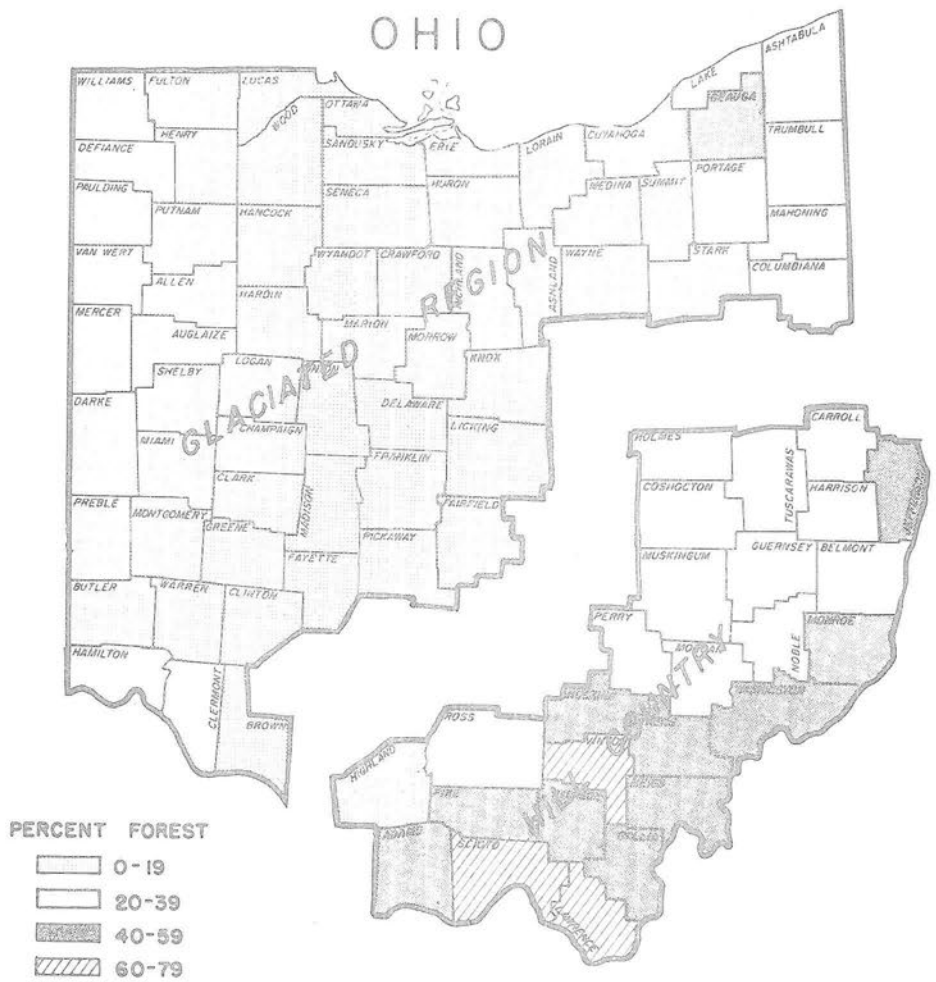


FIGURE 1—*The two geographic regions of Ohio and the percent of forest land by county.*

The Background

The pioneer settlers arriving at Marietta, Ohio in 1788 found 95 percent of the land in forest (1), heavily stocked with choice hardwood timber. But the settlers were farmers and the forests had to be cleared for cropland. Throughout the 19th century and well into the 20th, farmers hacked away at the woods until forest area reached its low ebb.

Almost from the beginning, the process began reversing itself. As the people along the Ohio River moved to the more productive land to the north, cleared fields reverted to forest. Iron smelting boomed, then declined, leaving areas cut for charcoal wood to return to tree cover. In the 1900's, as the conservation movement gained force, changing farm practices combined with tree planting and the beginnings of forest management began to restore some of the forest resources that had been removed. This change is still going on. We have no records to show the dip and rise of Ohio's forest resources, but the survey reported here shows that the volume of wood growing in Ohio is increasing. But before getting into a discussion of the forests, let's take a look at the background—the land and its resources—and see how forests and forestry fit into the general picture.

Geographically, Ohio is divided into two broad regions, separated by a line marking the southermost advance of glacial ice (fig. 1).

The unglaciated region, occupying the southeastern one-third of the State, is hilly, almost rugged in places, and contains most of the State's forest land;[1] the northern and western two-thirds of the State is glaciated land —rolling farming country, sparsely peppered with small woodlands.

The Hill Country

The Hill Country is probably best known for its mineral deposits, ceramic industries, its old iron furnaces (fig. 2), Indian mounds, and many recreation areas. It contains part of the Wayne-Hoosier National Forest; the Shawnee, Zaleski, Tar Hollow, and several other State forests; and most of the Muskingum Conservancy District. The residual soils of this region, derived from limestone, sandstone, and shale, are fairly rich agriculturally and are cultivated wherever the land is level enough. Successful farming, however, is mostly restricted to the flat ridgetops and valley floors. Underlying both farmed and timbered areas are deposits of coal, clay, limestone, sandstone, and some oil and gas.

FIGURE 2 — *Typical old iron smelter. Large areas were clear-cut around the middle of the 19th century to furnish charcoal for these furnaces.*

Much of the coal can be strip-mined, which creates problems in restoring cover to the land (fig. 3). Iron ore was mined during the 19th century but now only a few relic furnaces remain as reminders of this early industry. The furnaces were operated with charcoal made from surrounding timber. The areas cut for charcoal are now covered by stands that are even-aged and of sprout origin. These stands are of interest to foresters because they indicate what to expect when hardwood stands are clear-cut.

Although agriculture and mineral industries are the backbone of the economy in the Hill Country, the forests contribute in many ways and are becoming more and more important. Hundreds of sawmills operate in this region and several paper mills get part of their

[1]For definitions of forest survey terms used in this report see page 27.

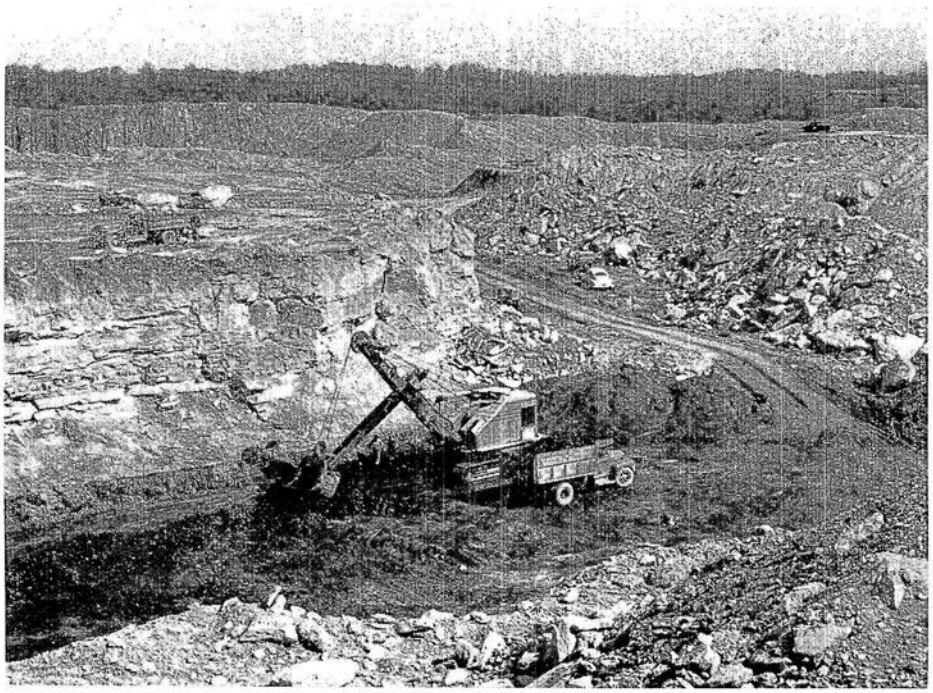


FIGURE 3 — *Strip-mining completely destroys plant cover on the affected land. However, most such areas are reclaimed by planting trees.*

pulpwood supply here. Because of the rough topography, forest and soil conservation activities are important in the lives of the people. Thus we find old fields being restored to new productivity by planting trees, dams being built to control water, and forests being developed around the new lakes for water-runoff and erosion control and to provide attractive recreation areas and a stable resource for new industries.

The Glaciated Region

The Glaciated Region coincides generally with what is commonly known as the Ohio Cornbelt and the Dairy Region. This includes a large share of the State's level to rolling glaciated land. Farming and manufacturing are the main activities. Forests are largely confined to "back forties" and the banks of streams—places that are too rough or too wet to farm or that the owner has not got around to clearing (fig. 4). Heavy woodland grazing, harmful to the forests, is commonly practiced. Although markets exist in this region for high-quality logs, a certain amount of mature timber is kept from the market because it is in small lots or because of the owner's indifference or his desire to keep the trees.

In northeastern Ohio the topography becomes rougher from west to east, culminating in the Allegheny foothills. The tree species here are more typical of the northern forests and the stands often occur in deep gorges and on swampy uplands. The forests of this area are best known as a source of maple syrup. Maple products are a traditional and lucrative sideline on many farms (fig. 5). Management favors the larger trees as the best sap producers at the expense of younger growing stock, with the result that many stands contain no reserve stocking for the future.

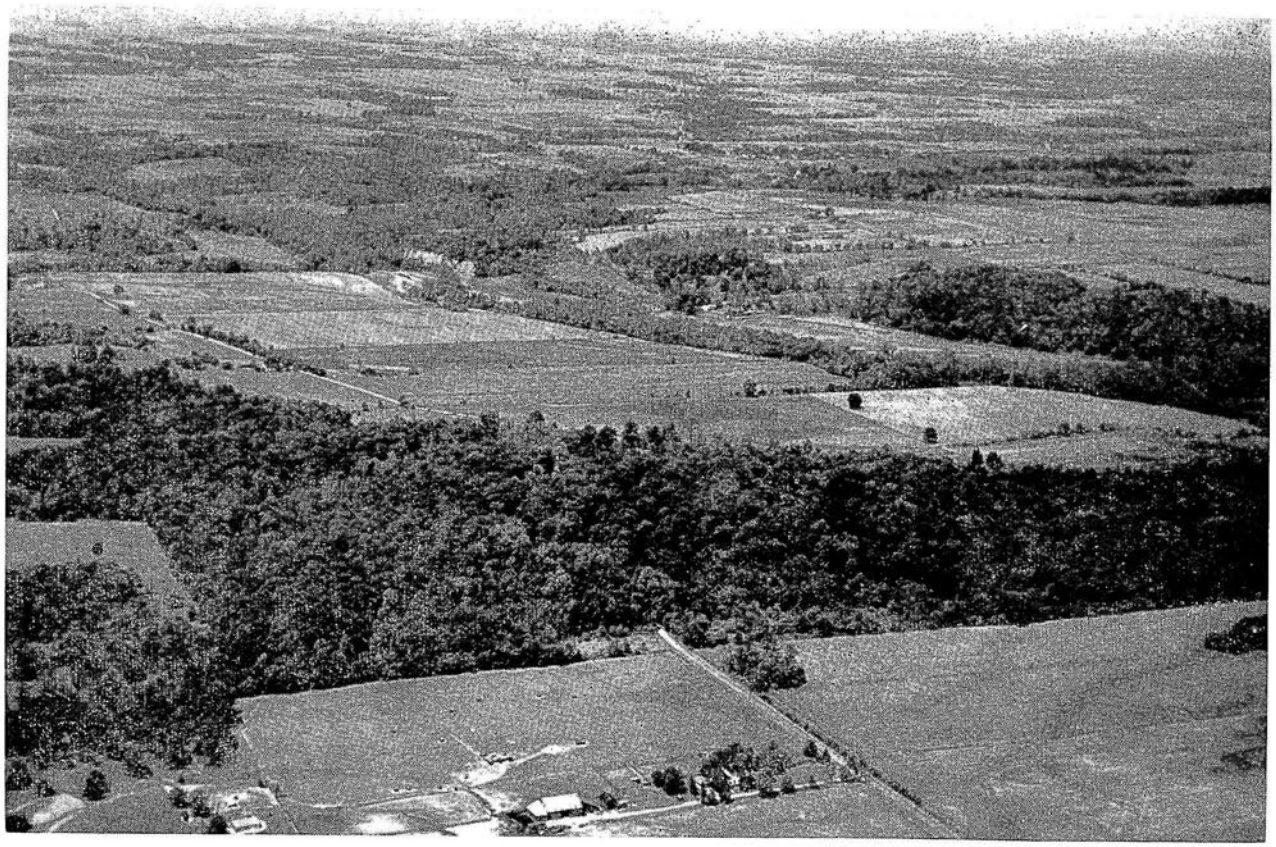


FIGURE 4 — *Forests in the Glaciated Region are scattered in small patches. (Courtesy of Ohio Division of Forestry.)*

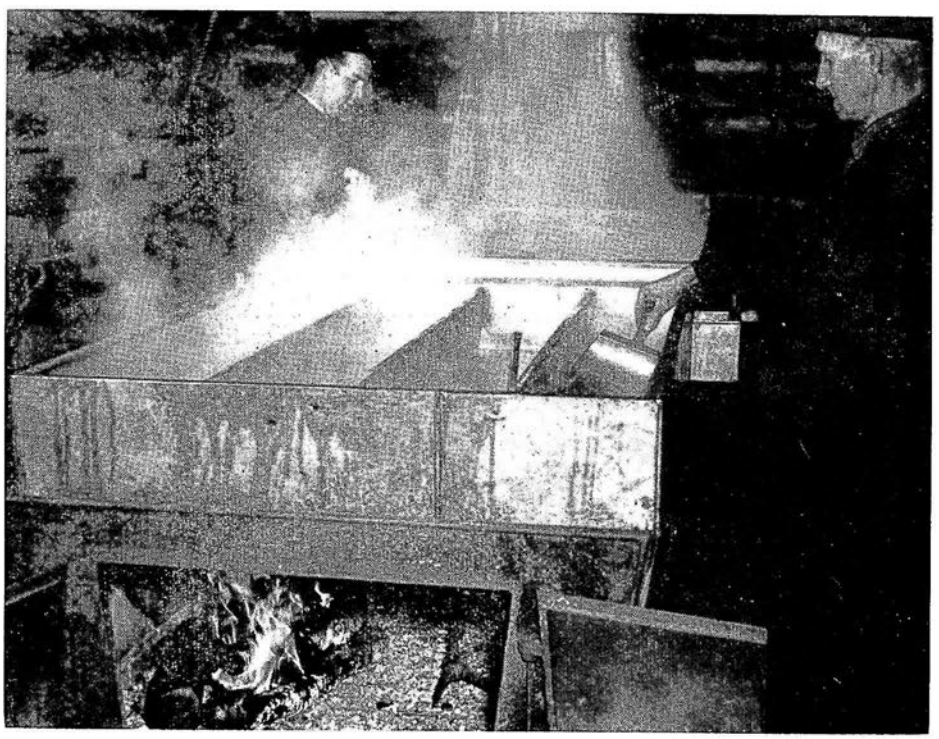


FIGURE 5 — *Boiling maple sap to make syrup at a small operation in northeastern Ohio. In 1949 Ohio produced maple syrup and sugar worth one-half million dollars. (Courtesy of Ohio Division of Forestry.)*

The Forest Land

Ohio has 5,396,000 acres of commercial forest land. In addition there are 50,000 acres of productive forest land reserved from timber cutting and therefore classed as noncommercial. Although the Hill Country covers less than one-third of the total land area, it has most of the State's forest land. The larger, Glaciated Region contains only two-fifths of the forest land.

Less than half of the commercial forest land is classed as sawtimber—stands that contain at least 1,500 board-feet per acre. The rest is in stands dominated by trees less than 10 inches in diameter. About 1.6 million acres are in large sawtimber, that is, stands with at least half their board-foot volume in trees 15 inches in diameter (measure at breast height, 4½ feet above the ground) or larger. Many of the trees in these large sawtimber stands are mature and contain high-quality logs. However, 60 percent of the large sawtimber volume is in the Glaciated Region where the forest areas are scattered and small, making it difficult to market timber economically (fig. 6).

Ownership

Treatment of forest land is determined to a large extent by type and size of ownership. For the most part, public forest holdings in Ohio are in large enough tracts to furnish commercially important amounts of wood in individual sales. The portion of the Wayne-Hoosier National Forest located in the Hill Country of Ohio contains 88,000 acres of forest land. The State of Ohio owns 169,000 acres of forest land, most of which is in the Hill Country in State forests. County, municipal, and other local governments own about 40,000 acres of forest land scattered throughout the State.

Ninety-five percent of the commercial forest land is privately owned (fig. 7). Farmers own about 3 million acres and coal, lumber, industrial, and other private owners own about 2 million.

In the 1950 Census of Agriculture, more than 119,000 farms reported owning woodland (8). The average woodland area per farm was 26 acres but most of the farms had less than this (table 1). The small size is a deterrent to management as a commercial enterprise. Small tracts are adequate, however, for supplying the farmer with lumber, posts, poles, fuelwood, and other usable products. Currently only a few farm woodland owners are using their forest land to good advantage.

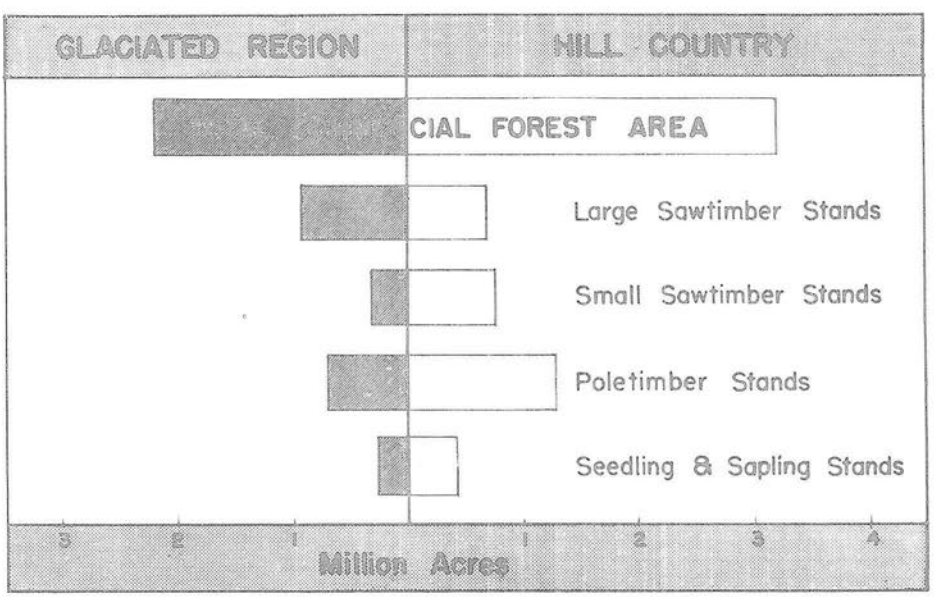


FIGURE 6 — *Forest area by geographic region and stand-size.*

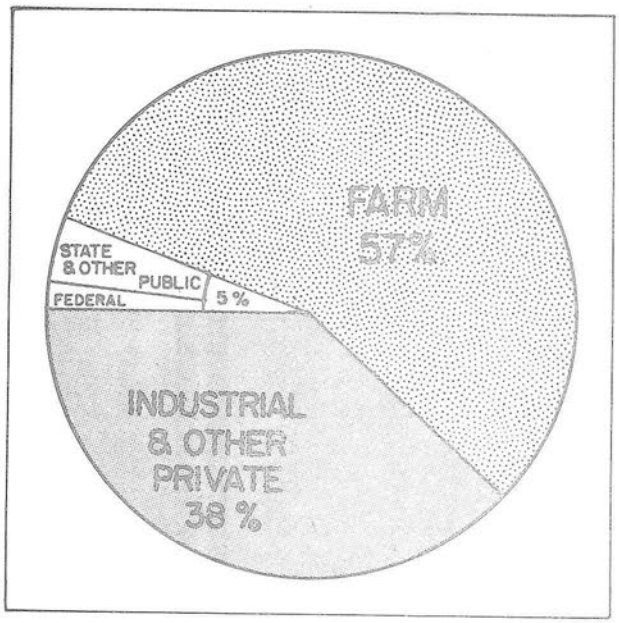


FIGURE 7 — *Ownership of commercial forest land.*

TABLE 1 — *Number of farms with woodland by farm size*[1], *Ohio*

Farm size	Farms	Woodland	Woodland per farm
acres	*number*	*acres*	*acres*
Less than 10	1,386	4,032	2.9
10 - 29	7,241	53,285	7.4
30 - 49	9,093	107,655	11.8
50 - 69	11,132	160,780	14.4
70 - 99	22,689	383,249	16.9
100 - 139	24,313	538,697	22.2
140 - 179	17,652	495,996	28.1
180 - 219	9,534	329,107	34.5
220 - 259	5,936	252,380	42.5
260 - 499	8,665	512,509	59.1
500 - 999	1,319	170,133	129.0
1000 plus	161	51,862	322.1
Total	119,121	3,059,685	25.7

[1]Compiled from 1950 Census of Agriculture.

Forest Types

The forest survey classified the forest land in the Central States into 8 different forest types, according to the species that were growing in a particular stand at the time of survey and regardless of how the composition had been influenced by artificial or catastrophic means (fig. 8). These types show the interrelationship of species such as oak-hickory, elm-ash-cottonwood, and so on.

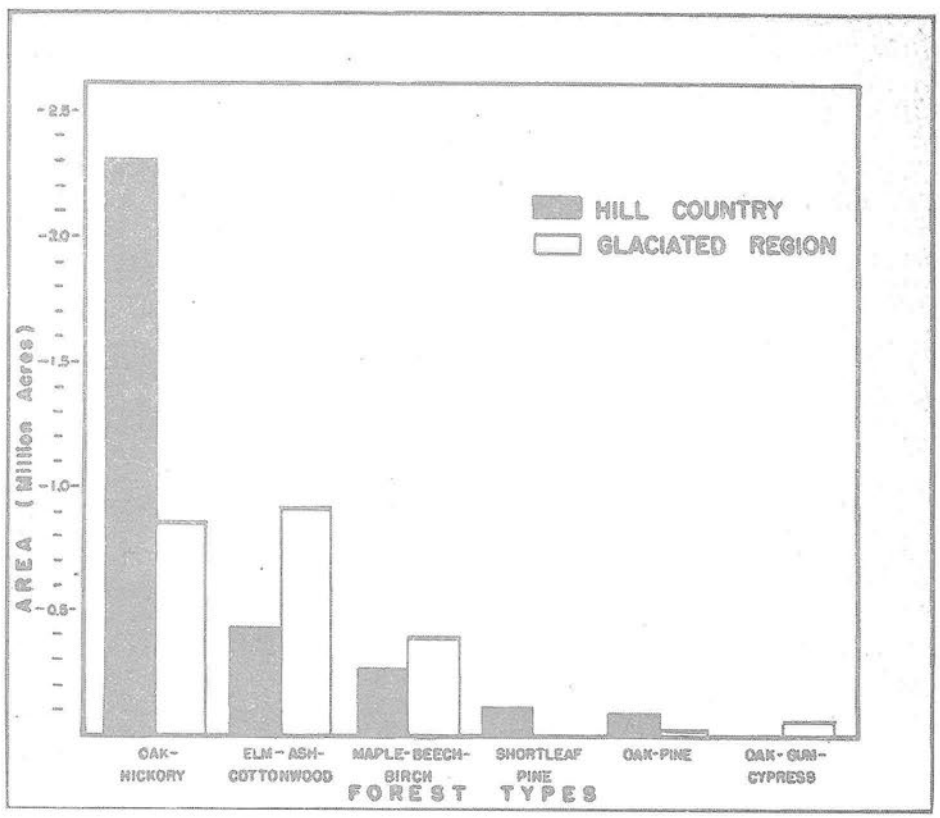


FIGURE 8 — *Forest area by forest type and region.*

Oak-hickory — In general this large and important type is found on upland sites and on less fertile soils than most of the other types (fig. 9). It includes several subtypes or associated types that are minor in area though not in importance. Two such are the white oak and yellow-poplar types.

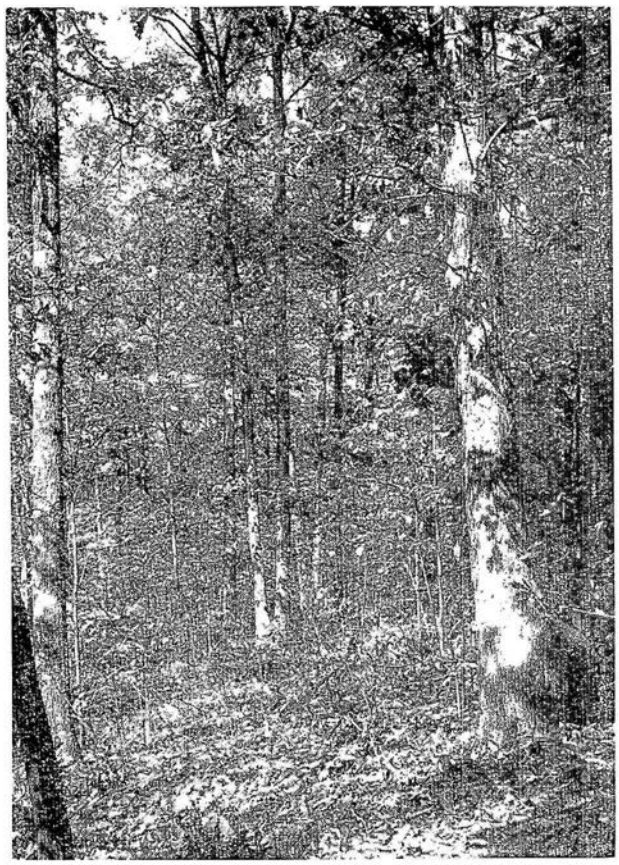


FIGURE 9 — *Much of the area cleared for charcoal for the iron smelters grew back into forests like this one. Most of the trees developed from sprouts and many of them are defective.*

Elm-ash-cottonwood — This type is found primarily along streams and on poorly drained flats. More than 900,000 acres of this type are found in the Glaciated Region. American elm and green ash are the predominant species. Cottonwoods, soft maples, sycamore, and swamp white oak occur commonly as associates.

Maple-beech-birch—There is very little yellow birch in Ohio but some commercially important stands of sugar maple and beech are found, especially in the northeast (fig. 10). Sugar maple is the chief component of the type and the maple syrup industry is prominent in this area. In many places this type has developed into a residual stand of nearly pure sugar maple as the associated species were cut and the sugar maple trees were maintained for "sugar bush."

Shortleaf pine and oak-pine—The shortleaf pine type is found only in the Hill Country as is most of the oak-pine type. These types occur mainly on dry ridgetops and the important pines in the types are shortleaf and Virginia. The pine types are increasing in importance in Ohio because so much pine is being planted each year and also because preliminary investigations indicate that it is feasible and probably profitable to convert dry ridgetops of the Hill Country from the present poor oak stands to natural stands of shortleaf pine.

Oak-gum, white-red pine, and aspen-birch—The oak-gum type is made up largely of pin-oak flats found in southwestern Ohio on poorly drained sites. The white-red pine type is made up almost entirely of plantations, and the aspen-birch type is mostly aspen found growing along the streams of the Hill Country.

Stocking

The forests of Ohio are generally understocked—that is, they are not growing nearly as much timber as they are capable of.

Research has not yet determined how much volume stands in Ohio must have under various conditions to obtain maximum yield. However, some of the better stands in the State can serve as examples of stocking goals we might aim for until better information is available. Well-stocked sawtimber stands sampled in the Glaciated Region averaged 8,900 board-feet as compared with about 2,600 board-feet for the average sawtimber stand.

One of the things that influences stocking is grazing. As commonly practiced in hardwood forests, livestock grazing decreases timber growth by killing tree reproduction. Cull is increased in the surviving trees, roots are exposed to trampling, and the soil becomes compacted thereby increasing water runoff, and destroying ground litter and humus (fig. 11). The degree of damage of course depends upon the intensity of grazing. The forest survey found that 10 percent of all forest land is being heavily grazed—grazed to such a degree that if continued the forest cover will eventually be eliminated. Destructive woodland grazing is more prevalent in the Glaciated Region where small, fenced farm woodlands predominate and livestock production is an important industry. Here 16 percent of the forest land is heavily grazed.

FIGURE 10 — *A stand of maple and beech in northeastern Ohio. The maple is being tapped for sap; beech is an unwanted species in the stand. (Courtesy of Ohio Division of Forestry.)*

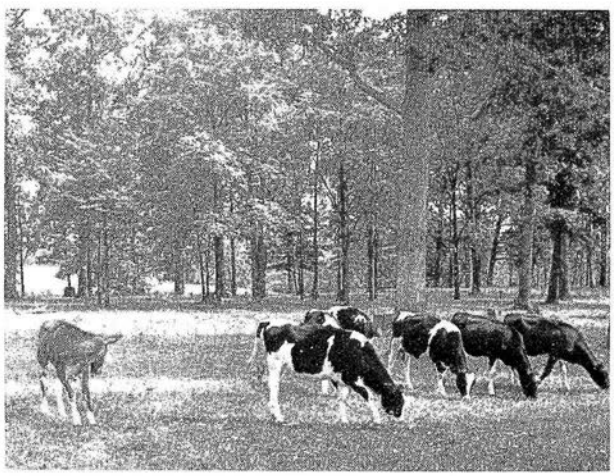


FIGURE 11 — *Notice the lack of seedlings and small trees in the heavily grazed woods. (Courtesy of Ohio Division of Forestry.)*

Site Quality

The ability of forest land to produce timber is called "site quality." This ability is influenced by such things as soil, topography, climate, elevation, and exposure. It is expressed as the number of logs a mature, dominant tree would yield on a given site. About 1 percent of the forest area of Ohio is capable of producing hardwood trees averaging four 16-foot logs: About 40 percent is capable of producing 3-log trees; 57 percent of the area can produce trees averaging two logs; and about 2 percent will average only one log. Apparently the best growing sites are in the Glaciated Region, which has 54 percent of the 3-log and 74 percent of the 4-log producing area.

These site classifications are conservative because the dominant trees now growing in the area were used as site indicators. Areas that had been cut a number of times have nothing left but the shorter, more poorly formed trees. With better management, these areas can produce better trees than they do now. On the other hand, use of land for cultivated crops before returning it to timber, repeated burning, and grazing may have resulted in poorer site conditions now than existed in the virgin forest.

Timber Volume

Sawtimber

Ohio has 14.4 billion board-feet of sawtimber. This is an average of more than 2,600 board-feet per acre—almost as much as found in any State of the Central States Region. However, it is only one-third to one-half as much volume as the land would support with intensive management and protection.

Ninety-eight percent of the sawlog volume is in hardwood species but many softwood plantations are just reaching sawtimber size, and will increase greatly in board-foot volume during the next few years. More pine and other softwoods are being planted every year.

In the Glaciated Region, farms and industries provide enough work and income so that few people depend upon the forest for their livelihood. Consequently the stands are not cut as often as those in the Hill Country, which average nearly one thousand board-feet per acre less than those in the Glaciated Region.

By Species

Thirty-eight percent of the sawtimber is oak, chiefly white oak, northern red oak, and black oak. Soft hardwoods—elm, yellow-poplar, soft maple, sycamore, cottonwood, gum, and others—make up more than 25 percent of the sawtimber volume. Hickory, ash, hard maple, and beech comprise another 25 percent, and miscellaneous species account for the remainder.

Climate and site have greatly influenced present species distribution. For example, 95 percent of the pine and chestnut oak is found in the Hill Country. Both of these species predominate on the poorer sites, usually dry upland areas. Most of the yellow-poplar is found in the Hill Country where it reaches its best growth in the moist cove sites. Species that predominate in the Glaciated Region include cottonwood, American elm, ash, sugar maple, and sycamore.

Cutting practices have also influenced stand composition. Sugar maple predominates in many stands of northeastern Ohio because it is so often saved for sap production.

Steel mills of the Mahoning Valley provide a ready market for car blocking—short timbers used to hold heavy steel pieces on railroad cars. While this market gives the sawmill operator a profit from cutting poletimber trees—trees that would not be cut as sawlogs elsewhere in the State—the result is that many stands are nearly clear-cut. In other areas of the Glaciated Region, American elm often predominates because it was not wanted during past harvesting operations. Throughout the State beech is often more prevalent today than it was in the past because it was not wanted by early loggers.

By Diameter Class

Thirty-eight percent of the board-foot volume is in sawtimber trees 14 inches in diameter or smaller. Generally, it will pay the owner to save the thrifty, well-formed trees in these small size classes to grow a future crop of high-quality logs. Twenty-eight percent of the sawtimber volume is in the 16-and-18-inch-diameter trees—trees that have just reached the minimum diameter required by some users of quality logs and are now adding quality growth. In fact, the annual diameter growth of these trees is usually greater than for smaller trees of the same species. The remaining 34 percent of the sawtimber volume, nearly 5 billion board-feet, is in the 20-inch-and-larger diameter classes. These trees are mature or reaching maturity and are generally ready for cutting. More than 60 percent of the volume of these large trees is in the Glaciated Region (fig. 12).

By Stand-size Class

Nearly 90 percent of the board-foot volume is in sawtimber stands. Large sawtimber stands, those that have at least half of the volume in trees 15 inches d.b.h. and larger, have 63 percent of the board-foot volume (fig. 13). These stands average about 6,000 board-feet in the Glaciated Region of Ohio and 5,400 board-feet in the Hill Country.

About 26 percent of the board-foot volume is in small sawtimber stands. Ten percent is in poletimber stands, and only 1 percent is in other stand-size classes. Small sawtimber stands average 3,444 board-feet per acre, while poletimber stands average 694 board-feet, and seedling and sapling, and nonstocked stands average 155 and 283 board-feet per acre, respectively.

Nearly 2 million acres of forest land support less than 500 board-feet per acre (fig. 14). Another 2 million acres support 2,000 or more board-feet per acre. Some 850 thousand acres support 5,000 board feet or more per acre. Most of the sawtimber volume occurs in stands heavy enough to be cut at a profit.

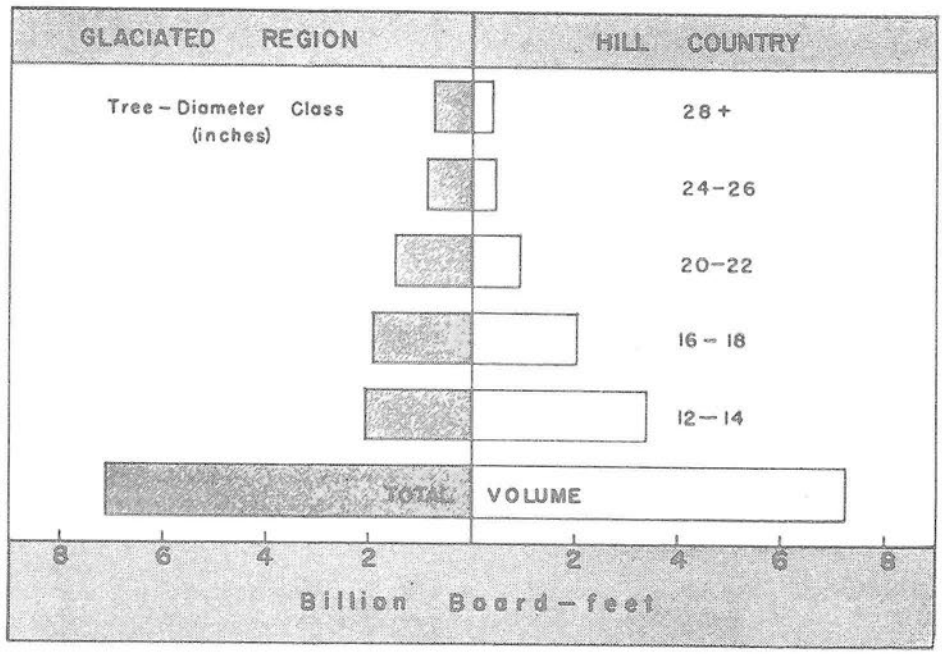


FIGURE 12 — *Distribution of sawtimber volume by geographic region and tree-diameter class.*

By Log Quality

Although Ohio produces some excellent hardwood timber, only 20 percent of the entire sawtimber volume is in the high-quality, grade 1 and 2 logs, which are in greatest demand for production of factory grades of lumber, veneer, cooperage, and so on. Eighty percent of the hardwood sawtimber volume is in grade 3 logs. These logs are generally cut into railroad ties, timbers, or local-use lumber. Such logs yield only about 20 percent of their volume in number 1 common or better lumber.

Past cutting practices, fire, and grazing are mainly responsible for the present low quality of the trees. Size is also important in determining tree quality. That is, trees 14 inches d.b.h. and smaller generally do not contain any high-quality volume because the logs are too small. High-quality logs generally come from good sites where growth is rapid, from fairly dense stands where straight stems and self pruning normally occur, and from stands that have not been damaged by grazing and repeated burning.

More than 75 percent of the high-quality volume now is in trees 18 inches d.b.h. and larger. Red and white oaks combined account for 36 percent of the high-quality volume. The Glaciated Region of Ohio has 56 percent of the high-quality volume and 56 percent of the volume in large sawtimber trees, indicating the relationship between log quality and tree size.

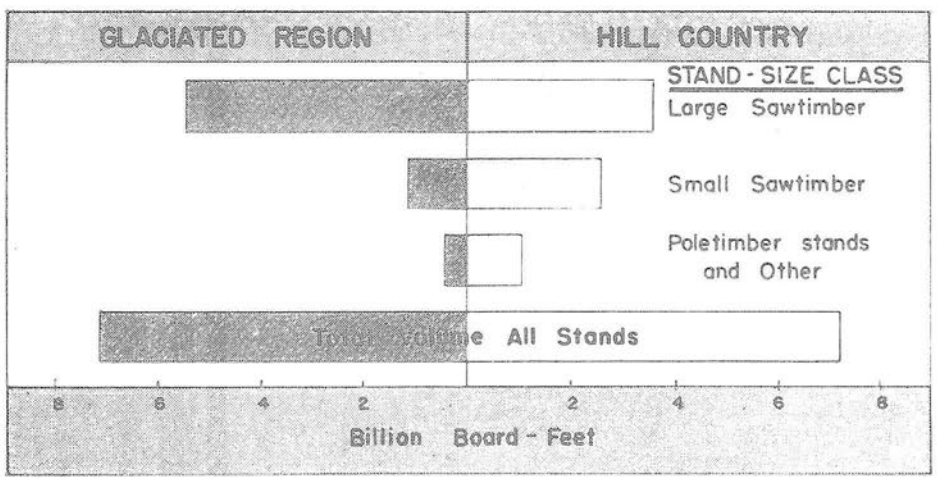


FIGURE 13 — *Sawtimber volume by geographic region and stand-size class.*

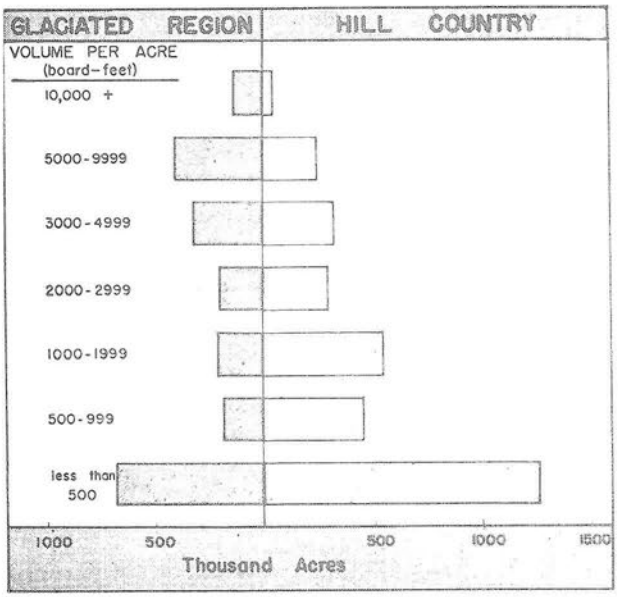


FIGURE 14 — *Forest area by geographic region and volume-per-acre class.*

Trees in the 12- and 14-inch diameter classes account for only 6 percent of the high-quality volume. Many of these 12- and 14-inch trees will improve in quality as they grow larger.

However, nearly 40 percent of the low-quality volume is in trees 18 inches d.b.h. and larger. Most of these trees will never improve in quality. It would be good management to cut these large, low-quality trees as soon as possible to increase the growth of the smaller, potentially high-quality trees.

Not included in the low-quality volume but certainly contributing to the low quality of stands is the large volume in cull trees (sawtimber trees were considered culls unless they were at least 50 percent sound; cull poles were those of such poor form and condition that they were not likely to grow into a merchantable sawtimber tree). The stands average 18 cull poletimber and sawtimber trees per acre. About 1 of every 6 sawtimber-size trees is a cull. Although cull trees are not considered merchantable, they are estimated to contain 438 million cubic feet of sound wood—about 81 cubic feet per forest acre. This wood is suitable for some uses, but the cost of harvesting it is usually too great to make it profitable.

Cubic-Foot Volume

All trees 5 inches d.b.h. and larger that are of good form, at least 50 percent sound, and of commercial species, are called "growing stock." The volume is measured in the central stem from the stump to a minimum top diameter of 4 inches inside the bark.

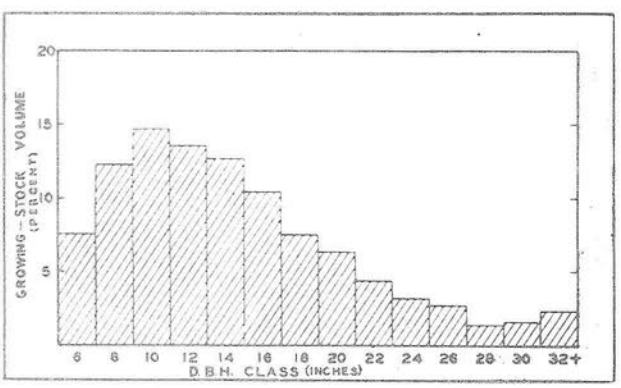
The total volume of growing stock is 3.9 billion cubic feet—722 cubic feet per acre.

The large sawtimber stands average about 1,200 cubic feet per acre and have 49 percent of the growing-stock volume. The small sawtimber stands average 1,000 cubic feet per acre with 29 percent of the growing stock. Poletimber stands average 405 cubic feet per acre and have 21 percent of the growing stock, leaving only 1 percent in the seedling and sapling and nonstocked stands.

Nearly 35 percent of the growing-stock volume is in poletimber trees. Twenty-six percent is small sawtimber, that is, trees 12 and 14 inches d.b.h. Eighteen percent is in 16- and 18-inch sawtimber and the remaining 21 percent is in trees 20 inches and larger in diameter. To obtain maximum growth, a larger percentage of the growing-stock volume is needed in 16- and 18-inch trees (fig. 15).

Including limbs and cull trees as well as the merchantable stems that are considered growing stock, the stands average about 971 cubic feet or about 15 cords of sound wood per acre in trees 5 inches and larger in diameter. Limbs alone average 168 cubic feet, about 2½ cords per acre. Cull trees without their limbs add more than one cord of sound wood per acre.

FIGURE 15 — *Distribution of growing-stock volume by tree-diameter (d.b.h.) class.*



Timber Growth and Mortality

Sawtimber Growth

The net growth of sawtimber in 1952 was 807 million board-feet. Seventy percent was growth on trees already of sawtimber size, 30 percent was "ingrowth." Ingrowth is the total board-foot volume of trees that grew to sawtimber size during the year. The net growth amounted to 5.6 percent of the sawtimber volume.

The total sawtimber growth distributed over the total forest area would amount to only 149 board-feet per acre. However, most of the sawtimber growth is in sawtimber stands which grow more than 200 board-feet per acre per year (fig. 16).

Growth per acre is slightly higher in the Glaciated Region of Ohio than in the Hill Country because of slightly better stocking conditions. In all parts of Ohio, sawtimber growth could be doubled by more intensive management. More high-quality logs could be obtained by growing more trees to a diameter of 16 inches and larger before cutting. Better protection from fire and grazing would help improve the stocking of seedlings and saplings and poletimber. Mortality could be reduced and the growth rate increased by removing defective and slow-growing trees.

Growing better timber is as important as growing more timber. Not more than 20 percent of the net board-foot growth is now in high-quality logs. In well-managed stands, probably as much as 30 to 40 percent of the sawtimber growth would be in high-quality logs.

While total volume of sawtimber growth could probably be doubled by practicing better forestry, the value might be tripled or quadrupled by increasing the percentage of high-quality sawtimber.

Growing-Stock Growth

The net growth of the growing stock in 1952 was 204 million cubic feet. This amounts to about 38 cubic feet per acre. With better stocking and better management the stands probably could be made to grow as much as 60 to 80 cubic feet per acre annually.

Growth of saplings to poletimber size accounted for about 8 percent of the cubic-foot growth. Trees in the 6-, 8-, and 10-inch diameter classes accounted for 53 percent of the cubic-foot growth, although these trees make up only 34 percent of the growing-stock volume. Sawtimber trees, containing 66 percent of the growing-stock volume, accounted for 39 percent of the cubic-foot growth.

Sawtimber trees on the average are growing faster in diameter than the poletimber trees, but the poletimber trees account for more of the growth volume because there are more than 10 times as many of them.

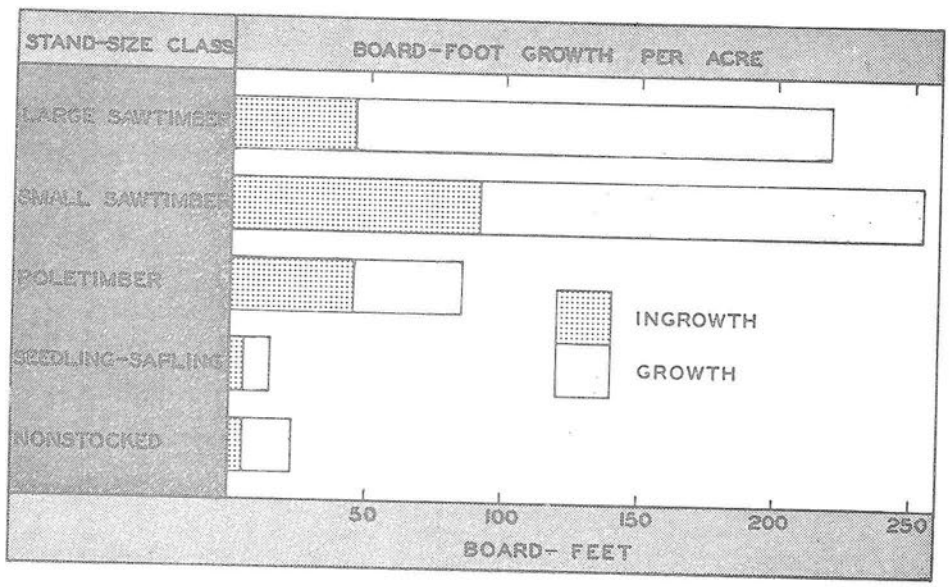


FIGURE 16 — *Growth in board-feet, by stand size.*

Mortality and Its Causes

Timber losses other than from cutting in 1952 were estimated at 24 million board-feet of sawtimber and 8 million cubic feet of growing stock. These losses, amounting to only a fraction of 1 percent of sawtimber and growing-stock volume, are not large but they occur annually and over the years add up to a considerable amount.

The Ohio timber mortality can be reduced by greater efforts to prevent fire (fig. 17). Most fires are caused by human carelessness—smoking, debris burning, campfires, and incendiarism—and therefore are preventable. The fall of 1952 and spring of 1953 was a severe fire season for Ohio. Of some 5 million acres protected, 28,588 acres burned during that period (4). The cost to the State of putting out these fires was more than 35 thousand dollars. The estimated damage to the timber was 165 thousand dollars.

Almost all privately owned forest land shows signs of being grazed at least lightly. Because the raising of livestock is so important in Ohio, many woodlands are used as pastures. Many woods are not restocking suitably because livestock are killing the seedlings and saplings. If an owner wishes to grow hardwood timber, livestock should be kept off the land. To encourage forest land-owners to keep livestock out of the woods, Ohio employs an educational program plus an incentive law which reduces taxes by half on land classified as forest land. Although the results of these programs fall short of the goals set for them, the educational program is considered the more successful. Better control of grazing or elimination of livestock from the woods could help reduce the mortality.

It was estimated that in 1952 the losses due to diseases amounted to about 11 million board-feet of sawtimber. The losses due to decreased growth and reduced timber quality caused by insects and diseases are much greater. Protection of the forests against fire and grazing and a sound cutting program to remove trees damaged by logging, wind, and other causes will help to guard against serious insect and disease attacks.

Oak wilt, recently found in 55 counties, could become the most serious disease in the State. Control measures are planned, but knowledge of how the disease spreads is sketchy. There has been a heavy loss of elm timber, caused by the Dutch elm disease and phloem necrosis, but the loss has been noticed more by city dwellers than by the wood-using industries. There are outbreaks from time to time of defoliating insects, such as the European sawfly and the hemlock looper, but these are usually in limited areas where they are fairly easy to control. Red pine plantations in the northern part of the State are seriously damaged by the European pine shoot moth. New plantations of red pine north of the U. S. 40 highway are not recommended unless the owner understands the risk he is taking and is willing to spray his plantation to control the shoot moth. The wood borers damage many logs and result in a degrading of the lumber or other products cut. The Ips beetles practically prohibit pine logging in summer months.

FIGURE 17 — *Losses caused by fires such as this are difficult to measure. Many trees are killed and others are damaged. Also, because the ground cover is destroyed, water runoff will increase and site conditions in general will deteriorate. (Courtesy of Ohio Division of Forestry.)*

Timber Cutting

The volume of timber cut from Ohio forests in 1951 has been estimated at 279 million board-feet of sawtimber plus about 8½ million cubic feet of poletimber, making a total cut of 53 million cubic feet of growing stock. This volume includes the material that actually went into finished products plus the material of merchantable quality that was lost in logging and milling. It does not include any volume produced from noncommercial forest areas or from dead and cull trees.

Sawtimber Cut

Much less timber is cut today than was cut at the turn of the century. At that time, lumber alone accounted for about 1 billion board-feet per year (7). Other important uses of timber were for basket veneer, cooperage, shingles, handles, hewn railroad ties, round and split mine timbers, fuelwood, posts, poles, and piling.

Today most of the timber is still cut for lumber with minor amounts being cut for fuelwood, fence posts, veneer logs, cooperage bolts, pulpwood, and mine timbers. Increasing amounts of wood products are being obtained from logging and milling residues (fig. 18). Of the amount of wood cut from live sawtimber on forest land, 80 percent was for sawlogs, 7 percent was for fuelwood, 5 percent for cooperage bolts, and nearly 5 percent for veneer logs. Fence posts, handle bolts, and other minor products accounted for the remaining 3 percent.

About 4 percent of the sawtimber cut—11.5 million board-feet—was left in the woods as logging residue. This residue volume is kept relatively small because some timber owners use part of it for fuelwood and other products.

All but 2½ million board-feet of the sawtimber cut was hardwood. Forty-eight percent was red and white oak. Maple accounted for about 13 percent, followed in order by beech, elm, yellow-poplar, ash, hickory, and minor species. The high-valued black walnut accounted for only 1 percent of the cut. The cut by species varied throughout Ohio, depending upon the local occurrence of the various species. For example, in southeastern Ohio, 73 percent of the sawtimber cut was oak while in northeastern Ohio only 24 percent of the volume cut was oak. Beech and maple on the other hand accounted for 41 percent of the cut in northeastern Ohio but only 4 percent of the cut in south-central Ohio.

Only about 22 percent of the sawtimber cut was from trees in the 12- and 14-inch diameter classes, although 37 percent of the stand volume is in these classes. The volume cut from 16- and 18-inch trees was proportional to the volume in the stand. But nearly 50 percent of the cut was from 20-inch and larger trees, although these trees make up only 35 percent of the stand volume.

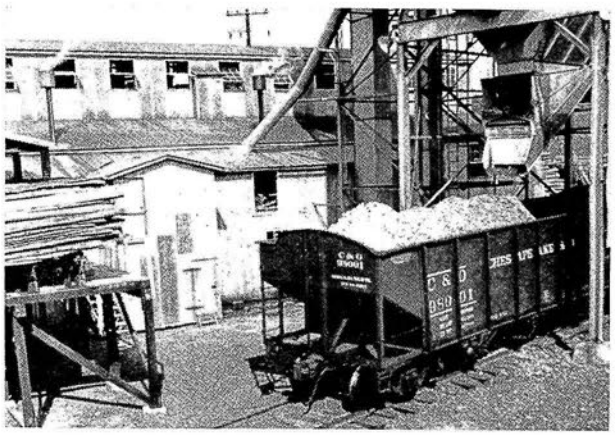


FIGURE 18 — *Wood chips, for use in steel refining, can be produced from slabs and other sawmill residues.*

The volume of sawtimber cut is about equally divided between the Glaciated Region and the Hill Country of Ohio. Nearly 250 thousand acres were partially cut. The cut averaged about 1,300 board-feet per acre. This cut per acre varied, however, from about 1,000 board-feet in southeastern Ohio to about 1,900 board-feet per acre in northeastern Ohio where the stands are cut heavily for car blocking.

Some cutting takes place on about 4.6 percent of the forest area each year. This means that, if the cut were spread over the entire forest area and continued at this rate, all forest land would be cut over in 20 to 25 years. However, practically all of the cut comes from sawtimber stands, which at the present rate are being cut over about every 10 years. Under intensive management, most stands would be cut over more frequently,

with a smaller volume being taken per cut and with cull and poor-risk trees being removed or killed in the process.

Growing-Stock Cut

Of the 53 million cubic feet cut from growing stock, about 16 percent was from poletimber and 84 percent from sawtimber. The poletimber was cut mostly for fuelwood, fence posts, pulpwood, and mine timbers. Eighty-seven percent of the fence posts cut from poletimber were black locust. There is little if any waste or residue from cutting poletimber. Most of the poletimber is utilized in a round or split form and does not require milling. Stems as small as 3 inches in diameter can be utilized for fence posts, and even smaller ones for fuelwood. Thus, when pole trees are cut for these products they often are utilized beyond the merchantability standards used by the forest survey.

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Trends In Timber Volume

The change taking place in Ohio timber volume may be estimated by comparing current annual growth with current annual timber cut. For this comparison, a 5-year average of timber cut is more representative than the 1951 timber cut figures used elsewhere in this report and hence is more comparable to growth. The average cut for the 5-year period, as estimated from stump measurements, was 331 million board-feet.

Sawtimber growth exceeded the cut by 476 million board-feet. This increased the amount of standing sawlog material by 3.3 percent or about 88 board-feet per acre per year. All species are growing faster than they are being cut. Volume is increasing annually in all except the larger diameter classes (fig. 19). Because the pattern of cutting varies among regions, certain species are being cut about as fast as they are growing in some areas.

Growth in the larger diameter classes is somewhat over-estimated because the annual loss through rot was applied as a stand average and not determined for individual diameter classes to allow for the increasing rot in large diameter trees. Thus the over-cutting of large diameter trees is more marked than the figures show.

In terms of log grades, the comparison of growth and cut is less favorable. We know that the volume cut for

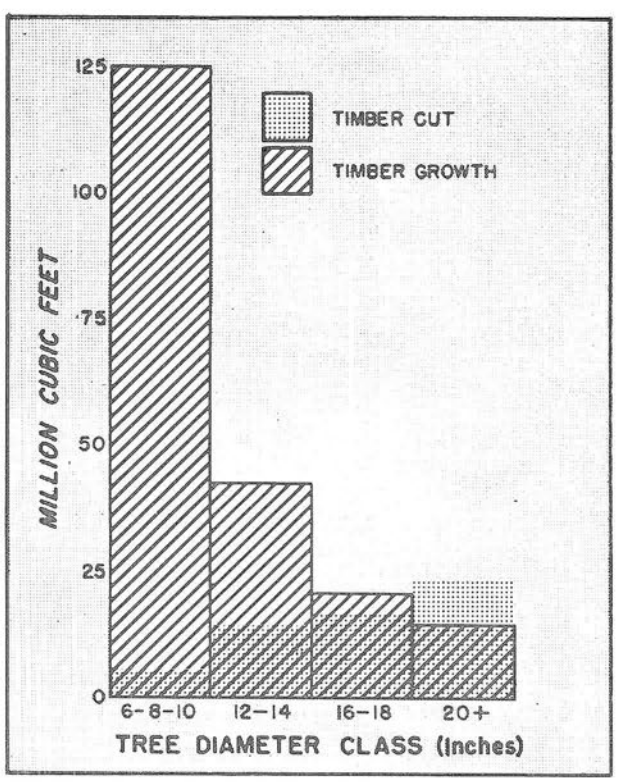

FIGURE 19 — *Total growth and cut, by tree-diameter class.*

veneer, cooperage, and handles is in high-grade logs. Thirty-eight percent of the lumber log volume is high grade. These four products account for 90 percent of the sawtimber cut. About 135 million board-feet of high-grade logs were cut for these products while about 160 million feet of high-grade material was growing.

Looking at the State as a whole, the Ohio forests are essentially young, but liberally sprinkled with remnants of former stands, which contain many cull trees. About 1 out of every 6 sawtimber trees is a cull. The forests of the Hill Country, having been subjected to periodic burning and heavy cutting, are more predominantly in the younger age classes than the forests of the Glaciated Region, which contain a higher percentage of decadent trees.

Cutting is concentrated in the larger size classes, as it should be. The merchantable volume in trees 24 inches and larger in diameter is enough to sustain the present rate of cut for 8 years without counting growth. Of course some of this large timber is scattered in stands of smaller, immature trees. Some of the latter trees will continue to be cut in order to harvest commercial volumes.

Growth can be expected to increase rather than decrease in the near future. There are 2 million acres of poletimber stands, more than 90 percent of which are well or medium stocked and supporting 20 percent of the growing stock. These stands will add to ingrowth in the coming decades if poletimber cutting does not greatly increase. Ingrowth now accounts for one-third of the total sawtimber growth. The result will be continued additions to the sawtimber area and a general "thickening" of the present sawtimber stands.

Signs point to a rapid build-up of total sawlog volume, a much slower increase in high-grade sawlog volume, and, paradoxically, a continued deterioration in certain aspects of stand quality. Sawtimber inventory is being added at a rate approaching half a billion board-feet a year. Unfortunately, the percentage of desirable species, notably white oak and northern red oak, is dropping while the percentage of less desirable species, notably hickory, is increasing. Still, because of the large surplus being added each year, the volume of desirable species is increasing too.

The continued increase in sawtimber volume will be limited by the presence of cull trees occupying the growing space. In many stands this limitation is already in effect. Although information programs designed to improve cutting practices are being pushed by both public and private organizations, it is still the general rule to cut the best and leave the worst. As long as this practice continues with little or no provision for girdling or felling unwanted trees, the ratio of cull timber to merchantable timber is likely to increase.

For the next 10 or 20 years, sawtimber volume should show an annual increase. The added material will not be of the highest quality but will be largely close to major markets. New industries are needed now, particularly in the Hill Country, to take advantage of the resource.

Timber Use and Harvest

Several times as much timber is consumed in Ohio as is produced from the local forests. For construction of homes and other buildings, the chief demand is for softwoods, which are not produced in quantity in this State. Moreover, probably less than half the hardwood lumber used in Ohio is cut within the State. In 1943, the last year that a lumber distribution study was made, Ohio industries received about 497 million board-feet of hardwood lumber, and only 250 million board-feet of this was from Ohio forests (5). In 1948, manufacturing industries used 621 million board-feet of wood as lumber, veneer, and bolts, but only 297 million feet of this was native hardwoods (3). Most of the wood used was softwoods imported from other states.

The Lumber Industry

Around 1900 the sawmills in Ohio produced about a billion board-feet of lumber and allied products annually. At that time Ohio had a generous supply of high-quality hardwood logs, and timber was relatively cheap—much of it being acquired as a by-product of land clearing. As more and more of the land passed from forest to farm use, the high production of high-quality hardwood could not be maintained.

A complete canvas in 1952 showed that there were 1,776 sawmills in the State (6). This is an average of about one mill for every 1,600 acres of sawtimber. Only about 6 percent of these sawmills produce as much as 1 million board-feet per year. In Ohio, as elsewhere in the Central States, most of the lumber is produced by small, portable, circular mills (fig. 20). In 1947, mills cutting less than 500 thousand board-feet produced 58 percent of the lumber.

In 1953 the Bureau of the Census estimated the lumber production in Ohio to be 254 million board-feet. From forest survey studies we know that lumber production accounts for about 80 percent of the volume of wood products cut from Ohio sawtimber. Oaks of all kinds account for about 45 percent of the lumber production. Soft maple and sugar maple together account for about 16 percent followed by elm accounting for about 12 percent, beech 8 percent, yellow-poplar 6 percent, and species of minor importance making up the remainder of the production.

In Ohio timber for lumber production is bought in several ways. Probably the greater portion of the timber is purchased on the stump by lumpsum bid. In other words, the sawmill operator offers a cash price for all the timber he can use from the woodland with a diameter cutting limit being specified sometimes. Only a small amount of the timber is purchased on the basis of a timber cruise. Some operators purchase sawlogs delivered at the mill. In most cases these logs are paid for by the Doyle log scale, which generally underestimates the volume of lumber that will be cut, especially from small logs. The price may vary by species but usually not by quality of the logs.

In 1952 all the sawlogs cut in Ohio were worth between 8 and 9 million dollars, delivered to the sawmills. The products cut from these logs vary in value depending upon how they are marketed. The better grades of lumber go to wholesalers and jobbers buying for factory use. Most of the lumber is sold rough and green for various uses such as car blocking, use on the local farms, pallet manufacture, and so on. Some of it is sold as railroad ties. Only a few of the better sawmills grade and dry the lumber before selling it. The car blocking lumber brings around $50.00 per thousand delivered. Lumber for use on the farm is usually sold millrun for $65.00 to $75.00 per thousand. Lumber that is dried and sold by grades brings much more, of course, for the better grades, but it is difficult to dispose of the number 3 common and poorer grades of lumber.

Grading studies of logs cut in the woods and delivered at mill decks indicated that about 38 percent of the sawlog volume used was in grade 1 and 2 logs. Grade 1 logs will normally yield about 65 percent number 1 common and better lumber, while grade 2 will yield about 40 percent of the same quality. On the other hand, grade 3 logs, which account for 62 percent of the production, yield only about 20 percent of their volume in number 1 common and better lumber. Probably not more than one-third of Ohio's lumber production is in the number 1 common and better lumber grades that are easy to sell. As much as 35 to 40 percent is likely to be number 3 common and poorer lumber for which markets are limited.

It is difficult to estimate how much labor goes into lumber production in Ohio because so many of the operations are seasonal and are performed with inefficient equipment and part-time labor. However, in 1947 commercial sawmills in Ohio (cutting more than 200,000 board-feet) averaged 1,934 employees with an annual payroll of 3.3 million dollars (9).

FIGURE 20 — *At this typical Ohio sawmill, boards are being edged with the headsaw.*

The Veneer Industry

Ohio cuts as much timber for veneer as does Indiana, which is noted for its veneer and furniture industries. About 40 percent of the production is soft hardwoods for manufacture of container veneer and baskets. The other 60 percent of the production is walnut, white oak, and other fine hardwoods for the furniture industry. About 90 percent of the soft hardwoods production is used within the State but only 54 percent of the furniture veneer production is used locally.

Actually the secondary industries of Ohio use much more veneer than is produced here. The veneer-log production in 1951 was 12.3 million board-feet, but to supply all of the veneer used in Ohio would require a cut of about 80 million board-feet of logs and flitches. Only about 60 percent of the veneer used, however, is from species that are grown locally.

Veneer-log buyers must search wide areas in Ohio and adjacent states to obtain the logs they need. To produce either face or container veneer, clear bolts and logs at least 16 inches in diameter are desired. Premium prices are paid. High-quality logs for container veneer may bring $60.00 or $70.00 per thousand board-feet at the mill, while high-quality logs for furniture veneer may bring $100 to $200 or more per thousand board-feet, depending upon the quality of the logs.

The Cooperage Industry

All of the cooperage stock produced in Ohio is for tight cooperage. This requires large, high-quality white oak timber. Ordinarily a white oak tree must be at least 16 inches in diameter before it is cut for cooperage. Even then the bolts must be straight grained and free from knots and other serious defects.

Ohio has more than a billion board-feet of large white oak timber, but such timber is becoming more and more scattered and difficult to find in commercial quantities. In 1951, nine stave and heading mills were found to be getting at least a part of their white oak supply from Ohio. Seven of these mills were located in Ohio. Together they used 12.6 million board-feet of high-quality white oak timber worth more than one million dollars at the mills. Work at these mills usually is not steady because the production of staves and heading fluctuates seasonally and from year to year. Also, the mills are portable and may shift from one county to another to take advantage of available timber.

The Handle Industry

Another specialized wood-using industry is the manufacture of handles for shovels, pitchforks, hoes, and other long-handled tools. Five plants get at least a part

of their wood supply from Ohio. In 1951 these plants used about 4½ million board-feet of timber, mostly ash, although small amounts of hard maple and hickory are also used. Manufacturers of handles for small hand tools buy lumber or squares cut at the proper dimensions for further manufacture into handles. For example, in 1948, 17 million board-feet of wood was used in Ohio for the manufacture of handles. But of this only 9 million board-feet was delivered to the handle plants in the form of logs or bolts.

Logs and bolts delivered at handle plants are worth more than the same timber utilized as sawlogs. Logs of suitable quality usually bring $80.00 to $90.00 per thousand at the plants.

The Pulpwood Industry

Five pulp mills draw part of their wood supply from Ohio. In 1951 they used about 32 thousand cords of Ohio timber. Sixty percent of the wood used was soft hardwoods and about forty percent was hard hardwoods such as the oaks. The use of hard hardwoods for pulpwood is increasing. Only a small amount of pine was obtained from Ohio.

There is a growing interest in the forests of Ohio as a source of pulpwood. Pulpwood delivered at the mills brings about $15.00 per cord (unpeeled). Some of this material can be cut from logging residues and tops of trees left after logging for such products as sawlogs, veneer logs, and cooperage bolts. Something like 80 to 90 thousand cords of sound wood in logs and bolts 8 inches and larger in diameter are left in the woods. The volume left in upper stems and limbs to a minimum 4-inch diameter amounts to another 300 to 400 thousand cords annually. At least one plant in Ohio is now using some of this material. More of it will probably be utilized as suitable markets develop and ways are found to reduce the cost of handling.

Other Uses for Wood

The industries discussed up to this point use more than 80 percent of all the wood cut in Ohio and practically all of the high-quality wood cut. Also they are about the only Ohio industries processing wood for further manufacture. A small amount of wood is used for guardrail posts, piling, and hewn ties. Also a small amount is used to produce charcoal (fig. 21). Most of the remaining production, however, is for fuelwood, fence posts, and mine timbers.

More than 20 million cubic feet was produced for fuelwood but only a little more than one-fifth of this was cut from the growing stock. Three and six-tenths million cubic feet was used for fence posts and 77 percent of this came from the growing stock. About 1.4 million cubic feet of wood was utilized for mine timbers and all of this came from the growing stock.

Fuelwood has a low value but provides an outlet for much low-quality timber and logging and milling residue that might not be used otherwise. About 28 percent of the fuelwood was cut from cull and dead trees. Another 18 percent was cut from nonforest land. Twenty-nine percent came from logging and sawmill residues and about 2 percent was cut from saplings. The remaining 23 percent was cut from growing stock.

Farmers in Ohio cut more than 4½ million fence posts in 1951. Half of these were cut from poletimber trees. Twenty-two percent came from sawtimber, 15 percent from saplings, 8 percent from nonforest land, and 4 percent from cull and dead trees and logging residues. About three-fourths of the fence posts cut from sawtimber and poletimber trees were black locust. Oaks and miscellaneous species made up the remainder.

Practically all of the mine timbers were cut from poletimber growing stock. Producers of mine props usually cut heavily in well-stocked hardwood poletimber stands. This practice can affect the growth adversely and delay development of high-quality stands of sawtimber. However, mine props bring a comparatively good price for the volume and quality of wood involved, and afford an opportunity for timber owners to make thinnings and improvement cuttings and receive some immediate return from these operations.

Wood Used In Manufacturing

Wood is a basic raw material in more than 700 manufacturing plants in Ohio. The wood is used in 45 or more different classes of products. A few of the more important are containers, furniture, general mill work, flooring, pallets, motor vehicles, prefabricated houses, and construction and repair of railroad cars. The plants use far more wood than is produced in the State. In 1948 only 48 percent of the wood used in manufacturing was native hardwoods and much of this is brought infrom nearby states. In 1951 a study conducted by the Interstate Commerce Commission showed that Ohio received about 15 carloads of wood products for every carload shipped out (2).

The woodworking plants of Ohio provide employment for more than 40,000 workers and an annual payroll of 175 million dollars or more. Ohio timber provides an important source of income which is needed especially in the Hill Country where farmers must work a good part of the year off the farm and where population is declining due to lack of opportunities for making a living.

FIGURE 21 — *These pictures show some of the work that went into making charcoal in years past. Upper is an area cleared for charcoal wood. In the center a worker is piling the wood on the cutting site. Lower, the wood has been hauled and piled at the burning site, and the workers are now covering the wood with dirt and leaves before lighting the fire.*

Significance of the Survey Picture

Ohio is a populous and heavily industrialized State. Its industries require much more timber than can be produced on its forest land. Population growth and continued plant expansion during the next 20 years can be expected to increase timber requirements substantially. The State now imports, with high freight charges, large quantities of timber and other wood products and many kinds of paper and pulp products.

For maximum efficiency the State will need to get increased production from the available forest land. There is not much chance of greatly enlarging the area devoted to growing trees. Planting on strip-mined areas (fig. 22) and abandoned fields (fig. 23) and the natural reversion of old fields will offset land clearing

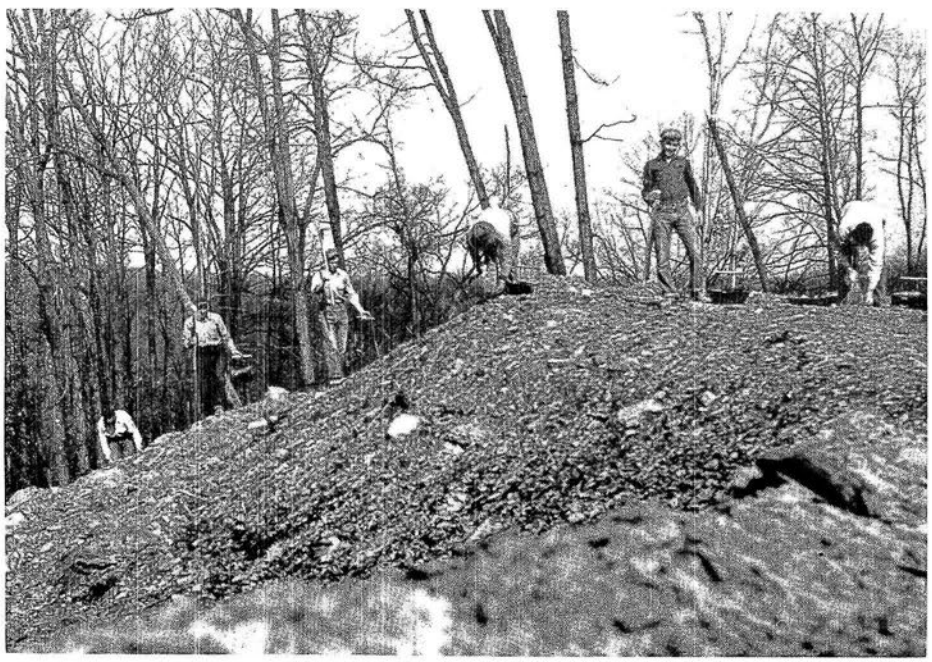

FIGURE 22 — *In the upper scene the strip-mined area is being prepared for planting. In the lower picture a crew is planting tree seedlings using planting bars.*

FIGURE 23 — *There are many old fields such as these in the Hill Country of Ohio that might profitably be planted to trees. (Courtesy of Ohio Division of Forestry.)*

for a time. But the encroachment of cities, farms, and reservoirs eventually may turn the balance the other way. With a large population demanding room for outdoor recreation, more and more forest land may be developed to provide for such use, as well as for timber production and other uses.

The present overall excess of timber growth over cut is certainly encouraging. However, this generally favorable relationship tends to obscure many local points of imbalance. More emphasis should be given to concentrating growth on the larger, better formed trees of desirable species. The State will need to grow better quality timber and to make more use of the present surplus of low-quality material. To do this, timber owners need to remove low-value species to make room for preferred species such as white oak, northern red oak, yellow-poplar, white ash, and black walnut.

The measures necessary to secure better forest management for Ohio are not new. They have been advocated for most of the central hardwood region for many years. The major programs suggested are: (1) improve cutting practices, (2) provide more complete protection from fire and much better protection from livestock, insects, and disease, (3) improve utilization and marketing, and (4) inform landowners and timber operators about proper management practices. Continuing research and education are necessary to discover and make available methods for improving the programs.

Adopting better cutting practices would go a long way toward improving the forest situation. With rare exceptions, the present stands are building up in spite of logging rather than with the help of planned harvesting. Sometimes the product being cut is conducive to destructive cutting practices (fig. 24). If more attention were given to leaving the stands in good condition for future production, the increasing sawtimber volume would be much more valuable. Removing cull and poor-risk trees would provide more growing space and get rid of sources of infection, reducing the damage caused by insects and diseases.

Present systems of handling timber from the stump to the factory no doubt can be improved. The methods of selling stumpage and timber products have evolved haphazardly, and are complicated by small ownerships and lack of interest on the part of the owners. Such things as lumber quality, reliability of producers, stability of industry, costs, and buyer preferences have received too little attention. Woodland owners need some means of keeping advised of existing markets and market conditions, just as farmers are informed of markets for such farm products as poultry, livestock, and grain. Uninformed as they are now, it is difficult for woodland owners to know when a fair price is being offered for their timber.

Many holdings in Ohio are so small that they are difficult to manage effectively as commercial operations —at least under present marketing conditions. The pattern of small woodland ownerships makes it necessary to cut heavily in order to get a salable volume unless high-quality products such as veneer logs, stave bolts, and handle bolts are available. Lighter cuts could be made on small woodlands if the owners could do their own harvesting and if units could be consolidated for marketing purposes. Existing farm cooperatives might help solve some of the timber marketing and utilization problems in certain areas. They might make suitable

timber harvesting equipment available to the woodland owners or perhaps furnish a timber harvesting service. Some of the equipment needed to handle heavy timber products is too costly for an individual farmer to own, especially when it would be used so infrequently. However, a number of farmers may be able to own and share such equipment through a cooperative.

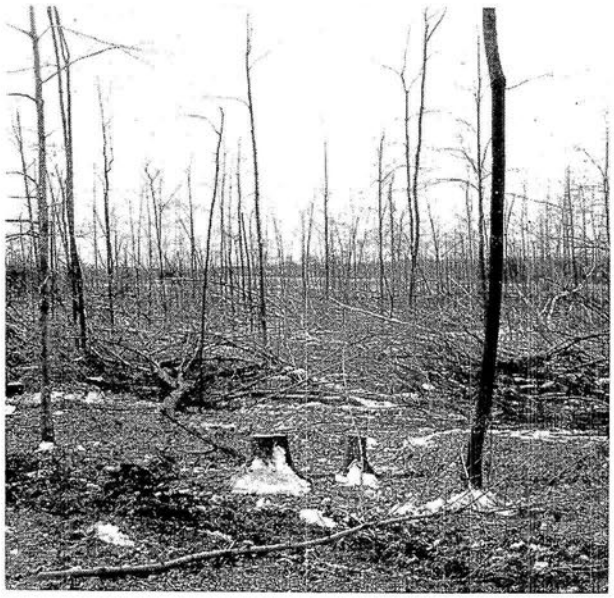

FIGURE 24 — *This stand in northeastern Ohio has been cut to produce car blocking. For this market nearly any tree down to about a 6-inch diameter limit regardless of quality can be utilized. (Courtesy of Ohio Division of Forestry.)*

Farmers and other woodland owners might be encouraged to do more of their own harvesting if permanent markets were available that could take a variety of wood products in small quantities. Such concentration yards could also help the secondary industries by channeling logs and bolts to their highest use, thereby preventing the processing of many high-quality logs into low-value products.

Because private owners hold 95 percent of the forest land, they control the future productivity of Ohio forests and the future of the wood-using industries dependent on the forests. Farmers and other small owners must be the primary targets of any improvement programs. A few large industrial owners and the public agencies can contribute by doing a good job of management on the areas they control. These areas can and do serve as demonstrations and so fit into the education program.

To help woodland owners to practice better management, the State Division of Forestry has 13 foresters who give technical assistance in cruising, marking, marketing, planting, and other services. This assistance currently reaches about 1,000 owners each year out of a total of about 150,000.

Another source of assistance available to woodland owners is through the Agricultural Conservation Program of the U. S. Department of Agriculture. Woodland owners may apply through the local county ACP committee to have the Federal government share in the cost of (1) planting trees when they are to be planted for erosion control, watershed protection, or forestry purposes; (2) improving a stand of forest trees for erosion control, watershed protection, or forestry purposes; and (3) constructing permanent fences to protect woodland from grazing. The minimum requirements to fulfill these broad purposes are specified by the State committee.

A number of associations and industrial owners such as the Ohio Reclamation Association, the Muskingum Conservancy District, the Ohio Power and Light Company, the Baker Wood Preserving Company, and others employ foresters to manage their land and to help owners with whom they deal. Ohio timber owners can also obtain the services of a number of consulting foresters.

Education to help all classes of owners is carried out by the State Division of Forestry, the Ohio Agricultural Experiment Station, the Soil Conservation Service, the Ohio Forestry Association, and others. Research in forestry is being done by the Central States Forest Experiment Station with a work center at Athens and an experimental forest near McArthur. The Ohio Agricultural Experiment Station is active in several phases of forest research—forest genetics, forest physiology, silviculture, strip-mine reclamation, and forest products.

Although assistance in one form or another reaches many forest owners, there are many privately owned forest tracts that remain untended. Some are held by non-residents who cannot give their forests proper attention. Others are owned by individuals, companies, and institutions not interested in managing land for timber production. There is a need to encourage the purchase of forest land by individuals and corporations interested in growing timber.

The State through its Division of Forestry produces nearly 12½ million tree seedlings annually at three nurseries located at Marietta, Green Springs, and Zanesville. These seedlings are distributed for planting by the Division of Forestry, other State agencies, by farmers, 4-H Club members, agricultural extension groups, industry, institutions, schools, communities, and

FIGURE 25 — *Tree planting machinery in action. A crew can plant about 10 acres a day with such equipment. (Courtesy of Ohio Agricultural Experiment Station.)*

other municipal organizations. In 1955 Ohio planted 12,652 acres to trees, bringing the total planted in Ohio to 193,356 acres (*10*) (fig. 25).

Although Ohio has made good progress in forestry, past research and experience have opened the door to new problems and to greater expectations for the future. Means should be available for measuring the timber needs of the forest industries, through a cooperative sampling plan. Trends in cutting practices should be surveyed periodically and the effect on stand composition and growth evaluated. Subsequent surveys of the forest resources should be intensive enough to yield reliable estimates of volume for counties—at least in the Hill Country—and thus assist in the location of new industries. The organization necessary to accomplish this work might be small but it would have a permanent job keeping track of the changing forest conditions.

Research can find better ways to safeguard our forests from fire, insects, and disease. Research is needed in management to solve regeneration problems; to establish desirable cutting practices for the many stand conditions and forest types; to find ways of increasing the productivity and quality of our forests; and to determine the management that best serves the interests of timber, water, wildlife, and recreation on public land (fig. 26). In Ohio, as elsewhere, it is becoming increasingly important that we learn more about the influence of forests upon the water resource in order to assure a dependable water supply for the expanding population and industry of the State. Research is needed in harvesting, marketing, and utilization to find easier and cheaper ways to do the many jobs and to find the land-use and management program that gives the greatest dollar return.

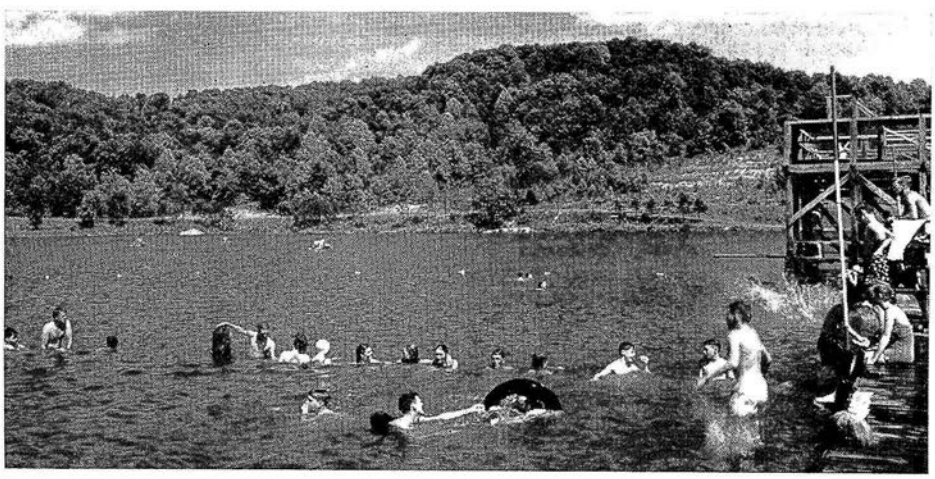

FIGURE 26 — *The value of forests cannot always be measured in dollars. These people are enjoying swimming, boating, and fishing in the clear water at Lake Hope. The watershed at Lake Hope is protected by forest cover. (Courtesy of Ohio Division of Forestry.)*

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Appendix

Forest Survey Procedure

The inventory of the forests of Ohio was made during the period August 1951 to September 1953. The sampling procedure used involved an office study of aerial photographs and a field examination of randomly selected forest and nonforest plots.

Area Estimates

The percentage of forest land was obtained by placing a transparent sheet marked with uniformly spaced dots over aerial photographs and counting the number of dots falling on forest and nonforest areas. The percentage of forest dots in a county, multiplied by the total county area gave a preliminary estimate of the forest area. This was later adjusted after field examination of selected plots showed how many plots had changed from forest to nonforest and vice versa since the date of aerial photography.

Systematically selected dots falling on forest land were marked on the photographs. The acre surrounding each marked dot was examined stereoscopically and was classified by stand-size class according to height, crown width, and number of trees on the plot.

Plots to be examined in the field were randomly drawn but the selection was weighed—more of the larger stand-size classes were selected than the smaller. Crews of two men located these points on the ground and established a 1/5-acre circular plot at each point. Such data as tree species, size, log quality, cull, and growth of trees were recorded.

The following tabulation gives the number of dots and plots examined for the State as a whole.

Number of photo dots counted for forest-area determination	247,498
Number of plots stereoscopically examined on photos	12,240
Number of forest plots field examined	3,439
Number of nonforest plots field examined	143

Volume Estimates

Sawtimber volume—The gross board-foot and cubic-foot volume tables used in the Ohio Forest Survey were based on the Mesavage-Girard form class tables. Two sets of volume tables were prepared—one for Forest Survey units 1 and 2 and one for units 3, 4, and 5. Average form classes were computed from measurements of form class on 603 trees for units 1 and 2 and on 754 trees for units 3, 4, and 5. Whenever Ohio data did not appear to give a sufficiently reliable form class for some particular species, Indiana data were added in.

The upper stem volume of all sawtimber trees was computed. This volume includes the portion between the merchantable top and a minimum top diameter of 4.0 inches inside bark on the central stem. The average upper stem volume of sample trees in units 1 and 2 was computed for three diameter groups (12-14, 16-18, and 20+ inches). These average upper stem volumes were plotted, a curve was fitted to the points, and upper stem volumes by 2-inch d.b.h. classes were read from the curve.

Poletimber volume — Diameter and merchantable height was measured on 1,032 poletimber trees in units 1 and 2 and on 975 in units 3, 4, and 5. These measurements were summarized by species group, merchantable height, and by d.b.h. Cubic-foot volume tables were computed for three groups of hardwood trees having similar height and diameter relationships. The volume table prepared for eastern red cedar in western Kentucky was used in Ohio.

Cull Estimates

Trees of pole size or sawtimber size which did not qualify as merchantable trees were tallied as cull trees.

Allowance for defect in merchantable sawtimber trees was determined by estimating sound and rotten board-foot cull in sample trees. A separate analysis was made for units 1 and 2 and for units 3, 4, and 5. From curves of cull over diameter class, species with similar cull percents were grouped and a weighted cull percent was computed for the group. The cubic-foot cull in sawtimber trees was estimated in a similar manner. However, estimates of cubic-foot cull in sawtimber were made for unsound defects only. The cull in poletimber trees due to unsound defects was also computed on the basis of allowance made for sample trees. Separate analyses were made for units 1 and 2 and for 3, 4, and 5.

For the purpose of estimating the volume of sound wood in cull trees, sound cull trees were arbitrarily assigned form class of 78. If a log length was not given, the volume allowed was equivalent to a 1/4-log tree. Rotten cull trees with a given log length were given 40-percent of the gross volume of

a tree with form class 78. If no log length was given the volume allowed was 40 percent of a tree with ¼-log and form class 78.

Growth Estimates

Cores were taken from 3,236 sample trees and growth for the past 10 years was measured. The average 10-year diameter growth inside bark by species and 2-inch diameter classes was determined. The diameter growth was plotted over the average diameter of the sample trees. From bark thickness studies, an allowance was made for bark increase duing the past 10 years and added to the diameter growth measured from the cores. The average volume of trees in the present 2-inch classes was determined. From the growth curves the future 10-year volume of the present average tree was determined. The ratio of the present volume to the future volume was determined for each species and 2-inch class. One-tenth of the volume growth in 10 years was taken as the estimate of current annual gross growth.

To estimate the volume of ingrowth the number of inventory trees were plotted by 2-inch d.b.h. classes. From d.o.b. growth curves the number of trees 4.9 inches d.b.h. and smaller that would grow to 5.0 inches or larger in the next year was estimated. The same estimate was made for trees 10.9 inches d.b.h. and smaller that would grow to 11.0 inches or larger. To determine the ingrowth volume the number of ingrowth trees were multiplied by the volume of trees 5.1 and 11.1 inches in diameter for each species.

Gross growth and ingrowth estimates were adjusted to net estimates from analysis of the number of trees that died during the 4-year period prior to the survey.

Timber-Cut Estimates

The estimates of timber cut from Ohio forests in 1951 were made by a sampling survey of wood-product producers, wood users, and of logging operations (to determine the amount of cutting residue).

The amount of timber cut for sawlogs was obtained by sampling sawmills for lumber production. This was done by supplementing the annual survey of the U. S. Census Bureau. Lumber tally was converted to log volume, International ¼-inch scale, and the volume of logging residue was added. Because the sample did not give reliable data by species, the timber cut for lumber was distributed by species in proportion to the 100-percent canvass of the 1947 Census.

An area sample was used to determine the timber cut for fuelwood, fence posts, and miscellaneous farm timbers. The Master Sample of Agriculture was used to draw the samples. One hundred "open" area segments were canvassed with the aid of personnel from the State Division of Forestry.

The timber cut for veneer, cooperage, handles, pulp, and excelsior was determined by a complete canvass of processors in Ohio and adjacent states. The production reported from Ohio timber by the processors was converted to timber cut by adding in the logging residue.

The timber cut for round mine timbers was based on the production of coal from deep mines. A study made by John Tillinghast in 1944 for the Ohio Coal Association showed that 0.1502 cubic feet of wood was used for each ton of deep-mined coal produced. The 1951 coal production of Ohio's deep mines was multiplied by this factor but an adjustment was made to account for the recent use of roof bolts in lieu of round wood timbers in seams 5, 6, 6A, and 8.

The timber cut for hewn cross ties was determined by a canvass of the concentration yards. Other products cut in small amounts include guard rail posts, piling, and charcoal wood.

In Ohio, timber cut was also estimated by recording data from stumps found on the 1/5-acre field plots. Analysis of these data added to the information on timber cut by species and by tree diameters.

Accuracy of Estimates

Forest area and timber volume estimates. — Statistical analysis of forest area and timber volume data in Ohio shows a sampling error ±1.0 percent (±54 thousand acres) for commercial forest area and of ±1.6 percent (±62 million cubic feet) for growing stock volume. This means that at one standard error the chances are two out of three that the estimated areas and volume would not differ from the totals that would have been obtained by 100 percent measurement by more than the values shown.

These estimates of sampling error do not include errors resulting from the development and application of volume tables and cull factors, or from mistakes in measurement or judgment. All phases of field and office work were closely supervised to keep these errors to a minimum.

Since the percentage error increases with each subdivision of the total, small acreages or volumes may have large errors and may therefore indicate only relative magnitudes. The following tabulation may be used as a guide in estimating the probable sampling error of the subdivisions of forest areas and volumes in the tables:

Commercial forest		Growing stock		Sawtimber	
Area	Sampling error	Volume	Sampling error	Volume	Sampling error
Thousand acres	*Percent* ±	*Million cu. ft.*	*Percent* ±	*Million bd. ft.*	*Percent* ±
5,396	1.0	3,896	1.6	14,375	2.2
2,000	1.6	2,000	2.2	5,000	3.7
1,000	2.3	1,000	3.2	1,000	8.3
500	3.3	500	4.5	500	11.8
50	10.4	50	14.1	50	37.3
10	23.2	10	31.6	10	83.4

Timber cutting estimates. — Most of the timber cut is estimated by sampling the producers. The estimates are usually reported as production of a commodity and are seldom book records. Production is mathematically converted to board-foot log scale (International ¼-inch rule) or cubic-foot volume after studies have been made of mill overrun and of the volume of woods residue. Possible errors then include reporting errors, errors in determination of overrun and residue factors, and sampling errors. Only the sampling error can be calculated; all reasonable precautions are taken to keep other errors to a minimum. The following tabulation shows the computed sampling error by commodity and the percentage that the commodity is of the total timber cut:

Commodity	Percentage of all timber cut from growing stock	Sampling error
	Percent	*Percent* ±
Sawlogs	68.5	12.0
Fuelwood	10.8	29.4
Fence posts	5.3	23.5
Veneer bolts	3.8	0.0
Cooperage bolts	3.9	0.0
Round mine timbers	2.6	12.0
Pulpwood and other	5.1	0.0
Total	100.0	8.1

Explanation of Terms Used

Forest Land Classes

Forest land area. — Includes (a) land which is at least 10 percent stocked by trees of any size and capable of producing timber or other wood products, or of exerting an influence on the climate or on the water regime; (b) land from which the trees described in (a) have been removed to less than 10 percent stocking and which have not been developed for other use; (c) afforested areas.

Commercial forest land area. — Forest land which 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.

Noncommercial forest land area. — Forest land (a) withdrawn from timber utilization through statute, ordinance, or administrative order but which otherwise qualifies as commercial forest land, and (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 Types

White-red-jack pine. — Forests in which 50 percent or more of the stand is eastern white pine, red pine, or jack pine, singly or in combination. White pine occurs naturally in Ohio but the other pines occur only in plantations. (Common associates include hemlock, aspen, birch, and maple.)

Loblolly-shortleaf pine. — Forests in which 50 percent or more of the stand is loblolly pine, shortleaf pine, or other southern yellow pines, except longleaf or slash pine, singly or in combination. Shortleaf, pitch, and Virginia pine occur naturally in Ohio. Other southern pines may be found in plantations. (Common associates include oak, hickory, and gum.)

Oak-pine. — Forests in which 50 percent or more of the stand is hardwoods, usually upland oaks, but in which southern pines make up 25-49 percent of the stand. (Common associates include gum, hickory, and yellow-poplar.)

Oak-hickory. — Forests in which 50 percent or more of the stand is upland oaks or hickory, singly or in combination, except where pines comprise 25-49 percent in which case the stand would be classified "oak-pine." (Common associates include yellow-poplar, elm, maple, and black walnut.)

Oak-gum. — Forests in which 50 percent or more of the stand is tupelo, blackgum, sweetgum, or oaks, singly or in combination, except where pines comprise 25-49 percent in which case the stand would be classified "oak-pine." (Common associates include cottonwood, willow, ash, elm, hackberry, and maple.)

Elm-ash-cottonwood. — Forests in which 50 percent or more of the stand is elm, ash, or cottonwood, singly or in combination. (Common associates include willow, sycamore, beech, and maple.)

Maple-beech. — Forests in which 50 percent or more of the stand is maple, or beech, singly or in combination. (Common associates include hemlock, elm, basswood, and white pine.)

Aspen-birch. — Forests in which 50 percent or more of the stand is aspen, balsam poplar, paper birch, or gray birch, singly or in combination. (Common associates include maple and balsam fir.)

Tree Classes

Sawtimber trees. — Trees of commercial species that contain at least one merchantable sawlog as defined by regional practice and which are of the following minimum diameters at breast height (d.b.h.): softwoods 9.0 inches and hardwoods 11.0 inches.

Large sawtimber trees.—Hardwood and softwood sawtimber trees 15.0 inches d.b.h. and larger.

Small sawtimber trees. — Hardwood and softwood sawtimber trees less than 15.0 inches d.b.h.

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.

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

Cull trees. — Live trees of sawtimber or poletimber size that are unmerchantable for sawlogs now or prospectively because of defect, rot, or species (such as sumac, redbud, hophornbeam).

Rotten cull trees. — Live trees of sawtimber or poletimber size that fail to meet regional specifications of proportion of sound volume to total volume.

Sound cull trees. — Live trees of sawtimber or poletimber size that meet regional specifications of freedom from rot but will not make at least one merchantable sawlog now or prospectively according to regional specifications because of roughness, poor form, or species.

Volumes

All-timber volume. — Net volume in cubic feet of live and salvable dead sawtimber trees and poletimber trees of commercial species, and cull trees of all species from stump to a minimum 4.0-inch top inside bark. Includes bole only of softwoods but both bole and limbs of hardwoods to a minimum 4.0-inch diameter inside bark.

Live sawtimber volume. — Net volume in board feet, International ¼-inch rule, of live sawtimber trees of commercial species to a merchantable top.

Merchantable top. — The point on the bole of sawtimber trees above which a minimum merchantable sawlog, as defined regionally, cannot be produced.

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

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

Upper stem portion. — Net volume in cubic feet of bole of sawtimber trees between merchantable top and a minimum top diameter of 4.0 inches inside bark on the central stem.

Stocking

Stocking is the extent to which growing space is effectively utilized by present or potential growing-stock trees of commercial species. "Degree of stocking" is synonymous with "percent of growing space occupied" and means the ratio of actual stocking to full stocking for comparable sites and stands.

Well-stocked stands. — Stands that are 70 percent or more stocked with present or potential growing stock trees.

Medium-stocked stands. — Stands that are 40 to 69 percent stocked with present or potential growing-stock trees.

Poorly stocked stands. — Stands that are 10 to 39 percent stocked with present or potential growing-stocked trees.

Nonstocked area. — Areas that are 0 to 10 percent stocked with present or potential growing-stock trees.

Site

Forest site. — Site class was determined by the average number of 16-foot merchantable logs that an area is capable of producing in mature trees. All stem sections ½ log (8 feet) in length or longer, suitable for cross ties or rough lumber were considered to be merchantable. Merchantable heights were estimated to the nearest ½ log. Where mature trees were not present, site was estimated from soil and moisture conditions, topography, exposure, and appearance of vegetation. The following site classes were recognized:

Very good. — Areas that can produce hardwood trees averaging three or more logs at maturity.

Good. — Areas that can produce hardwood trees averaging 2 to 2½ logs at maturity.

Fair. — Areas that can produce hardwood trees that average 1 to 1½ logs at maturity.

Poor. — Areas that can produce hardwood trees that average ½ log at maturity.

Stand-size Classes

Sawtimber stands. — Stands with sawtimber trees having a minimum net volume per acre of 1,500 board feet, International ¼-inch rule.

Large sawtimber stands. — Sawtimber stands having more than 50 percent of the board-foot volume in large sawtimber trees.

Small sawtimber stands. — Sawtimber stands having 50 percent or more of the net board-foot volume in small sawtimber trees.

Poletimber stands. — Stands failing to meet the sawtimber stand specifications, but at least 10 percent stocked with poletimber and larger (5.0 inches d.b.h. and larger) trees and with at least half the minimum stocking in poletimber trees.

Seedling and sapling stands. — Stands not qualifying as either sawtimber or poletimber stands, but at least 10 percent stocked with trees of commercial species and with at least half the minimum stocking in seedling and sapling trees.

Nonstocked and other areas not elsewhere classified. — Areas not qualifying as sawtimber, poletimber, or seedling and sapling stands.

Diameter Measurement and Classes

Diameter at breast height (d.b.h.) — Tree diameter, outside bark, measured at 4.5 feet above average ground level.

Diameter class. — Trees were recorded in 2-inch diameter classes, each class including 1.0 inch below and 0.9 inch above the midpoint of the class; e.g., the 8-inch class included all trees ranging from 7.0 to 8.9 inches d.b.h.

Diameter inside bark (d.i.h.) — Tree diameter inside the bark at any point specified.

Hardwood Log Grades[2]

Grade 1. — Butt logs at least 14.0 inches (upper logs at least 16.0 inches) in diameter inside bark at the small end. Minimum length is 10 feet. Five-sixths of the best surface on the three best faces must be clear of defect. Two clear cuttings are allowed on any face, but the minimum length of cuttings is 7 feet for butt logs and 5 feet for upper logs. Cull deductions including sweep cannot exceed 15 percent. Such logs will normally yield about 65 percent No. 1 common and better lumber.

Grade 2. — Logs at least 12 inches in diameter inside bark at the small end. Minimum length is 8 feet. Two-thirds of the surface on the three best faces must be clear of defect. Three clear cuttings are allowed on any face, but the minimum length of cuttings is 3 feet. Cull deductions including sweep cannot exceed 50 percent. Such logs for most species will normally yield about 40 percent No. 1 common and better lumber.

Grade 3. — Logs at least 8 inches in diameter inside bark at the small end. Minimum length is 8 feet. One-half of the surface on the three best faces must be clear of defect, in cuttings not less than two feet long. Minimum standards require that these logs be at least 50 percent sound including deduction for sweep. Such logs for most species will normally yield about 20 percent No. 1 common and better lumber.

Growth

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

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

Ingrowth. — The total volume of all trees that during the year reach the minimum diameter (5.0 inches) for growing stock or the minimum diameter for sawtimber of 9.0 inches for softwoods and 11.0 for hardwoods.

Mortality

Annual timber mortality. — The net volume lost from live sawtimber or growing stock on commercial forest land during a specified year because of death from natural causes.

Timber Cut

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

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

Logging residues from growing stock. — The net cubic-foot volume of live sawtimber and poletimber trees cut or killed by logging on commercial forest land and not converted to timber products.

[2]The hardwood log grades used are essentially as developed by the Forest Products Laboratory, Madison, Wisconsin, for standard lumber logs and tie and timber logs.

Trees Species

Softwoods

Commercial species:

- Baldcypress ..... *Taxodium distichum*
- Hemlock, eastern ..... *Tsuga canadensis*
- Pine:
  - Eastern white pine ..... *Pinus strobus*
  - Jack pine ..... *P. banksiana*
  - Loblolly pine ..... *P. taeda*
  - Pitch pine ..... *P. rigida*
  - Red (Norway) pine ..... *P. resinosa*
  - Shortleaf pine ..... *P. echinata*
  - Virginia pine ..... *P. virginiana*
- Red cedar, eastern ..... *Juniperus virginiana*

Hardwoods

Commercial species:

- Ash:
  - Blue ash ..... *Fraxinus quadrangulata*
  - Green ash ..... *F. pennsylvanica*
  - White ash ..... *F. americana*
- Aspen:
  - Bigtooth aspen ..... *populus grandidentata*
  - Quaking (trembling) aspen ..... *P. tremuloides*
- Basswood ..... *Tilia spp.*
- Beech, american ..... *Fagus grandifolia*
- Birch ..... *Betula* spp.
- Buckeye ..... *Aesculus* spp.
- Butternut ..... *Juglans cinerea*
- Catalpa ..... *Catalpa* spp.
- Cherry, black ..... *Prunus serotina*
- Cottonwood:
  - Eastern cottonwood ..... *Populus deltoides*
  - Swamp cottonwood ..... *P. heterophylla*
- Cucumbertree ..... *Magnolia acuminata*
- Dogwood ..... *Cornus* spp.
- Elm:
  - American elm ..... *Ulmus americana*
  - Rock elm ..... *U. thomasii*
  - Slippery elm ..... *U. rubra*
  - Winged elm ..... *U. alata*
- Gum:
  - Blackgum (black tupelo) ..... *Nyssa sylvatica*
  - Sweetgum (red) ..... *Liquidambar styraciflua*
  - Water tupelo (tupelo-gum) ..... *Nyssa aquatica*
- Hackberry ..... *Celtis occidentalis*
- Hickory ..... *Carya* spp.
- Honey locust ..... *Gleditsia triacanthos*
- Kentucky coffeetree ..... *Gymnocladus dioicus*
- Locust, black ..... *Robinia pseudoacacia*
- Maple, hard:
  - Black maple ..... *Acer nigrum*
  - Sugar maple ..... *A. saccharum*
- Maple, soft:
  - Boxelder ..... *A. negundo*
  - Red maple ..... *A. rubrum*
  - Silver maple ..... *A. saccharinum*
- Mulberry, red ..... *Morus rubra*
- Oak, red:
  - Black oak ..... *Quercus velutina*
  - Cherrybark oak (swamp red oak) ..... *Q. falcata* var. *pagodaefolia*
  - Northern red oak ..... *Q. rubra*
  - Pin oak ..... *Q. palustris*
  - Scarlet oak ..... *Q. coccinea*
  - Shingle oak ..... *Q. imbricaria*
  - Southern red oak ..... *Q. falcata*
  - Water oak ..... *Q. nigra*
  - Willow oak ..... *Q. phellos*
- Oak, white:
  - Bur oak ..... *Q. macrocarpa*
  - Chestnut oak ..... *Q. prinus*
  - Chinkapin oak ..... *Q. muehlenbergii*
  - Overcup oak ..... *Q. lyrata*
  - Post oak ..... *Q. stellata*
  - Swamp chestnut oak ..... *Q. michauxii*
  - Swamp white oak ..... *Q. bicolor*
  - White oak ..... *Q. alba*
- Osage orange ..... *Maclura pomifera*
- Persimmon, common ..... *Diospyros virginiana*
- Sassafras ..... *Sassafras albidum*
- Sycamore, american ..... *Platanus occidentalis*
- Walnut, black ..... *Juglans nigra*
- Willow ..... *Salix* spp.
- Yellow-poplar ..... *Liriodendron tulipifera*

Noncommercial species:

- Ailanthus (tree of heaven) ..... *Ailanthus altissima*
- Hawthorn ..... *Crataegus* spp.
- Hophornbeam, eastern (ironwood) ..... *Ostrya virginiana*
- Pawpaw ..... *Asimina triloba*
- Plum, wild ..... *Prunus* spp.
- Redbud, eastern ..... *Cercis canadensis*
- Serviceberry ..... *Amelanchier* spp.
- Sourwood ..... *Oxydendrum arboreum*
- Sumac ..... *Rhus* spp.

Supplementary Tables

TABLE 2 — *Total land and forest area by physiographic region and county, Ohio, 1952*

GLACIATED REGION

County	Total land area[1]	Forest area	
	Thousand acres	*Thousand acres*	*Percent*
Allen	262	24	9
Ashland	268	51	19
Ashtabula	452	119	26
Auglaize	256	25	10
Brown	314	49	16
Butler	301	26	9
Champaign	277	25	9
Clark	257	21	8
Clermont	293	59	20
Clinton	264	23	9
Columbiana	342	78	23
Crawford	259	26	10
Cuyahoga	292	55	19
Darke	387	25	6
Defiance	262	31	12
Delaware	294	26	9
Erie	169	23	14
Fairfield	323	43	13
Fayette	260	10	4
Franklin	344	18	5
Fulton	260	23	9
Geauga	260	107	41
Greene	266	21	8
Hamilton	265	53	20
Hancock	341	25	7
Hardin	299	24	8
Henry	266	17	6
Huron	318	47	15
Knox	335	48	14
Lake	148	46	31
Licking	439	64	15
Logan	295	26	9
Lorain	317	48	15
Lucas	220	26	12
Madison	297	17	6
Mahoning	268	53	20
Marion	259	14	5
Medina	271	44	16
Mercer	291	25	9
Miami	260	15	6
Montgomery	298	20	7
Morrow	259	35	14
Ottawa	168	18	11
Paulding	266	19	7
Pickaway	325	14	4
Preble	274	25	9
Portage	323	76	24
Putnam	311	20	6
Richland	318	55	17
Sandusky	262	21	8
Seneca	353	34	10
Shelby	262	26	10
Stark	367	47	13
Summit	264	49	19
Trumbull	397	91	23
Union	278	18	6
Van Wert	262	18	7
Warren	261	35	13
Wayne	353	39	11
Williams	269	28	10
Wood	396	20	5
Wyandot	260	22	8
Total	18,077	2,230	12

[1]Source: Areas of the United States, 1950, U. S. Bureau of the Census.

HILL COUNTRY

County	Total land area	Forest area	
	Thousand acres	*Thousand acres*	*Percent*
Adams	376	188	50
Athens	323	138	43
Belmont	343	102	30
Carroll	248	60	24
Coshocton	349	102	29
Gallia	301	130	43
Guernsey	332	87	26
Harrison	258	74	29
Highland	355	59	17
Hocking	269	151	56
Holmes	271	54	20
Jackson	269	124	46
Jefferson	263	107	41
Lawrence	292	184	63
Meigs	278	132	47
Monroe	291	128	44
Morgan	267	93	35
Muskingum	424	128	30
Noble	255	53	21
Perry	262	87	33
Pike	283	161	57
Ross	440	165	38
Scioto	390	237	61
Tuscarawas	353	101	29
Vinton	263	179	68
Washington	408	192	47
Total	8,163	3,216	39

TABLE 3. — *Land area by major use and physiographic region, Ohio, 1952*

Land use	State total		Glaciated region	Hill country
	Thousand acres	*Per-cent*	*Thousand acres*	*Thousand acres*
Forest:				
Commercial	5,396	20.6	2,193	3,203
Noncommercial:				
Withdrawn from timber use	50	.2	37	13
Nonproductive	.....	.....	.....	.....
Total forest land	5,446	20.8	2,230	3,216
Nonforest	20,794	79.2	15,847	4,947
Total land area	26,240	100.0	18,077	8,163
Percent	100		69	31

TABLE 4 — *Commercial forest area by ownership and physiographic region, Ohio, 1952*

Ownership	State total		Glaciated region	Hill country
	Thousand acres	*Per cent*	*Thousand acres*	*Thousand acres*
Public:				
National forest	88	1.6	.....	88
State	169	3.1	18	151
County & Municipal	40	.8	15	25
Total public	297	5.5	33	264
Private:				
Farm	3,047	56.5	1,723	1,324
Industrial and other	2,052	38.0	437	1,615
Total private	5,099	94.5	2,160	2,939
Total	5,396	100.0	2,193	3,203

TABLE 5 — *Commercial forest area by stand size and physiographic region, Ohio, 1952*

Stand-size class	State total		Glaciated region		Hill country	
	Thousand acres	*Percent*	*Thousand acres*	*Percent*	*Thousand acres*	*Percent*
Large sawtimber stands	1,581	29	916	42	665	21
Small sawtimber stands	1,098	20	319	15	779	24
Poletimber stands	1,978	37	682	31	1,296	40
Seedling & sapling stands	679	13	247	11	432	14
Nonstocked stands	60	1	29	1	31	1
Total	5,396	100	2,193	100	3,203	100

TABLE 6 — *Commercial forest area by forest type and physiographic region, Ohio, 1952*

Forest type	State total		Glaciated region		Hill country	
	Thousand acres	*Percent*	*Thousand acres*	*Percent*	*Thousand acres*	*Percent*
White-red-jackpine	8	0.1	.....	.....	8	0.3
Loblolly-shortleaf pine	108	2.0	.....	.....	108	3.4
Oak-pine	106	2.0	13	0.6	93	2.9
Oak-hickory	3,133	58.1	840	38.3	2,293	71.6
Oak-gum-cypress	57	1.1	57	2.6	.....	.....
Elm-ash-cottonwood	1,334	24.7	904	41.2	430	13.4
Maple-beech-birch	642	11.9	379	17.3	263	8.2
Aspen-birch	8	.1	.....	.....	8	.2
All types	5,396	100.0	2,193	100.0	3,203	100.0

TABLE 7 — *Commercial forest area by forest type and stand-size class, Ohio 1952*
(In Thousands of Acres)

Forest type	State total	Large sawtimber stands	Small sawtimber stands	Pole-timber stands	Seedling & sapling stands	Nonstocked and other areas
White-red-jack pine	8	.....	4	4	.....	.....
Loblolly-shortleaf pine	108	.....	23	44	41	.....
Oak-pine	106	4	19	44	39	.....
Oak-hickory	3,133	776	744	1,189	373	51
Oak-gum-cypress	57	9	16	26	6	.....
Elm-ash-cottonwood	1,334	434	203	533	157	7
Maple-beech-birch	642	358	89	130	63	2
Aspen-birch	8	.....	.....	8	.....	.....
All types	5,396	1,581	1,098	1,978	679	60
Percent	100.0	29.3	20.3	36.7	12.6	1.1

TABLE 8 — *Net board-foot volume on commercial forest area by ownership and physiographic region, Ohio 1952*

Ownership	State total		Glaciated region	Hill country
	Million bd. ft.	*Percent*	*Million bd. ft.*	*Million bd. ft.*
Public:				
National forest	187	1.3	.....	187
State	380	2.6	36	344
County and municipal	88	.6	31	57
Total public	655	4.5	67	588
Private:				
Farm	8,737	60.8	5,749	2,988
Industrial and other	4,982	34.7	1,302	3,680
Total private	13,719	95.5	7,051	6,668
All ownerships	14,374	100.0	7,118	7,256
Percent	100.0		49.5	50.5

TABLE 9 — *Net board-foot volume on commercial forest area by species and physiographic region, Ohio 1952*

Species	State total		Glaciated region		Hill country	
	Million bd. ft.	*Percent*	*Million bd. ft.*	*Percent*	*Million bd. ft.*	*Percent*
Pine	229	1.6	12	5	217	95
Other softwoods	110	.8	47	43	63	57
White oak	1,729	12.0	602	35	1,127	65
Chestnut oak	577	4.0	26	5	551	95
Other white oaks	351	2.4	287	82	64	18
Black oak	993	6.9	231	23	762	77
Northern red oak	1,093	7.6	526	48	567	52
Scarlet oak	523	3.6	79	15	444	85
Other red oaks	237	1.7	223	94	14	6
Hickory	1,059	7.4	480	45	579	55
Ash	742	5.1	521	70	221	30
American elm	1,375	9.6	1,176	86	199	14
Slippery elm	366	2.5	205	56	161	44
Cottonwood	124	.9	114	92	10	8
Yellow-poplar	821	5.7	177	22	644	78
Sugar maple	862	6.0	632	73	230	27
Soft maple	644	4.5	410	64	234	36
Sycamore	379	2.6	271	72	108	28
Beech	842	5.9	470	56	372	44
Black walnut	254	1.8	109	43	145	57
Other hardwoods	1,064	7.4	520	49	544	51
All species	14,374	100.0	7,118	.....	7,256	.....
Percent	100		50		50	

TABLE 10 — *Net board-foot volume on commercial forest area by tree-diameter class and physiographic region, Ohio, 1952*

Tree-diameter class (inches)	State total		Glaciated region		Hill country	
	Million bd. ft.	*Percent*	*Million bd. ft.*	*Percent*	*Million bd. ft.*	*Percent*
10	93	0.6	8	0.1	85	1.2
12-14	5,348	37.2	2,054	28.9	3,294	45.4
16-18	3,965	27.6	1,924	27.0	2,041	28.1
20-22	2,465	17.1	1,513	21.2	952	13.1
24-26	1,359	9.5	880	12.4	479	6.6
28+	1,144	8.0	739	10.4	405	5.6
Total	14,374	100.0	7,118	100.0	7,256	100.0
Percent	100	.....	50	.....	50	.....

TABLE 11 — *Net board-foot volume on commercial forest area by species and stand-size class, Ohio, 1952*

Species	Total		Large sawtimber stands	Small sawtimber stands	Pole-timber stands	Seedling & sapling stands	Nonstocked and other areas
	Million bd. ft.	*Percent*	*Million bd. ft.*	*Million bd. ft.*	*Million bd. ft.*	*Million bd. ft.*	*Million bd. ft.*
Pine	229	1.6	17	147	61	4	.....
Other softwoods	110	.8	77	29	3	1	.....
White oak	1,729	12.0	1,046	517	140	25	1
Chestnut oak	577	4.0	201	341	33	2	.....
Other white oaks	351	2.4	270	56	24	1	.....
Black oak	993	6.9	583	331	78	(1)	1
Northern red oak	1,093	7.6	799	206	79	8	1
Scarlet oak	523	3.6	196	252	72	2	1
Other red oaks	237	1.7	122	87	26	2	.....
Hickory	1,059	7.4	629	312	113	4	1
White ash	692	4.8	452	184	52	1	3
Black ash	50	.3	32	11	7	.....	.....
American elm	1,375	9.6	975	271	112	11	6
Slippery elm	366	2.5	243	86	36	.....	1
Cottonwood	124	.9	92	24	5	3	.....
Yellow-poplar	821	5.7	462	208	142	9	.....
Sugar maple	862	6.0	683	119	55	5	.....
Soft maple	644	4.5	465	139	35	5	.....
Sycamore	379	2.6	302	43	30	4	.....
Beech	842	5.9	731	72	37	1	1
Black walnut	254	1.8	122	74	55	3	.....
Post species	66	.5	26	18	20	1	1
Other hardwoods	998	6.9	573	255	157	13	.....
All species	14,374	100.0	9,098	3,782	1,372	105	17
Percent	100.0		63.3	26.3	9.6	0.7	0.1

[1]Less than 0.5 million board feet.

TABLE 12 — *Net board-foot volume on commercial forest area by species and tree-diameter classes, Ohio, 1952*

Species	Total	Tree-diameter classes (inches)					
		10	12-14	16-18	20-22	24-26	28+
Pine	229	79	102	37	.....	11	.....
Other softwoods	110	14	40	32	17	7	.....
White oak	1,729	.....	622	417	221	163	306
Chestnut oak	577	.....	335	181	44	16	1
Other white oaks	351	.....	92	74	61	52	72
Black oak	993	.....	345	282	177	136	53
Northern red oak	1,093	.....	221	258	242	163	209
Scarlet oak	523	.....	242	154	81	38	8
Other red oaks	237	.....	97	78	37	7	18
Hickory	1,059	.....	584	302	137	21	15
White ash	692	.....	299	202	124	41	26
Black ash	50	.....	21	17	8	4	.....
American elm	1,375	.....	408	387	270	164	146
Slippery elm	366	.....	172	111	41	23	19
Cottonwood	124	.....	19	35	50	15	5
Yellow-poplar	821	.....	324	257	112	86	42
Sugar maple	862	.....	282	227	230	98	25
Soft maple	644	.....	211	173	137	70	53
Sycamore	379	.....	90	61	82	71	75
Beech	842	.....	161	281	242	119	39
Black walnut	254	.....	146	81	25	2	.....
Post species	66	.....	43	21	2	.....	.....
Other hardwoods	998	.....	492	297	125	52	32
All species	14,374	93	5,348	3,965	2,465	1,359	1,144
Percent	100.0	.6	37.2	27.6	17.1	9.5	8.0

TABLE 13 — *Hardwood sawtimber volume by log grades and physiographic region, Ohio 1952*

Region	Total	Log grade 1		Log grade 2		Log grade 3	
	Million bd. ft.	*Million bd. ft.*	*Percent*	*Million bd. ft.*	*Percent*	*Million bd. ft.*	*Percent*
Glaciated	7,059	929	13.2	663	9.4	5,467	77.4
Hill Country	6,976	516	7.4	743	10.6	5,717	82.0
State	14,035	1,445	10.3	1,406	10.0	11,184	79.7

TABLE 14 — *Hardwood sawtimber volume by log grades and tree diameter class, Ohio, 1952*

Tree-diameter class (inches)	Total		Tree-diameter class					
			Log grade 1		Log grade 2		Log grade 3	
	Million bd. ft.	*Percent*	*Million bd. ft.*	*Percent*	*Million bd. ft.*	*Percent*	*Million bd. ft.*	*Percent*
12-14	5,206	100.0	.....	.....	168	3.2	5,038	96.8
16	2,237	100.0	133	6.0	354	15.8	1,750	78.2
18+	6,592	100.0	1,312	19.9	884	13.4	4,396	66.7
Total	14,035	100.0	1,445	10.3	1,406	10.0	11,184	79.7

TABLE 15— *Net cubic-foot volume of growing stock on commercial forest area by species and physiographic region, Ohio 1952*

Species	State total		Glaciated region		Hill country	
	Million cu. ft.	*Percent*	*Million cu. ft.*	*Percent*	*Million cu. ft.*	*Percent*
Pine	68.4	100	2.0	2.9	66.4	97.1
Redcedar	2.8	100	.1	3.6	2.7	96.4
Other softwoods	21.7	100	10.3	47.5	11.4	52.5
White oak	426.3	100	116.8	27.4	309.5	72.6
Chestnut oak	195.2	100	5.2	2.7	190.0	97.3
Other white oaks	85.8	100	66.3	77.3	19.5	22.7
Black oak	241.6	100	47.5	19.7	194.1	80.3
Northern red oak	229.1	100	107.7	47.0	121.4	53.0
Scarlet oak	123.6	100	14.8	12.0	108.8	88.0
Other red oaks	63.5	100	58.0	91.3	5.5	8.7
Hickory	366.7	100	150.8	41.1	215.9	58.9
White ash	213.5	100	136.9	64.1	76.6	35.9
Black ash	15.9	100	11.3	71.1	4.6	28.9
American elm	353.0	100	291.7	82.6	61.3	17.4
Slippery elm	123.0	100	64.9	52.8	58.1	47.2
Cottonwood	23.3	100	21.6	92.7	1.7	7.3
Yellow-poplar	202.8	100	35.5	17.5	167.3	82.5
Sugar maple	212.5	100	136.7	64.3	75.8	35.7
Soft maple	188.5	100	103.3	54.8	85.2	45.2
Sycamore	77.9	100	52.1	66.9	25.8	33.1
Beech	175.0	100	93.0	53.1	82.0	46.9
Black walnut	79.3	100	30.8	38.8	48.5	61.2
Post species	69.3	100	23.4	33.8	45.9	66.2
Other hardwoods	337.1	100	156.2	46.3	180.9	53.7
Total	3,895.8	.....	1,736.9	.....	2,158.9	.....
Percent	100	.....	45	.....	55	.....

TABLE 16—*Net cubic-foot volume of growing stock on commercial forest area and by species and tree-diameter class, Ohio, 1952 (million cubic feet, i.e., 000,000 omitted)*

Species	Total	6-8	10	12-14	16-18	20-22	24-26	28+
Pine	68.4	24.8	16.3	19.1	6.4	.....	1.8	.....
Other softwoods	24.5	4.1	3.3	7.6	5.5	2.8	1.2	.....
White oak	426.3	59.9	58.8	118.8	73.6	37.5	27.1	50.6
Chestnut oak	195.2	41.9	44.1	65.4	33.0	7.9	2.7	.2
Other white oaks	85.8	14.1	7.5	18.9	13.4	10.6	8.8	12.5
Black oak	241.6	31.6	31.5	66.2	50.3	30.5	22.6	8.9
Northern red oak	229.1	20.1	19.7	41.8	45.7	40.2	27.3	34.3
Scarlet oak	123.6	14.1	15.5	45.2	27.1	13.8	6.4	1.5
Other red oaks	63.5	11.5	9.3	18.7	13.6	6.4	1.2	2.8
Hickory	366.7	106.1	70.5	109.7	51.9	22.7	3.5	2.3
White ash	213.5	53.7	35.2	56.8	35.4	21.1	6.8	4.5
Black ash	15.9	4.0	2.7	4.3	2.8	1.5	.6	.....
American elm	353.0	61.3	40.1	80.7	70.6	47.0	28.0	25.3
Slippery elm	123.0	31.9	23.5	33.3	19.9	6.8	4.1	3.5
Cottonwood	23.3	.7	.7	3.5	6.4	8.7	2.5	.8
Yellow-poplar	202.8	33.8	28.3	59.7	43.1	17.9	11.1	8.9
Sugar maple	212.5	37.8	23.3	52.9	39.3	38.6	16.3	4.3
Soft maple	188.5	45.3	26.8	40.8	31.1	23.5	12.0	9.0
Sycamore	77.9	6.9	7.1	16.3	10.7	13.2	11.6	12.1
Beech	175.0	15.5	15.7	30.3	47.8	40.3	19.1	6.3
Black walnut	79.3	17.1	14.0	28.9	14.3	4.5	.5	.....
Post species	69.3	40.0	15.7	9.2	4.1	.3	.....	.....
Other hardwoods	337.1	92.2	61.6	94.4	52.6	22.2	8.8	5.3
Total	3,895.8	768.4	571.2	1,022.5	698.6	418.0	224.0	193.1
Percent	100.0	19.7	14.7	26.2	17.9	10.7	5.8	5.0

TABLE 17—*Average volume of growing stock per acre by stand-size class and region, Ohio, 1952*

BOARD-FOOT VOLUME

Stand+size class	State total	Glaciated	Hill country
Large sawtimber stands	5,755	5,999	5,418
Small sawtimber stands	3,444	3,746	3,321
Poletimber stands	694	556	766
Seedling and sapling stands	155	154	155
Nonstocked stands	283	379	194
All classes	2,664	3,246	2,265

CUBIC-FOOT VOLUME

Stand+size class	State total	Glaciated	Hill country
Large sawtimber stands	1,209.1	1,221.7	1,191.7
Small sawtimber stands	1,034.9	1,087.5	1,013.4
Poletimber stands	405.0	371.8	422.4
Seedling and sapling stands	62.6	60.7	63.7
Nonstocked stands	73.3	79.3	67.7
All classes	722.0	792.0	674.0

TABLE 18—*Number of trees on commercial forest land by region and by tree-size and stand-size classes, Ohio, 1952 (thousands of trees, i.e., 000 omitted)*

Tree class	Total	Tree size		Stand size				
		Saw-timber	Pole-timber	Large sawtimber	Small sawtimber	Pole-timber	Seedling & sapling	Non-stocked
THE HILL COUNTRY								
Sound	781,044	57,837	723,207	127,539	178,180	391,775	82,337	1,213
Sound cull	20,355	1,509	18,846	2,680	4,200	9,217	2,219	2,039
Rotten cull	42,295	10,191	32,104	10,246	11,850	18,680	1,062	457
Dead chestnut	1,305	318	987	.....	.....	.....	.....	.....
Other dead	3,224	405	2,819	.....	.....	.....	.....	.....
THE GLACIATED REGION								
Sound	512,460	45,735	466,725	164,120	83,745	209,521	54,788	286
Sound cull	16,458	2,010	14,448	4,630	1,876	8,142	1,580	230
Rotten cull	18,978	6,618	12,360	8,362	4,022	5,670	772	152
Dead chestnut	248	44	204	108	100	24	16	.....
Other dead	2,632	472	2,160	940	806	766	120	.....
THE STATE								
Sound	1,293,504	103,572	1,189,932	291,659	261,925	601,296	137,125	1,499
Sound cull	36,813	3,519	33,294	7,310	6,076	17,359	3,799	2,269
Rotten cull	61,273	16,809	44,464	18,608	15,872	24,350	1,834	609
Dead chestnut	1,553	362	1,191	.....	.....	.....	.....	.....
Other dead	5,856	877	4,979	.....	.....	.....	.....	.....

TABLE 19 — *Average 10-year diameter growth by species and tree-size class, Ohio, 1952*

Species	Seedling and sapling	Pole-timber	Saw-timber
	Inches	*Inches*	*Inches*
Pine	3.08	2.44	1.54
Redcedar	1.60	.....	.80
Other softwoods	2.70	.98	1.40
White oak	1.28	1.40	1.90
Chestnut oak	.94	1.18	1.66
Other white oaks	1.80	2.08	2.00
Black oak	1.50	1.80	2.08
Northern red oak	1.40	1.98	2.30
Scarlet oak	1.18	1.68	2.14
Other red oaks	1.72	2.66	3.04
Hickory	1.20	1.30	1.28
White ash	1.58	1.86	2.16
Black ash	1.24	1.36	2.54
American elm	1.74	2.06	2.16
Slippery elm	1.64	1.66	1.94
Cottonwood	.....	3.20	3.48
Yellow-poplar	2.56	3.12	3.06
Sugar maple	1.22	1.72	1.74
Soft maple	1.86	2.12	2.18
Sycamore	2.90	1.40	2.38
Beech	1.24	1.44	1.70
Black walnut	2.32	2.20	1.88
Post species	1.82	1.70	2.04
Other hardwoods	1.74	2.04	2.04
Average all species	1.64	1.82	2.02

TABLE 20 — *Average annual net board-foot growth by species, expressed as a percentage of sawtimber inventory volume, Ohio, 1951*

Species	Growth on original stand less mortality	Ingrowth	Net growth
	Percent	*Percent*	*Percent*
Pine	4.42	2.82	7.24
Other softwoods	3.43	1.05	4.48
White oak	3.21	1.58	4.79
Chestnut oak	3.14	2.32	5.46
Other white oaks	3.17	1.02	4.19
Black oak	3.76	1.51	5.27
Northern red oak	3.19	1.18	4.37
Scarlet oak	3.78	1.81	5.59
Other red oaks	5.93	3.47	9.40
Hickory	2.71	2.21	4.91
White ash	4.24	2.65	6.89
Black ash	4.00	2.54	6.54
American elm	4.08	1.45	5.53
Slippery elm	3.65	1.95	5.60
Cottonwood	5.78	.93	6.71
Yellow-poplar	7.58	2.87	10.44
Sugar maple	2.78	1.44	4.22
Soft maple	3.50	2.12	5.62
Sycamore	3.13	.85	3.98
Beech	2.67	.58	3.26
Black walnut	4.35	3.46	7.81
Post species	4.30	6.75	11.05
Other hardwoods	3.97	2.91	6.88
Average all species	3.74	1.87	5.61

TABLE 21 — *Number of sound trees on commercial forest land by species and tree-diameter class, Ohio, 1952 (thousands of trees, i.e., 000 omitted)*

Species	Total	Tree-diameter class in inches								
		2	4	6	8	10	12-14	16-18	20-22	24+
Pine	48,752	20,509	13,803	8,068	3,305	1,732	1,114	202	.....	19
Redcedar	5,032	1,806	2,251	558	333	47	25	12	.....	.....
Other softwoods	3,033	969	483	379	381	294	350	132	35	10
White oak	88,101	25,798	18,486	14,202	9,746	7,551	8,069	2,558	857	834
Chestnut oak	42,781	10,265	8,822	7,160	5,699	5,034	4,384	1,170	199	48
Other white oak	17,821	3,332	5,292	3,449	2,147	987	1,570	539	238	267
Black oak	35,205	8,308	7,026	4,649	4,625	3,594	4,287	1,674	631	411
Northern red oak	25,657	8,378	3,412	3,561	2,712	2,142	2,507	1,510	768	667
Scarlet oak	16,244	2,890	3,328	2,554	1,815	1,759	2,673	853	266	106
Other red oak	22,697	8,690	7,415	2,551	1,198	958	1,231	474	146	34
Hickory	167,535	75,708	38,953	22,853	13,137	8,152	6,667	1,582	417	66
White ash	73,515	31,521	14,257	11,489	6,900	4,141	3,528	1,117	433	130
Black ash	3,841	1,087	800	781	471	287	272	96	34	13
American elm	118,111	44,586	30,481	16,810	9,700	5,790	6,253	2,709	1,093	689
Slippery elm	42,245	16,340	9,374	6,509	4,192	2,627	2,229	716	146	112
Cottonwood	925	67	.....	74	115	70	195	208	154	42
Yellow-poplar	48,191	22,546	8,360	5,755	4,105	2,856	3,034	1,091	277	167
Sugar maple	96,273	54,359	18,499	10,072	4,837	2,801	3,394	1,255	770	286
Soft maple	77,448	34,126	19,767	10,018	5,675	3,145	2,760	1,133	521	303
Sycamore	6,291	1,672	288	1,028	936	717	951	270	201	228
Beech	33,434	13,973	7,005	3,604	2,111	1,878	2,147	1,536	867	313
Black walnut	15,317	2,901	2,123	2,738	2,956	1,855	2,072	541	121	10
Post species	101,921	53,214	28,906	11,925	5,001	1,891	766	208	10	.....
Other hardwoods	203,134	117,013	38,073	21,215	11,188	7,075	6,145	1,760	488	177
All species	1,293,504	560,058	287,204	172,002	103,285	67,383	66,623	23,345	8,672	4,932
Trees per forest acre	239.7	103.8	53.2	31.9	19.1	12.5	12.3	4.3	1.6	.9

TABLE 22 — *Net board-foot volume on commercial forest area by forest type and physiographic region, Ohio, 1952*

Forest type	State total		Glaciated region	Hill country
	Million bd. ft.	*Percent*	*Million bd. ft.*	*Million bd. ft.*
White-red-jack pine	23	0.1	.....	23
Loblolly-shortleaf pine	116	.8	.....	116
Oak-pine	111	.8	24	87
Oak-hickory	8,086	56.2	2,685	5,401
Oak-gum-cypress	125	.9	125	.....
Elm-ash-cottonwood	3,431	23.9	2,675	756
Maple-beech-birch	2,482	17.3	1,609	873
Total	14,374	100.0	7,118	7,256

Standard Summary Tables

As each State throughout the Nation is reported upon by the Forest Survey, a standard set of tables presenting information on forest area, ownership, timber volume, growth and drain will be presented. With such tables, forest statistics for any region or group of States can easily be compiled. Standard tables prepared for the State of Ohio, based on the 1949 survey, appear on the following pages.

TABLE 23 — *Land area, by major classes of land, Ohio 1952*

Class of land	Area	
	Thousand acres	*Percent*
Forest:		
Commercial	5,396	20.6
Noncommercial		
Productive—reserved from commercial timber use	50	.2
Total forest land	5,446	20.8
Nonforest land	20,794	79.2
Total, all classes	26,240	100.0

TABLE 24 — *Commercial forest land area, by ownership and stand-size classes, Ohio, 1952*

Ownership	Total	Large sawtimber stands	Small sawtimber stands	Pole-timber stands	Seedling & sapling stands	Non-stocked and other areas
	Thousand acres	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*
Federal:						
National Forest	88	7	35	33	10	3
Indian	0	0	0	0	0	0
Other	(1)	.....	(1)	.....	.....	.....
Total	88	7	35	33	10	3
State	169	25	62	60	22	(1)
County & municipal	40	7	13	14	6	.....
Private:						
Farm	3,047	989	526	1,116	382	34
Industrial & other	2,052	553	462	755	259	23
Total	5,099	1,542	988	1,871	641	57
All ownerships	5,396	1,581	1,098	1,978	679	60

[1]Less than 500 acres or 0.5 percent.

TABLE 25 — *Area of commercial forest land by major forest types, Ohio, 1952*

Forest type	Thousand acres
White-red-jack pine	8
Loblolly-shortleaf pine	108
Oak pine	106
Oak-hickory	3,133
Oak-gum-cypress	57
Elm-ash-cottonwood	1,334
Maple-beech-birch	642
Aspen-birch	8
All types	5,396

TABLE 26 — *Net volume of live sawtimber and growing stock on commercial forest land by stand-size class, Ohio, 1952*

Stand-size class	Sawtimber	Growing stock
	Million bd. ft.	*Million cu. ft.*
Sawtimber stands	12,880	3,047.9
Poletimber stands	1,372	801.0
Seedling & sapling stands	105	42.5
Nonstocked and other areas	17	4.4
All classes	14,374	3,895.8

TABLE 27 — *Net volume of live sawtimber and growing stock on commercial forest land by ownership class, Ohio, 1952*

Ownership class	Volume	
	Sawtimber	Growing stock
	Million bd. ft.	*Million cu. ft.*
National forest	187	57.6
State	380	114.7
County & municipal	88	26.4
Private:		
Farm	8,737	2,275.5
Industrial & other	4,982	1,421.6
Total	13,719	3,697.1
All ownerships	14,374	3,895.8

TABLE 28 — *Net volume of live sawtimber and growing stock on commercial forest land by species, Ohio, 1952*

Species	Sawtimber	Growing stock
	Million bd. ft.	*Million cu. ft.*
Softwoods:		
Pine	229	68.4
Other eastern softwoods	110	24.5
Total softwoods	339	92.9
Hardwoods:		
White oaks	2,306	621.5
Red oaks	1,093	229.1
Other white oaks	351	85.8
Other red oaks	1,753	428.7
Sugar maple	862	212.5
Soft maple	644	188.5
Beech	842	175.0
Ash	742	229.4
Hickory	1,059	366.7
Cottonwood	124	23.3
Yellow-poplar	821	202.8
Black walnut	254	79.3
Other eastern hardwoods	3,184	960.3
Total hardwoods	14,035	3,802.9
All species	14,374	3,895.8

TABLE 29 — *Net volume of all timber on commercial forest land by class of material and species group, Ohio, 1952 (in million cubic feet)*

Class of material	Total	Softwoods	Hardwoods
Growing stock:			
Sawtimber:			
Sawlog portion	2,236.4	55.9	2,180.5
Upper stem portion	339.4	8.1	331.3
Total sawtimber	2,575.8	64.0	2,511.8
Poletimber trees	1,320.0	28.9	1,291.1
Total growing stock	3,895.8	92.9	3,802.9
Other material:			
Sound cull trees	140.7	1.7	139.0
Rotten cull trees	297.0	1.5	295.5
Hardwood limbs	906.4	.....	906.4
Salvable dead trees	.....	.....	.....
Total other material	1,334.1	3.2	1,340.9
Total all timber	5,239.9	96.1	5,143.8

TABLE 30 — *Net volume of live sawtimber on commercial forest land, by diameter class groups and species, Ohio, 1952 (in million cubic feet)*

Species	Tree diameter class (inches)						
	10	12	14	16	18	20+	Total
Softwoods:							
Pine	79	66	36	18	19	11	229
Other eastern softwoods	14	17	23	23	9	24	110
Total softwoods	93	83	59	41	28	35	339
Hardwoods:							
White oaks	.....	513	444	368	230	751	2,306
Other white oaks	.....	44	48	39	35	185	351
Red oaks	.....	104	117	143	115	614	1,093
Other red oaks	.....	320	364	296	218	555	1,753
Sugar maple	.....	139	143	119	108	353	862
Beech	.....	71	90	136	145	400	842
Yellow-poplar	.....	144	180	165	92	240	821
Other eastern hardwoods	.....	1,252	1,233	971	716	1,835	6,007
Total hardwoods	.....	2,587	2,619	2,237	1,659	4,933	14,035
All species	93	2,670	2,678	2,278	1,687	4,968	14,374

TABLE 31 — *Net annual growth, annual mortality, and annual cut of live sawtimber and growing stock on commercial forest land by species group, Ohio, 1952*

Item	Sawtimber			Growing stock		
	Total	Soft-woods	Hard-woods	Total	Soft-woods	Hard-woods
	Million bd. ft.	*Million bd. ft.*	*Million bd. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*
Net annual growth	807	22	785	204.1	8.7	195.4
Annual mortality	25	1	24	8.2	0.2	8.0
Annual cut:						
Timber products	267	2	265	49.0	0.4	48.6
Logging residue	12	.....	12	4.2	.....	4.2
Total	279	2	277	53.2	0.4	52.8

TABLE 32 — *Output of timber products and annual cut of live sawtimber and growing stock, Ohio, 1951*

Product	Output of timber products					Annual cut of sawtimber			Annual cut of growing stock		
	Volume in standard units		Roundwood volume								
	Standard units	Number	Total	Soft-woods	Hard-woods	Total	Soft-woods	Hard-woods	Total	Soft-woods	Hard-woods
			M cubic feet			M board feet[1]			M cubic feet		
Sawlogs	M bd. ft.[1]	218,722	32,777	358	32,419	222,515	2,465	220,050	36,489	408	36,081
Veneer logs and bolts	M bd. ft.	12,298	1,823	.....	1,823	12,884	.....	12,884	2,037	.....	2,037
Cooperage logs and bolts	M bd. ft.	12,560	1,862	.....	1,862	13,158	.....	13,158	2,081	.....	2,081
Pulpwood	Std. cords[2]	[3]32,203	2,006	1	2,005	1,260	.....	1,260	2,006	1	2,005
Fuelwood	Std. cords	[4]324,599	20,427	.....	20,427	19,988	.....	19,988	5,754	.....	5,754
Piling	M linear ft.	36	25	.....	25	154	.....	154	25	.....	25
Poles	M pieces	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Posts	M pieces	4,574	3,607	.....	3,607	5,033	.....	5,033	2,814	.....	2,814
Hewn ties	M pieces	20	79	.....	79	500	.....	500	79	.....	79
Mine timbers	M cu. ft.	1,407	1,407	.....	1,407	.....	.....	.....	1,407	.....	1,407
Miscellaneous[5]	M cu. ft.	[6]493	493	1	492	3,238	.....	3,238	547	1	546
Total	xxxx	xxxx	64,506	360	64,146	278,730	2,465	276,265	53,239	410	52,829

[1]International ¼-inch rule.
[2]Rough wood basis.
[3]Not including wood from mill residues used for pulp and hard boards.
[4]Not including wood from mill residues used for domestic and industrial fuel.
[5]Includes chemical wood, handle stock, farm timbers, etc.
[6]Not including mill residues used for miscellaneous products.

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