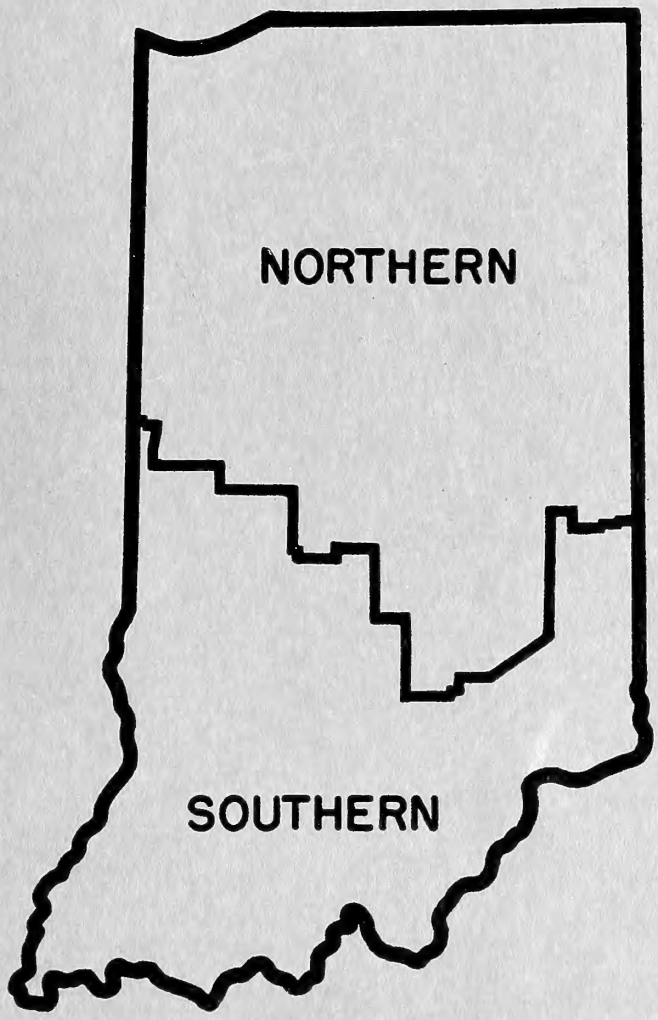
INDIANA'S FOREST RESOURCES *and* INDUSTRIES



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UNITED STATES DEPARTMENT OF AGRICULTURE

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Indiana's Forest Resources and Industries

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CENTRAL STATES FOREST EXPERIMENT STATION

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Preface

THIS REPORT presents the results of a forest survey made in Indiana as part of the national survey of forest resources. Its purpose is to make a field inventory of the present supply of standing timber; to find out how fast it is being increased through growth, and how much it is being diminished by industrial and domestic uses, fire, insects, diseases, and other causes; and to interpret and correlate these findings in formulating private and public forest policies.

The survey was made during the period November 1949 to December 1950. Results of this work show that Indiana has more timber than previously estimated. Because the present survey standards and procedures are not comparable with those used in previous estimates, it is not known how much of the increase is due to growth. The statistics that follow, however, indicate that Indiana timber stands are now growing faster than they are being cut, but the quality is declining.

Contents

Highlights of Indiana Forests

Indiana has 4.1 million acres of forests.—Although this area represents only 18 percent of the State's total land, the forests are so distributed that farmers, urban dwellers, and wood-using industries all benefit greatly from them. All forest land is available for growing and harvesting commercial timber except 58,000 acres, chiefly in parks and recreation areas, which are reserved from cutting.

Ninety-five percent of the commercial forest area is privately owned.—More than 100,000 farmers own 2.9 million acres of forest land, mostly in tracts of 10 to 25 acres. These tracts, although too small to manage effectively as separate commercial enterprises, contribute appreciably to individual farm needs. From their woodlands farmers get lumber, fence posts, poles, fuelwood, and other products valued at more than 7 million dollars annually. Other private forest lands total 0.9 million acres. The Federal Government owns 163,000 acres of forest land divided between the Wayne-Hoosier National Forest and military reservations. Other public forests include 93,000 acres in State parks and forests and 2,000 acres in county and community forests.

The forests support 2.8 billion cubic feet of growing stock.—Ninety-nine percent of this stock is in hardwood species. Poletimber trees make up 32 percent of the growing stock, and sawtimber trees account for the other 68 percent.

Sawtimber totals 11 billion board-feet (International ¼-inch Log Rule).—More than 50 percent of the area supports 1,500 board-feet or more per acre and by definition is classed as sawtimber stands. More than 90 percent of the board-foot volume is in sawtimber stands; the other 10 percent is scattered in stands having less than 1,500 board-feet per acre. Of the sawtimber volume, oaks comprise about 40 percent, other hard hardwoods another 30 percent, and soft hardwoods the remaining 30 percent. Softwoods account for less than one-half percent of the sawtimber volume.

Stands in general are understocked and of poor quality.—Although large sawtimber stands average nearly 5,800 board-feet per acre and the small sawtimber stands more than 3,000, the quality is low. Only 14 percent of the hardwood sawtimber volume is in high-quality logs (grades 1 and 2) that yield veneer, high-grade lumber, handle stock, and other high-quality wood products. Not included in the sawtimber volume but certainly contributing to the low quality of the stands is the large number of cull trees. About 1 of every 6 sawtimber-size trees is a cull. The stands average nearly 11 cull poletimber and sawtimber trees per acre.

Even though only about half the annual sawtimber growth is being harvested, the quality of the stands continues to decline, largely because most users seek high-quality logs and too much growth is laid on by low-quality trees. The cut of high-quality logs amounts to about 117 million board-feet, while the growth of high-quality material is only about 85 million board-feet annually.

Indiana has more than 1,000 sawmills.—Most of them are small; only about 30 cut a million board-feet or more each year. There are also more than 30 veneer plants, about 10 cooperage-stock mills, and several handle plants. Besides the primary plants, the State has about 650 manufacturing plants. In 1948 about 450 million board-feet of lumber, veneer, and bolts was used in manufacturing, but only about 250 million board-feet of this was native hardwoods. These plants employ more than 30,000 workers and have an annual payroll of more than $70,000,000.

The overall condition of Indiana forests is above average for the Central States region.—Even so, there is room for improvement. Using a large amount of high-quality logs, Indiana can well afford to adopt a forest management program aimed at growing more high-quality timber than at present and giving the better sites first priority for management. Greater stress could be placed on the fundamental requirements of good forest management, i. e., better cutting practices to eliminate the cull trees from the stands; cutting practices that will allow more small-diameter trees to grow to large diameter and high quality before harvesting; and better protection from fire, grazing, insects, and diseases. Improved marketing and utilization, and the use by new industries of low-grade material could help to improve the condition of the forests.

The occurrence of considerable timber in small tracts and the reluctance of owners to use good woods practices are obstacles to managing and utilizing effectively much timber in Indiana. Continued research is needed in all phases of the forest program as well as continued effort in interpreting the findings to timber owners and users.

Contribution of Forests to Indiana's Development

INDIANA is an agricultural and industrial State. Before settlement, forests covered about nine-tenths of the land, but now only about one-fifth is forested. To appreciate the part that forests have played in the development of Indiana and the place that forests have in the present economy, it is necessary to know something about the land, the climate, and the people.

Land and Climate

Indiana is one of the smaller States in the Union, covering but 36,205 square miles of land, 86 square miles of inland lakes and streams (*7*),[1] and 230 square miles of Lake Michigan (*2*). Most of the land surface is gently rolling, tillable, and well suited to growing cultivated crops. However, about 6,000 square miles in the southern part of the State is unglaciated (fig. 1), rough, and rather hilly; soils are thinner and less fertile than in the northern part and erode seriously when not protected by vegetation. It is in this section that some large, contiguous forest areas are still found. Several counties are more than half forested.

Some previously cleared land has been allowed to revert to forest, and additional areas are continually reverting as better land-use practices are adopted on hill farms. Thus in the southern part of the State, forest areas are not only larger but will probably remain about the same size as they are now (fig. 2). Rural people depend upon off-the-farm work, much of which can be provided by logging operations and small woodworking plants.

All the northern region was glaciated throughout which forests now occur mainly as farm woods, occupying poorly drained soils, stony moraines, steep slopes, and stream margins. The forests of this region are more scattered and on the average are in smaller tracts (fig. 3). The commercial importance of individual tracts is less than that of the more extensive areas in the southern part of the State, although these northern woodlands contain some of the finest hardwood timber remaining in Indiana. Because

FIGURE 1.—*Northern and southern Indiana, as referred to in this report, are roughly divided by the boundary of the Wisconsin glacier, which covered all but about 6,000 square miles of the State.*

of the level, tillable land of this region and the deep, fertile soils, the forest area is not likely to be increased much.

The climate is favorable for growing trees as well as for cultivated crops. The growing season averages about 170 days. Rainfall is fairly well distributed throughout each month, and the total averages about 42 inches per year. The State is located in the path of prevailing westerly winds and occasional cyclonic storms. Therefore, farmers value strips of timber and small woodlands as windbreaks and for livestock shelter, as well as for the wood products obtained.

[1] Italic numbers in parentheses refer to Literature Cited, page 29.

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FIGURE 2.—*Southern Indiana has wide expanses of forests broken only by small fields in the valleys.*

Settlement and Development

Pioneers began arriving in Indiana from the Eastern States early in the 19th century. Travel was easiest on streams and so the first settlements were along the Ohio and Wabash Rivers. To the pioneer timber indicated good soil. Because the hills were both forested and well drained, the pioneers settled the hill country first. Not many years after the forests were cleared from the hill land, serious soil erosion occurred on the steeper slopes. As the thin soils lost their fertility, the pioneers cleared other land. The limited prairie area of Indiana was the last to be settled because the productivity of prairie soils was not understood and forested areas were preferred (*3*).

About 1½ million people now make up the State's labor force. Approximately 25 percent of this force resides in the southern half of the State, and much of the unemployment has occurred in the more heavily forested southern portion.

Agriculture

Indiana has 19.7 million acres in farms: about 56 percent in crops, 18 percent in pasture, 15 percent in woodland (*8*), and 11 percent in roads, house lots, cropland not harvested or pastured, and wasteland.

There has been little change in land use in the State during the last 25 years. However, some shifting of farm population and a gradual increase in the size of farms has occurred. In 1920 there were 205,000 farms averaging 103 acres each, and in 1950 167,000 farms averaging 118 acres.

Although livestock and cultivated crops account for most of the farm income, sales of forest products amounted to 1.6 million dollars in 1950, according to the Census of Agriculture. Sixty-two percent of this income was from the sale of standing timber. More important than sales, however, is the value of fuelwood and fence posts cut for farm use. If farmers were required to purchase these products, the estimated cost would exceed 4 million dollars.

When cultivated some soils of the unglaciated area of southern Indiana erode so rapidly that many farms have been abandoned and are reverting to forest (fig. 4). Even where agriculture is successful, farms do not always provide full-time employment for the operators. Therefore, many operators work part time in other occupations including logging and sawmilling. Thus in 1949, 46,000 farmers worked 100 days or more off the farm. Fifty-nine percent of these farmers operated less than 50 acres of land.

Because livestock production is such an important industry in Indiana, pastureland is in great demand.

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FIGURE 3.—*This scene in Steuben County is somewhat typical of northern Indiana. The better soils have been cleared for crops, and forests remain as small, scattered woodlands and borders along streams.*

Besides the 3.5 million acres of cleared pastureland, farmers use 1.7 million acres of their woodlands for pasture. The Forest Survey found that 12 percent of all forest land is being so heavily grazed that, if such grazing continues, the forest cover will eventually be eliminated.

Mining

The more important minerals produced in Indiana are coal, gas and oil, stone, clay, and sand and gravel. Sand and gravel operations have disturbed an estimated 17,000 to 18,000 acres of land. Gas and oil

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FIGURE 4.—*Southern Indiana has many abandoned and eroded fields, such as this, which would often be better utilized as forest.*

operations disturb very little land. On the other hand, much low-grade lumber is used for construction and temporary roads while developing the oil fields.

Coal mining affects more acreage than mining for other minerals and therefore has more influence on forests. Coal is mined chiefly from a few counties in southwestern Indiana bordering Illinois. The deep coal mines use much roundwood and sawed material for props and shoring. Areas strip-mined for coal (fig. 5) are often suitable for growing timber. The present area stripped for coal amounts to more than 50,000 acres and an additional 1,500 to 2,000 acres are stripped each year. The Indiana Coal Association has planted trees on more than 33,000 acres (fig. 6); another 6,000 acres have restocked to trees naturally; and nearly 6,000 acres have been seeded and restored to pasture or other agricultural use.

Manufacturing and Transportation

Manufacturing has developed rapidly in Indiana since 1900. About 35 percent of the State's income is derived from manufacturing and 10 to 15 percent from farming.

Wood is important in Indiana manufacturing (fig. 7). More than 10 percent of the industries use wood in their products, and many more use wood in crating and shipping. Indiana is noted for its veneer mills and is one of the leading manufacturers of wood furniture. In 1948, Indiana used 447 million board-feet in manufacturing (*5*)—26 percent for furniture and 27 percent for containers (cooperage not included).

The total amount of wood used in manufacturing is less than the annual growth of Indiana's forests, yet only a small amount of it is grown locally. Forests of this State cannot supply much of its requirement for softwood lumber. Indiana has a large number of veneer, furniture, and other manufacturers requiring high-quality hardwood logs, but local forests can supply only part of the oak, walnut, gum, and other specialty woods required by these industries. Although the forest area and timber stands are still adequate to meet home requirements in volume, timber quality has declined so much that these users of high-quality logs must search several States to obtain the logs they want.

The various wood-using industries of this State employ more than 30,000 workers of whom 20,000 are employed in the furniture industry alone.

Indiana has excellent transportation facilities. Timber producers and wood-product manufacturers can

FIGURE 5.—*This area has recently been stripped for coal. Reclamation is being planned by the Indiana Coal Association.* (*Courtesy of Indiana Coal Association.*)

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FIGURE 6.—*This area was planted to trees after being stripped for coal. In a few more years it will be producing usable products such as fence posts, poles, and pulpwood.* (*Courtesy of Indiana Coal Association.*)

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FIGURE 7.—*This assembly line is turning out wooden high chairs—one of many products manufactured from wood in Indiana.*

easily reach local and national markets by rail, truck, or water.

In 1950 the State had 2.5 miles of road for each square mile of land area. At that time only 8,894 miles of State roads were unsurfaced. The Ohio River is an important carrier of freight and as a result important industries have developed in counties bordering this waterway.

Multiple Land Use

About 85 percent of the land in Indiana is in farms. Some large tracts are managed primarily for mining and other industrial purposes. Other tracts are set aside for urban development or public use. The forested areas—18 percent of the total land area—are especially well suited to multiple land use (fig. 8), including such uses as timber production, watershed protection, food and shelter for wildlife, and recreation.

Watershed protection and water storage are high priority uses of forest land. Good forest cover helps to prevent soil erosion, and thereby sedimentation in the reservoirs is reduced. Forests also increase the water-storing capacity of the watershed and regulate the flow of water into streams. It is important that as much rainfall as possible infiltrate the soil to maintain a uniform ground water level and an even flow of usable water in streams. Well-managed forests improve the porosity of the soil so that rainfall enters more readily.

Thousands of hunters visit the forests annually in search of game of many kinds. In 1951 hunters took nearly 4 million game animals and birds in Indiana. The State has a deer herd of about 5,500. Some 12,000 hunters killed 1,500 deer during the 3-day season of 1951.

Forests are ideal places to establish recreation areas. Of the half million acres of publicly owned land in Indiana, about half is forested. This land includes a national forest, 18 State parks, and 13 State forests. So many people visit these public areas annually to hunt, fish, hike, picnic, and visit historic sites that the Indiana Division of Forestry spends about one-third of its manpower and funds on recreational work. Even so, the public-use areas and facilities on State forests are inadequate for the number of people that use them. There is increasing pressure to develop more forest land for recreational use—preferably forests that will also protect community watersheds.

FIGURE 8.—*Timber, water, and recreation—the needs of many people are being served by this forest area. (Courtesy of Indiana Department of Conservation.)*

Forest Resources

Forest Area and Distribution

THE PRESENT forest area of Indiana is 4,140,000 acres, of which 58,000 have been withdrawn from timber use and 4,082,000 are commercial forest. Seventy-one percent of the forest area lies in the southern part of the State. Forest areas range from 72 percent in Brown County in the south to only 1 percent in Benton County in the prairie area of the north (fig. 9).

Distribution of Indiana's forested areas of the north contrasts sharply with those of the south. The economy of the north includes vast industrial development. Superior glaciated soils produce excellent crops, and the area has retained but small scattered woodlands. The south, hilly and unglaciated, supports extensive areas of forest land, and its economy depends in part on the income derived from its forest products.

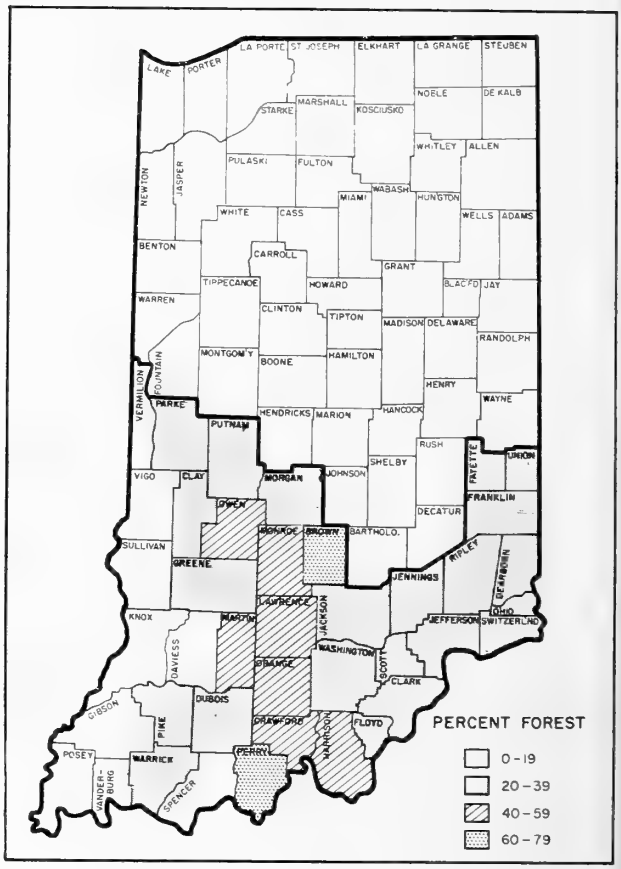

FIGURE 9.—*The most heavily forested counties are in the hilly, unglaciated area of the southern part.*

Ownership

Availability of timber and problems of management are often affected by ownership. For the most part, Federal and State forest holdings are in tracts sufficiently large to furnish commercially important amounts of wood in individual sales. The portion of the Wayne-Hoosier National Forest located in southern Indiana comprised 103,000 forested acres in 1950. The Federal Government has another 60,000 acres of forests in military depots and reservations. Other public forests include 93,000 acres in State parks and forests and 2,000 acres in county and community forests. These forests, of course, have values other than timber.

Private owners are understandably interested in immediate returns and may manage their forests with short-term perspectives to increase their current income. The values they receive are mostly from timber sales, cutting of material for buildings or other home use, grazing, and shelter for livestock. Future productivity of the forest is often sacrificed to increase immediate cash income.

Approximately 3.8 million acres (94 percent) of the commercial forest land is privately owned. Farmers own 2.9 million acres; mining companies, industrial concerns, and numerous small private owners control 0.9 million acres.

About 100,000 of the State's 167,000 farms reported woodland in 1950. The average woodland area per farm was 28.9 acres, but the majority of farms had somewhat less. For example, there are more than one million acres of forest scattered on 59,000 farms—an average of only 17 acres of woodland per farm. These units are unduly small for management as commercial enterprises but are suitable for supplying the farm with material for barns and additional buildings, posts, poles, fuelwood, and other usable products. Currently, however, only a few farm woodland owners are making their forest land produce to the best possible advantage. How to make more farm woods produce more and better timber is a major problem in Indiana forestry.

Area by Timber Types

The Forest Survey classified the forests of Indiana into eight type groups based on species composition. Each of these groups includes several subtypes.

The oak-hickory type (fig. 10) is found on 2.4 million acres or 58 percent of the forest area. In general this large and important type is found on dry upland sites and on less fertile soils than most other types. It includes several subtypes or associated types that are small in area but not minor in importance. Two such are the white oak and yellow-poplar types. Oak forests in which pine makes up 25 to 49 percent of the stand are listed as oak-pine type.

The elm-ash-cottonwood type is found primarily along streams and on poorly drained flats. American elm and green ash are the predominant species of this type. Cottonwood, soft maple, sycamore, and swamp white oak occur commonly as associates. This type occupies 1.0 million acres or 24 percent of the forest area.

The maple-beech-birch type is found on 418,000 acres or 10 percent of the forest area. In northeastern Indiana, sugar maple is its chief component (fig. 11). In the southern part beech is the dominant tree. Very little yellow birch is found in Indiana. The maple-beech-birch type has frequently developed as a resid-

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FIGURE 10.—*A young stand of mixed red and white oak, typical of the oak-hickory type in southern Indiana.*

ual stand, past logging having removed preferred species such as white oak, black walnut, white ash, and yellow-poplar.

The oak-gum-cypress type, comprising 3 percent or 138,000 acres of the forest area, is made up of pin oak flats on poorly drained uplands, and bottom-land stands chiefly along the flood plains of the Wabash and Ohio Rivers. The bottom-land stands contain tupelo, blackgum, sweetgum, some baldcypress, various species of red and white oak, hickories, and many less important species.

The other three types recognized are white-red-jack pine, loblolly-shortleaf pine, and aspen-birch. Except for some native Virginia pine and scattered white and jack pine, the pine is in plantations, the largest of which are in southern Indiana. In this State the pine types will increase in importance because so much pine is being planted each year, and also because some old fields in the southern part are restocking to Virginia pine.

Area by Stand-Size Classes

The size of timber and its volume per acre usually reflect the commercial importance of a stand.

More than half of the 4 million acres of forest land is in sawtimber stands. Two-thirds of this sawtimber area supports large sawtimber, i. e., stands with at least half of the board-foot volume in trees 15 inches diameter breast high or larger. The percentage of area classed as sawtimber is as great or greater than that found in neighboring States.

Poletimber stands occupy 1,337,000 acres or 33 percent of the forest area. Seedling and sapling stands occur on 600,000 acres or 15 percent. Only 61,000 acres or 1 percent of the area is nonstocked.

Although the forests of northern Indiana are more scattered and are in smaller tracts than in the south, they contain a greater percentage of large timber (fig. 12). Sixty-six percent of the northern forest area is sawtimber as compared with about 45 percent in the

FIGURE 11.—*Sugar maple may be found in nearly pure stands in northeastern Indiana where it is often tapped for sap. (Courtesy of Indiana Department of Conservation.)*

southern part. More than four-fifths of the northern sawtimber area contains large sawtimber compared with 25 percent in the south. This difference suggests that the northern stands are not cut as heavily or as often as those of the south and therefore have more valuable, mature timber and a smaller percentage of the forest area in immature stands.

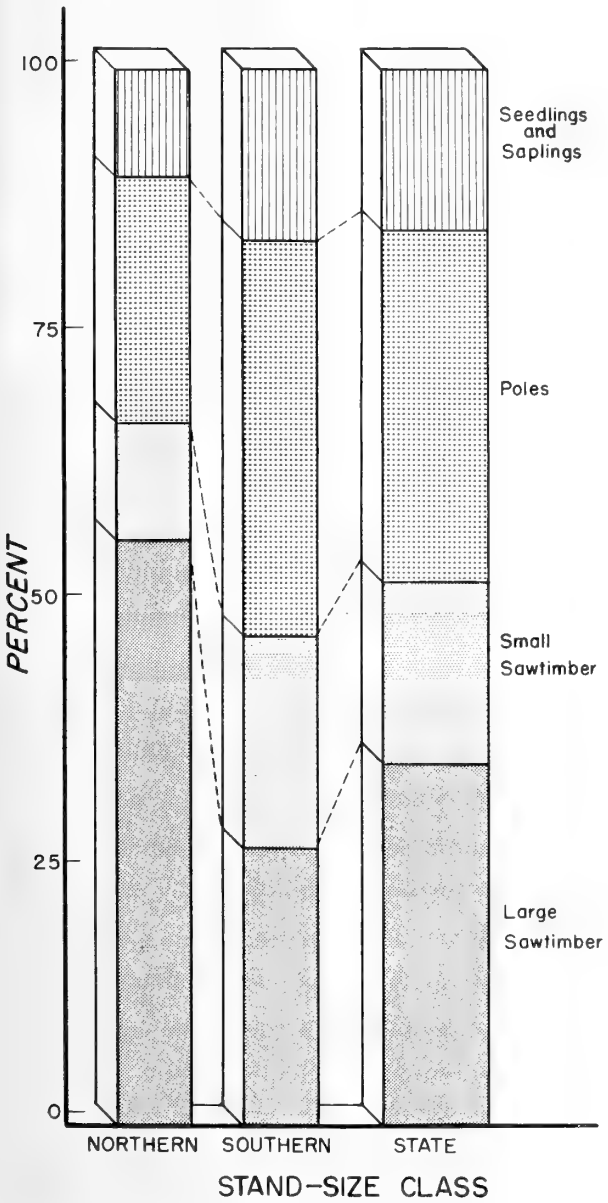

FIGURE 12.—*Northern Indiana has more area in the large sawtimber stand-size class than in all other stand-size classes combined; southern Indiana has only one-fourth of the forest area in this class.*

Stocking

On the basis of number of trees, volume, or basal area, per acre, the forests of Indiana are understocked, and as a whole average 335 sound trees per acre. Of this number 255 or more than 75 percent are saplings (not included in the volume of growing stock), 62 are poles, and 18 are sawtimber size. This number could represent a well-stocked stand if there were a different distribution in size classes. Actually, however, not enough trees are of sawtimber and poletimber size to obtain maximum growth. Stocking was somewhat poorer in northern Indiana than in southern, attributable no doubt to grazing, which has eliminated much of the reproduction. Nearly 24 percent of the forest area in the north is heavily grazed but only 7 percent in the south.

The large sawtimber stands average 1,165 cubic feet per acre, small sawtimber 920, poletimber 372, and seedling-sapling 48.

How much timber a stand in Indiana should support to obtain maximum growth has not been determined. A look at some of Indiana's better stands, however, gives some indication of the amount to be expected on the better sites. Selected sawtimber stands that are well stocked average 9,440 board-feet per acre. There was an average of 1,570 cubic feet of growing stock in 160 trees per acre. The average basal area was 85½ square feet per acre with only 19 percent of the basal area in trees 18 inches d. b. h. and smaller. Even these good sawtimber stands (fig. 13) are only

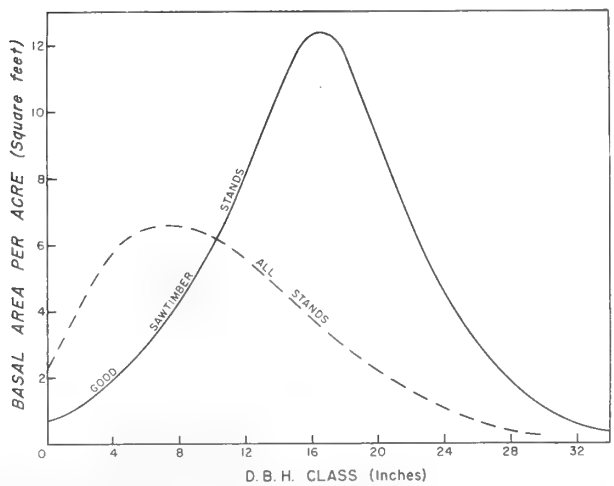

FIGURE 13.—*To obtain more board-foot growth, the basal area distribution for stands on good sites should be more like the distribution shown for good sawtimber stands.*

about 85 percent stocked when compared with normal yield tables. Better sawtimber growth can be obtained by increasing the stocking to a level of that shown by the good sawtimber stands in figure 13.

Area by Site Quality

The ability of forest land to produce timber is called "site quality" and is influenced by such things as chemical and physical properties of soil, topography, climate, elevation, and aspect.

About 1 percent of Indiana's forest area is capable of producing hardwood trees averaging three or more 16-foot logs. About 70 percent of the area is capable of producing mature hardwood trees averaging two 16-foot logs. Twenty-eight percent of the area is capable of producing 1-log trees. Less than 1 percent is capable of producing only ½-log trees.

This site classification is conservative because the dominant trees now growing in the area were frequently used as the site indicator. Areas that have been cut a number of times may have nothing left but the shorter, more poorly formed trees—improved management can produce better trees than these. Moreover, early cultivating, grazing, and burning on land that has since reverted to forest have lowered the site quality of such land.

Board-Foot Timber Volume

The forests of Indiana supported a total of 11 billion board-feet of sawtimber in 1950. With better management and protection the area could probably support 2 to 3 times as much volume. The average volume per acre was about 2,700 board-feet—a better average than that found in other States surveyed thus far in the Central States region. Nearly all the volume is in hardwood species. More pine and other softwoods are being planted every year, but the softwood sawtimber volume amounts only to 51 million board-feet.

The stands average nearly 4,000 board-feet per acre in northern Indiana but only 2,200 board-feet per acre in the southern part of the State. The stands in the north are not cut as often as those in the south. Farming and industry provide enough work and income in the north so that fewer people are compelled to depend upon the forests for income.

Volume by Species

Nearly 40 percent of the sawtimber is made up of oak—chiefly white, black, and northern red oak, all classed as hard hardwoods. Soft hardwoods—elm, cottonwood, yellow-poplar, basswood, blackgum, sweetgum, soft maple, and others—make up about 30 percent of the sawtimber volume. The remaining 30 percent is mostly hickory, ash, sugar maple, and beech.

Regional differences are found in species distribution over the State and in the proportion of each species in the northern and southern parts (fig. 14). Cutting practices as well as climate and soil have greatly influenced the present species distribution. Elm, hickory, beech, and maple predominate in many stands where better species such as white oak, northern red oak, white ash, and yellow-poplar have been cut. Most of the pine in the State grows in southern Indiana.

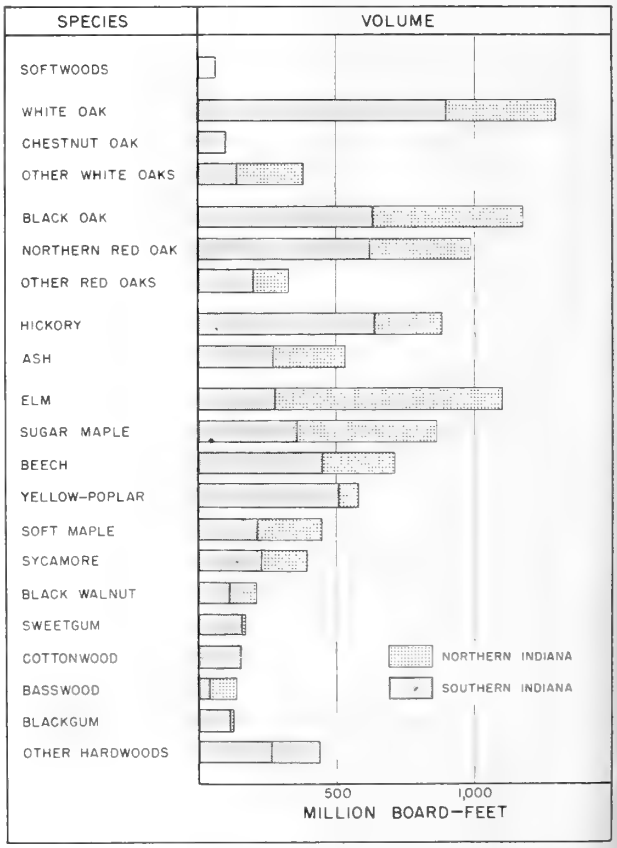

FIGURE 14.—*Net sawtimber volume on commercial forest land by species.*

Volume by Diameter Class

About one-third of the sawtimber volume is in the 12- and 14-inch or smaller diameter classes (fig. 15). Generally, the thrifty, well-formed trees in these small-size classes should be saved to grow a future crop of high-quality logs. Another third is in the

16- and 18-inch diameter classes. These trees have reached the minimum diameter required by some users of quality logs but are now adding quality growth. In fact, the annual diameter growth is usually greater than for smaller trees of the same species because the larger trees are usually vigorous and have reached a dominant position in the stand where their crowns get plenty of light.

The remaining third of the sawtimber volume (nearly 4 billion board-feet) is in the 20-inch and larger diameter classes. These trees are mature or are reaching maturity and as much as possible of the sawtimber harvest should come from them. Northern Indiana has more than half of this volume. More than 90 percent of it occurs in large sawtimber stands.

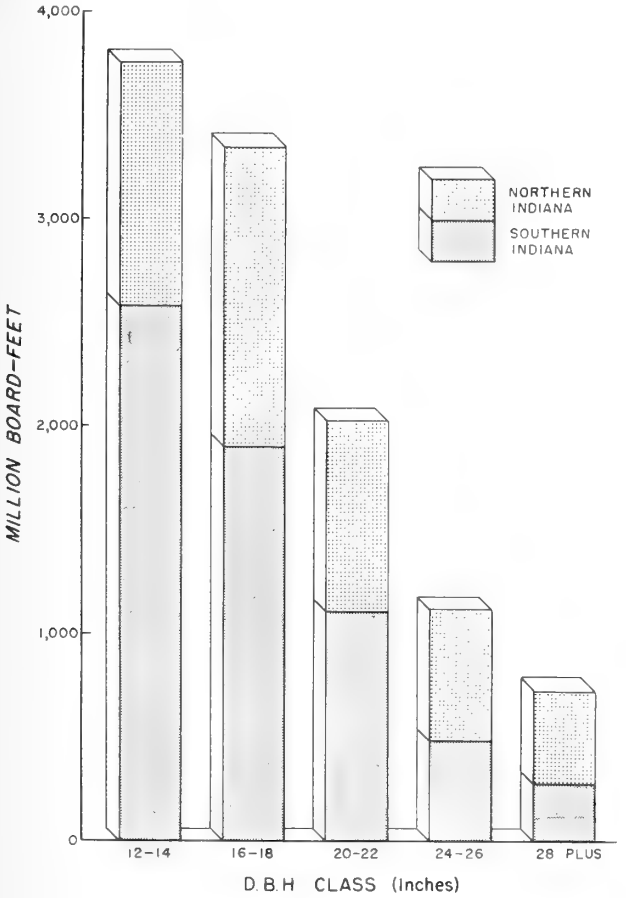

FIGURE 15.—*More sawtimber in large-diameter trees exists in northern Indiana than in the southern part of the State.*

Volume by Stand-Size Class

More than 90 percent of the board-foot volume is in sawtimber stands (fig. 16). Large sawtimber stands have more than 70 percent of the board-foot volume. (Such stands may have as little as 1,500 board-feet per acre but must have at least half the volume in trees 15 inches d. b. h. and larger.) In northern Indiana these stands average more than 6,000 board-feet per acre and in southern Indiana about 5,000.

About 20 percent of the board-foot volume is in small sawtimber stands, most of which are in southern Indiana. Their average volume throughout the State is about 3,000 board-feet per acre.

The large acreage of poles, seedlings, and saplings supports much less than 1,000 board-feet per acre (fig. 17) and totals less than one billion board-feet. Paradoxically, the "nonstocked" stands average more than 1,000 board-feet per acre in northern Indiana. These stands are classified nonstocked because they have less sawlog volume than the Forest Survey requires for the sawtimber classification, and heavy grazing and fire have prevented the establishment of

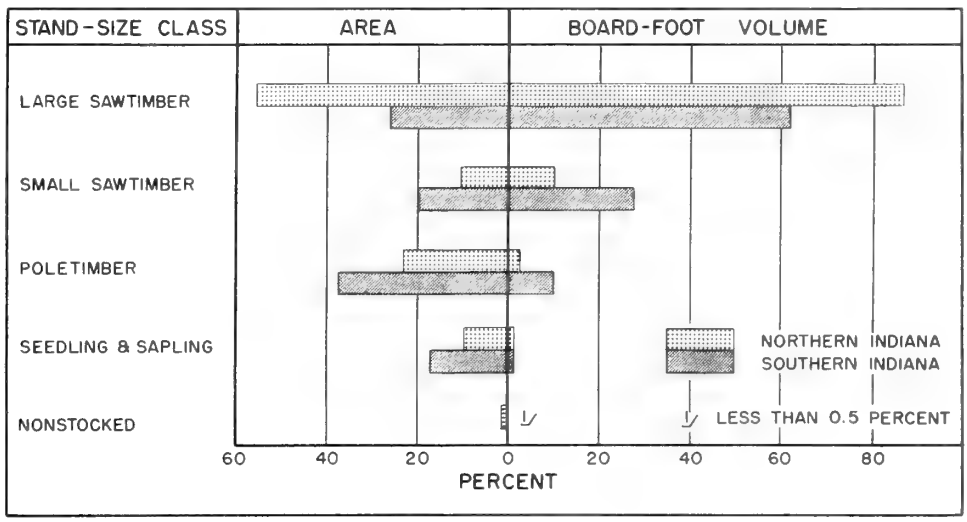

FIGURE 16.—*A larger percentage of sawtimber volume in sawtimber stands exists in northern Indiana than in the southern part of the State.*

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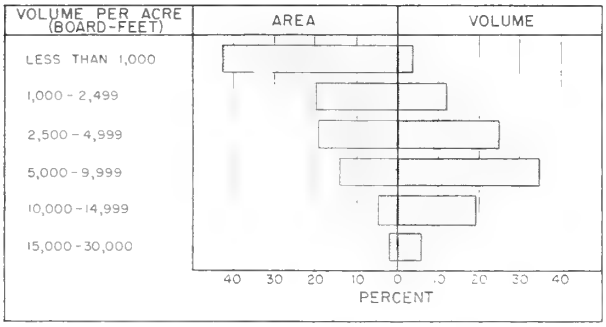

FIGURE 17.—*More than 40 percent of the forest area supports less than 1,000 board-feet per acre; only 19 percent supports 5,000 board-feet or more.*

an understory of seedlings, saplings, and poles. Many of these stands will probably be eliminated as forest land in the future (fig. 18).

Volume by Log Quality

Indiana produces some of the best hardwood timber in the United States. However, the Forest Survey data indicate that only about 14 percent of the entire sawtimber volume and 14 percent of the annual board-foot growth are in the high-quality grade 1 and 2 logs, which are in greatest demand. Eighty-six percent of the hardwood sawtimber volume is in grade 3 logs. These logs are generally cut into railroad ties, timbers, or lumber for use on farms; they are used in oil fields, as car blocking, or where quality is not a requirement. Such logs yield only about 20 percent of their volume in No. 1 Common or better lumber. Past practices—methods of cutting, burning, and grazing—are mainly responsible for the low quality of stands. Improper cutting practices leave undesirable species, poorly formed and cull trees, and those damaged in logging to produce the next crop. Both burning and grazing deteriorate the site, retard tree growth, damage the larger trees, and open the stands by killing reproduction.

Although quality is determined to a large extent by log size, high-quality logs generally come from good sites where growth is rapid, from fairly dense stands that encourage straight stems and self-pruning, and from stands that have not been damaged by improper cutting, grazing, and repeated burning.

More than 80 percent of the high-quality volume is now in trees 18 inches d. b. h. and larger. About one-third of this volume is oak, and the remaining two-thirds is other hardwoods. Northern Indiana has more than half of the high-quality volume (fig. 19) of the State.

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FIGURE 18.—*Indiana has nearly half a million acres of heavily grazed woodlands that are gradually being eliminated from the forest area.*

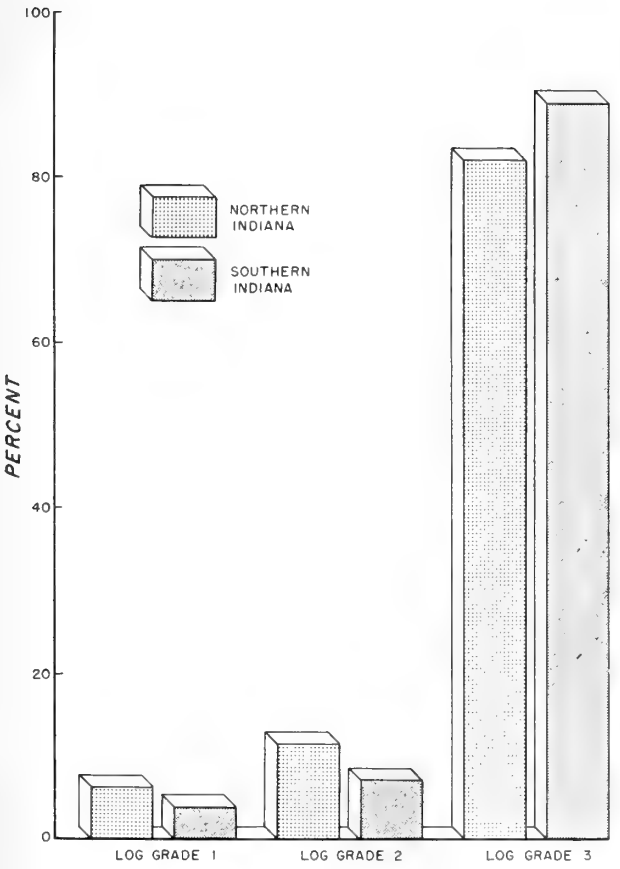

FIGURE 19.—*Comparison of sawtimber volume in northern and southern Indiana by log grades.*

Thirty-nine percent of the low-quality volume is in 12- and 14-inch trees. By survey standards these trees can be low quality because of size alone, and many will improve in quality as they grow larger. However, 44 percent of the low-quality volume is in trees 18 inches d. b. h. and larger. Some of this low-quality volume, of course, is in the upper logs of otherwise high-quality trees. On the other hand, there are many large, poorly formed trees that will never improve in quality. It would be good practice to cut these trees as soon as possible to increase the growth of smaller, potentially high-quality trees, and make way for reproduction.

Volume of Cull Trees

Not included in the low-quality volume of the growing stock but certainly contributing to the low quality of the stands is the large number of cull trees (fig. 20). The stands average nearly 11 cull poletimber and sawtimber trees per acre, 9 of which are rotten. About 1 of every 6 sawtimber-size trees is a cull. Eighty percent of the culls are in southern Indiana. Most of the forest fires occur in this part of the State and greatly affect the condition of the timber. Although cull trees are not considered merchantable, they are estimated to contain 534 million cubic feet of sound wood (including tops and limbs)—about 130 cubic feet per forest acre. This wood is suitable for some uses, but the cost of harvesting it is usually too great. The gross volume of rotten cull trees is 558 million cubic feet—a volume equal to one-fifth of the growing stock.

FIGURE 20.—*Trees like this one were tallied as culls by the Forest Survey because defects indicated that the stems were less than 50 percent sound.*

Growing-Stock Volume

All trees 5 inches d. b. h. and larger that are at least 50 percent sound and of commercial form and species are included in the growing stock. Volume includes the central stem from the stump to a minimum top diameter of 4 inches inside the bark.

Total volume of growing stock.—Total volume of growing stock in 1950 was 2.8 billion cubic feet—683 cubic feet per acre. In Indiana the stands average 858 cubic feet per acre in the north and 613 in the south.

Growing-stock volume by stand size.—The large sawtimber stands average little more than 1,000 cubic feet per acre and contain 58 percent of the growing-stock volume. The small sawtimber stands average about 900 cubic feet per acre and contain 23 percent of the growing stock. Pole stands average 372 cubic feet per acre and have 18 percent of the growing-stock volume. Seedling and sapling and nonstocked stands average 48 and 69 cubic feet per acre respectively and cover the remaining 1 percent.

Growing-stock volume by tree size.—Thirty-two percent of the growing-stock volume is in poletimber trees (fig. 21); 26 percent is in small sawtimber (12 and 14 inches d. b. h.); 20 percent is in 16- and 18-inch sawtimber; and the remaining 22 percent is in trees 20 inches and larger in diameter. If maximum growth is to be obtained, a larger percentage of the growing-stock volume should probably be in 16- and 18-inch trees.

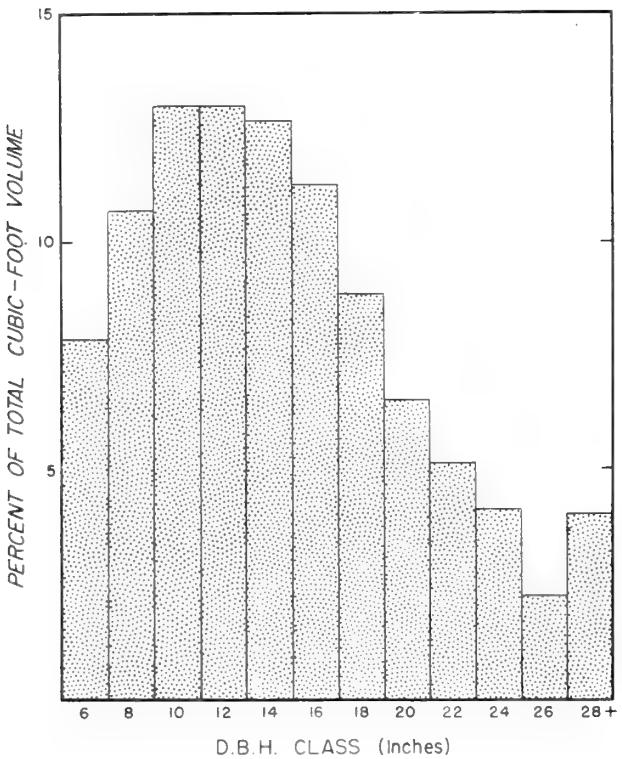

FIGURE 21.—*A high percentage of Indiana's growing stock is in 6- through 14-inch diameter classes. Proper management of the trees in these diameter classes could rapidly improve the stocking and quality of sawtimber stands.*

Total volume of sound wood.—Stands average about 1,027 cubic feet (16 cords) of sound wood per acre in trees 5 inches and larger in diameter including hardwood limbs and cull trees as well as the merchantable stems that are considered growing stock. Limbs alone average about 276 cubic feet (4 cords) per acre.

Timber Growth and Mortality

Sawtimber Growth

The net growth of sawtimber was 551 million board-feet in 1950. Fifty-five percent was growth on trees already of sawtimber size. The remaining 45 percent was ingrowth. Ingrowth is the total board-foot volume of trees that grew into the sawtimber class during the year. The net growth amounted to 5 percent of the sawtimber volume.

Average growth per acre was 185 board-feet in the northern part of the State but only 115 board-feet in the southern part. The better growth in the north indicates the advantage of maintaining a higher volume of growing stock. In both sections the growth probably could be doubled by practicing better forestry. Better protection from fire and grazing would help greatly to improve the stocking of seedlings, saplings, and poletimber. Mortality could be reduced and the growth rate increased by removing defective and slow-growing trees.

To get high-grade logs it is necessary to delay cutting the well-formed trees until they are 16 to 18 inches in diameter or larger. Only 14 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 is in high-quality logs. Since total volume of sawtimber growth could probably be doubled within a few decades by good forestry practices, value might be tripled or quadrupled by increasing the percentage of high-quality sawtimber.

Growth of the Growing Stock

Net growth of stock was 107 million cubic feet, or about 26 cubic feet per acre in 1950. By better stocking and management than used previously, the stands could probably be made to grow as much as 60 to 80 cubic feet per acre annually.

Saplings reaching poletimber size accounted for about 13 percent of the growth. Poletimber, which made up only 32 percent of the growing-stock volume, accounted for 47 percent of the cubic-foot growth. The remaining 48 percent was on sawtimber trees.

On the average, sawtimber trees are growing about 2 inches in diameter in 10 years, poletimber trees about 1¾ inches.

Mortality

Losses of growing stock other than by cutting in 1950 were estimated at 6.2 million cubic feet, which includes 19 million board-feet of sawtimber size. These losses, amounting to less than 1 percent of the growing-stock volume, are not large but occur annually and can be reduced by better protection and management. This waste occurs because some trees die or become susceptible to diseases and insects on account of suppression—competition for light and growing space. Fire (fig. 22) and grazing also kill many trees and damage others leaving wounds where decay fungi and insects can enter. Many trees fall or are broken during wind and ice storms.

In Indiana, timber mortality can be reduced by greater effort to prevent fires. Most fires are preventable because 75 percent of them are caused by smokers or debris burners. The other 25 percent are started by railroads, campers, loggers, and other miscellaneous causes. From 1947 to 1951 an average of 8,000 acres burned annually, but in 1952 nearly 28,000 acres burned. About half of the burned area was timbered.

The Forest Survey crews estimated how much grazing occurred on every forest field plot. An area was "heavily grazed" if (1) grazing had eliminated the reproduction, (2) grass sod was generally established, (3) a distinct grazing line was formed by stock browsing the lower branches, and (4) it appeared that continued grazing at the same intensity would eventually eliminate the forest. Heavy grazing was practiced on 12 percent of the forest land in the State. Almost all forest land shows signs of being grazed at least lightly. However, heavy grazing is most evident in northern Indiana where nearly 24 percent of the forest land was grazed heavily as compared to 7 percent in southern Indiana. When land is managed for timber production, elimination of livestock from the woods is generally desirable.

Diseases and insects, although not now causing noticeable losses but always present in the forests, are more serious than ordinarily recognized. Diseases and insects contribute to the annual tree mortality and reduce the quality and usable portion of many merchantable trees. Rot can be controlled best by protecting the stands from fire and grazing and by cutting the trees when they mature before they become defective. The Dutch elm disease has killed many elm trees, and oak wilt is a threat to the oaks.

Timber Cutting

The volume of timber cut from Indiana forests in 1949 was estimated at 254 million board-feet of sawtimber plus 157,000 cords of poletimber, making

F–393479

FIGURE 22.—*Fire damages the thin bark of many trees and either kills them or causes wounds where decay fungi and insects can enter.*

a total cut of 46½ million cubic feet of growing stock (fig. 23). This volume includes the material that actually went into finished products plus the material of merchantable quality that was cut but unused in logging. It does not include about 20 percent of the wood used in 1949 that came from saplings, dead and cull trees, and scattered trees in fence rows and pastures.

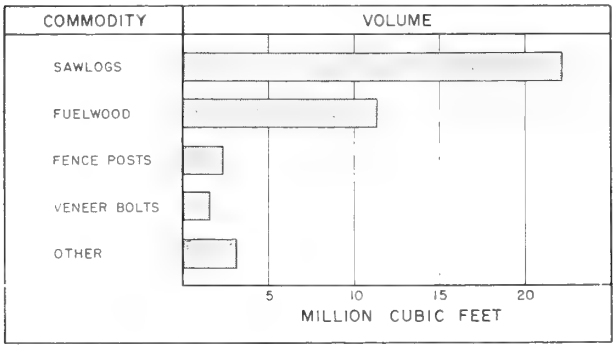

FIGURE 23.—*Eighty percent of the timber cut in Indiana is from sawtimber, 20 percent from poletimber mostly for fuelwood and fence posts.*

The sawtimber cut in 1952 amounted to 269 million board-feet, an increase of 15 million over the 1949 cut. The cut for lumber, veneer, cooperage, etc., has not changed much lately, but recent studies indicate a marked decline in the use of fuelwood.

Sawlogs for lumber accounted for 75 percent or 191 million board-feet (fig. 24) of the sawtimber cut; 14 percent was cut for fuelwood, 5 percent for veneer logs, and the remaining 6 percent for miscellaneous uses. About 32 million board-feet was left in the woods as logging residue. This volume would have been larger except that some timber owners cut part of the logging residue for fuelwood.

Practically all the sawtimber cut was hardwoods; more than one-third was oak. Beech was second in volume cut, followed by maple, yellow-poplar, elm, hickory, sycamore, cottonwood, and black walnut.

At least 40 percent of the volume cut from sawtimber was in high-quality logs (grades 1 and 2). Eighty percent of the high-quality timber was cut for lumber, the remainder for veneer, cooperage, and handle stock. In this class of material, the cut is one-third greater than the growth.

About 13 percent of the volume cut was from trees in the 12- and 14-inch diameter classes, although 34 percent of the stand volume is in these classes. The percentage of volume cut from 16- and 18-inch trees

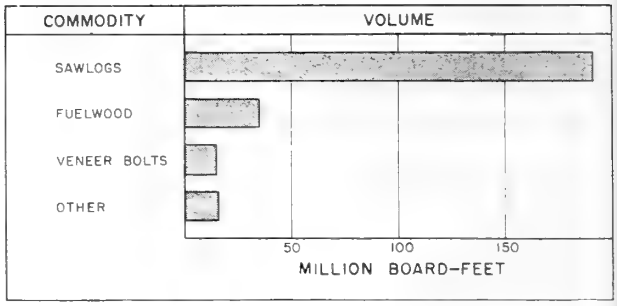

FIGURE 24.—*Most of Indiana's annual sawtimber harvest is sawed into lumber and related products such as timbers, railroad ties, and car blocking.*

was about the same as the occurrence in the stands, but nearly 60 percent of the cut was from 20-inch and larger trees, although only 35 percent of the stand volume is in this class.

Poletimber was cut mostly for fuelwood and fence posts. Forty-five percent of the fence posts cut from poletimber was black locust. There is little if any waste from cutting poletimber. Most of it is utilized in round or split form and does not require milling. Saplings as small as 3 inches in diameter are often utilized for fence posts, and even smaller material is used for fuelwood. Thus when poles are cut for these products, they are often utilized beyond the merchantability standards used by the Forest Survey.

Trends in Timber Volume

The 1949 sawtimber growth (551 million board-feet) exceeded the cut by 297 million board-feet. This increase raised the sawtimber inventory by 2.7 percent, or an average of about 73 board-feet per acre. Because wood-using industries are concentrated in southern Indiana, the cut is heavier in this region and the per-acre increase was not as great as in northern Indiana.

All species except beech are growing faster than they are being cut (fig. 25). More beech is being cut than is growing; this overcutting is a result of its slow growth rate plus a good demand in recent years for beech small-dimension stock. Much of the beech sawtimber is overmature, and there are few pole timber trees coming along to grow into sawtimber. Species such as elm and hickory, which are not in great demand, are increasing very rapidly. The volume of pine is also increasing rapidly because so much of it is in young plantations and is just reaching poletimber size, where it will be included as growing

stock. Cottonwood is being cut about as fast as it grows.

In spite of the surplus of total growth, the sawtimber stands of Indiana are still being depleted of large, high-quality timber. Although the high-quality growth amounted to about 85 million board-feet in 1949, about 117 million board-feet were cut. The industries using sawtimber are harvesting the best trees available because harvesting and manufacturing costs are less per unit of volume, the quality of product is better, and profits are greater.

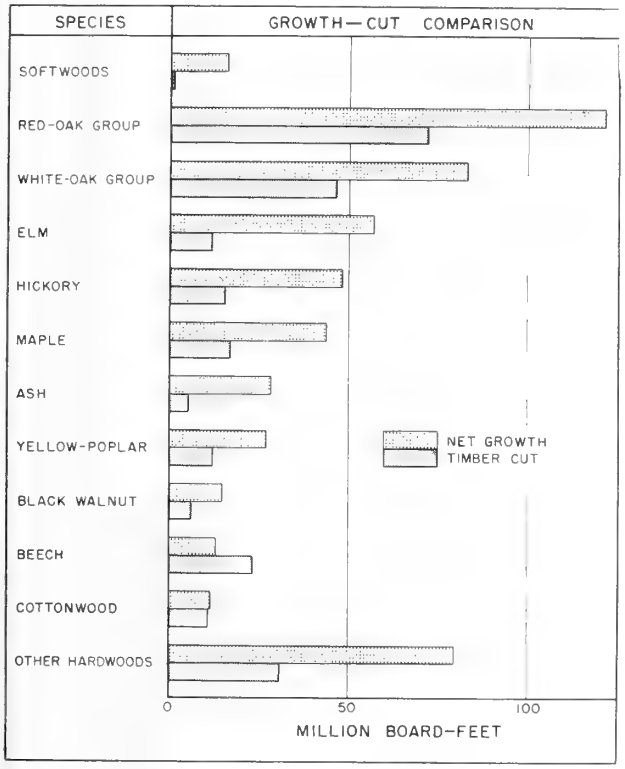

FIGURE 25.—*Growth exceeds the annual cut for all important species.*

The depletion of large, high-quality trees will probably continue, but in time the buildup in young trees can cause an increase in the growth of high-quality volume. At the present rate of increase in sawtimber volume and under the assumption that (1) cutting does not increase, (2) forest management continues at the present level, and (3) catastrophic losses do not occur, the growth of high-quality logs might equal the cut in the next 15 to 20 years. This balance could be achieved in a shorter period through improved cutting practices and efforts by industry to utilize more of the lower quality logs.

Prospects for Indiana Forests

It seems likely that the forest land of Indiana may remain at about the present 4 million acres. Some increase in forest land is expected in southern Indiana as poor cropland is returned gradually to forest, but this increase is likely to be offset in northern Indiana where owners may clear woodlands on the better soils to obtain cropland or may deforest farm woodlands by continued heavy grazing.

The forest land, although understocked, is growing wood at an average annual rate of 135 board-feet per acre. This growth amounts to more than twice the volume used by present primary forest industries. If half the current growth is permitted to accumulate, and if it is assumed that cutting does not increase and that management and protective practices continue at the present rate, there is likely to be a 60-percent increase in sawtimber volume in the next 20-25 years. All diameter classes would increase in volume, though most of the increase would be in the 12- and 14-inch classes. The problem for the near future is one of quality rather than quantity.

To maintain the present wood-using industries requires a continued supply of high-quality wood. If good wood is not available, the industries must either curtail operations, lower their standards, switch to the manufacture of products that can be made from lower quality wood, or import wood from out of State. Thus far, the Forest Survey has found that the volume of high-quality wood is declining in each of the Central States, although the total volume of wood is increasing. However, there will be a tendency for high-quality growth to increase if thrifty pole and young sawtimber trees are permitted to mature before harvesting. Saving growing-stock trees less than 18 inches in diameter, for example, and removing culls and low-quality trees could rapidly improve the quality of the stands.

Timber Use in Indiana

SEVERAL TIMES as much timber is consumed in Indiana as is produced from local forests. For construction of homes and other buildings, the chief demand is for softwoods which are not produced in quantity in the State. Probably less than half of the lumber used is cut within the State. In 1948, manufacturing industries used 450 million board-feet of wood as lumber, veneer, and bolts, but only about 250 million feet of this was native hardwoods. In fact, most users of wood products secure at least part of their wood needs from out-of-State sources.

The Lumber Industry

Indiana was once a leading producer of high-quality hardwood lumber and allied products. About the turn of the century, sawmills in the State cut more than a billion board-feet of lumber annually (fig. 26). However, many of the high-quality hardwood logs were a byproduct of land clearing. As more and more of the land passed from forest to farms, the high production of quality hardwoods could not be maintained.

There are about 1,100 sawmills in the State—about one mill for every 4,000 acres of forest land or one mill for every 2,000 acres of sawtimber.

In Indiana, as elsewhere in the Central States, much of the lumber is produced by small, portable, circular mills (fig. 27). There were only 30 sawmills that cut 1 million board-feet or more in 1947 (fig. 28), yet these few mills sawed 29 percent of all the lumber. Nine of these fairly large mills are in northern Indiana and 21 in the southern part of the State.

Production of native-grown lumber in 1949 was estimated to be 183 million board-feet. About two-thirds of this lumber was produced in southern

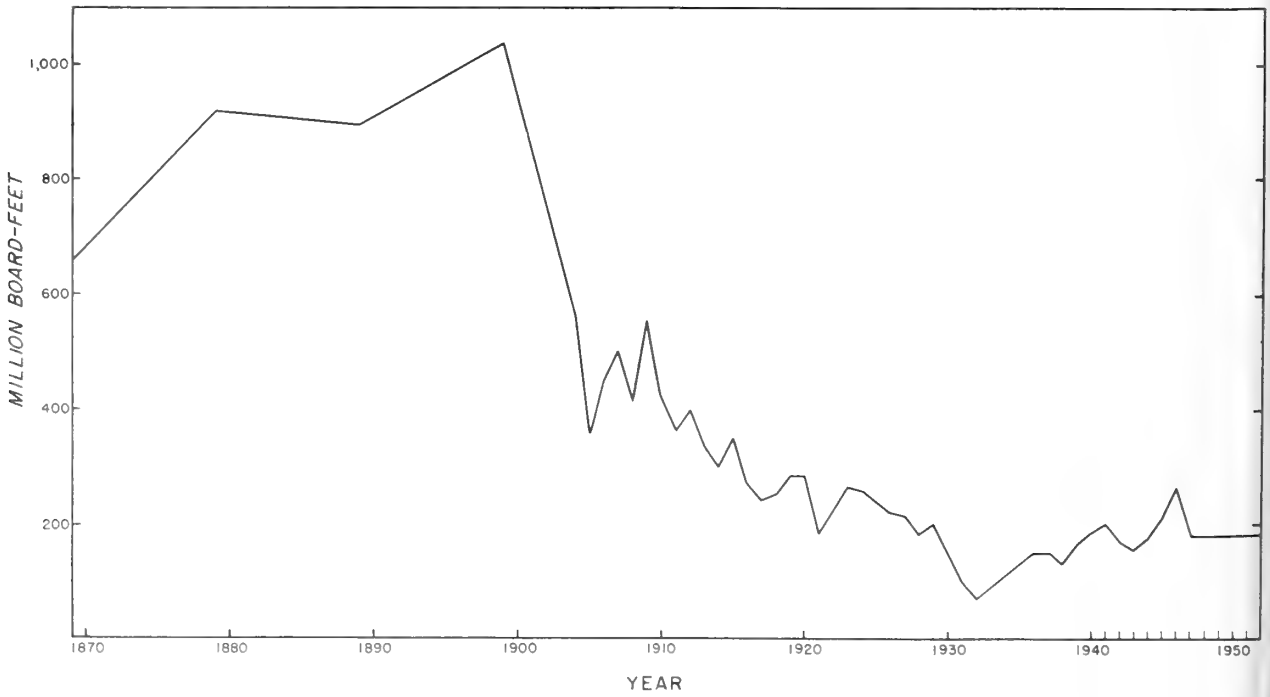

FIGURE 26.—*Lumber production in Indiana has leveled off at about 200 million board-feet annually. (Source: Lumber Production in the United States, 1799–1946, U. S. Dept. Agr. Misc. Pub. 669. 1948. Forest Service estimates shown beyond the year 1946.)*

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FIGURE 27.—*This sawmill is typical of many small sawmills operating in Indiana. They usually set in or beside the woods and are generally operated by small gasoline or diesel engines.*

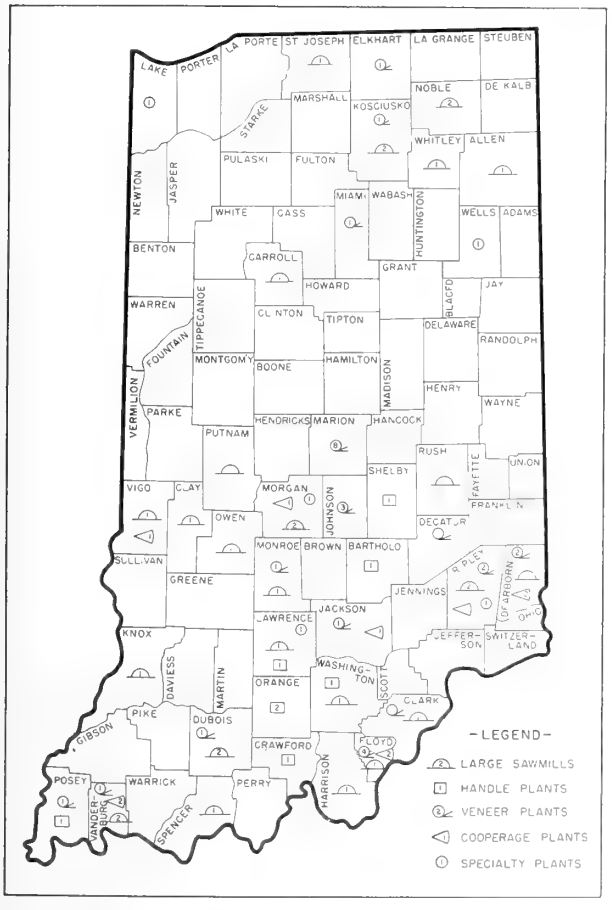

FIGURE 28.—*The primary wood-using industries of Indiana are concentrated in the southern half of the State. (Number in the symbol indicates the number of such plants in county.)*

Indiana. Red and white oaks made up about 45 percent of the production, followed by beech, maple, elm, and yellow-poplar.

Sawlogs delivered to Indiana sawmills in 1952 were estimated to be worth more than 6 million dollars. This total amounted to about 26 cents per cubic foot or about 35 dollars per thousand board-feet. The products cut from these logs varied in value depending on how they were marketed. Railroad crossties and rough, green lumber sold on a mill run basis brought 50 to 60 dollars per thousand board-feet. Lumber that was dried and sold by grade brought much more. For example, No. 1 Common and better oak lumber brought much more than 100 dollars per thousand board-feet at the mill.

Grading studies of logs at mills indicated that about 58 percent of the sawlog volume used was in grade 1 and 2 logs, although less than 15 percent of the stand volume is in logs of these grades. The other 42 percent of the sawlog volume is in grade 3 logs. Many of these are upper logs harvested in the course of obtaining a high-quality butt log. Grade 1 logs will normally yield about 65 percent No. 1 Common and better lumber; grade 2 will yield about 40 percent of the same quality. When sawmills sell graded lumber, they find a ready market for the better grades but often find it difficult to sell the low-grade lumber. Most small sawmills, however, do not saw to obtain the greatest return in graded lumber. Some sawyers do not know how to get the highest average grade of lumber; others believe it is more profitable to cut for

quantity rather than quality; still others cut for local markets where quality is not a requirement. Probably 60 to 70 million board-feet (35 to 40 percent) of the 1949 lumber production was No. 3 Common or poorer in grade.

The labor required to produce the lumber cut in 1949 amounted to about 218,000 man-days in the woods and about 311,000 man-days in the mills. This total labor requirement is the equivalent of full-time employment for about 2,000 men. However, because sawmilling is often a seasonal occupation, especially for owners of small mills, many more than 2,000 men worked in the lumber industry.

The Veneer Industry

Indiana is a center of veneer production, especially face veneers, and the manufacture of veneer products. In 1948 Indiana used the equivalent of 52½ million board-feet of veneer in the manufacture of various products; about 70 percent of the veneer was of native hardwood species, and softwoods and foreign woods made up the remainder. More than 100 million board-feet of logs and flitches were required to produce this amount of veneer.

In 1949 about 14 million board-feet of Indiana timber was cut for veneer. Veneer production is fairly stable and it is estimated that about the same volume was used in 1952. The logs went to 33 plants and buyers—94 percent to Indiana mills. Nearly 60 percent of the volume was cut into face and commercial veneers for the furniture industry (fig. 29) and was mainly white oak, black walnut, and yellow-poplar. The other 40 percent was cut into container veneer for baskets and was mostly cottonwood, soft maple, sweetgum, and other soft hardwoods.

During the early development of the veneer industry in Indiana, high-quality hardwood timber was plentiful. Much of it was acquired as a byproduct of land clearing. High-quality timber is not plentiful today, and the log buyers must search wide areas of Indiana and adjoining States to get the logs needed. To produce either face or container veneer, clear bolts and logs at least 16 inches in diameter are needed (fig. 30), and premium prices are paid. Veneer logs and bolts at the roadside or delivered at the mills were worth nearly 1 million dollars in 1952 at about 60 cents per cubic foot or 80 to 100 dollars per thousand board-feet. Nearly 100,000 man-hours of woods and plant labor were required to produce the logs and veneer.

F-395243

FIGURE 29.—*These workers are matching and taping high-quality walnut veneer for the furniture industry.*

FIGURE 30.—*Large elm and beech logs being delivered to a container veneer plant.* (*Courtesy of Purdue Agricultural Experiment Station, Department of Forestry and Conservation.*)

The Cooperage Industry

Most of the cooperage stock produced in Indiana is for tight cooperage. This commodity 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 tree must have sections that are straight-grained and free of knots and other serious defects. This species still makes up 12 percent of the sawtimber volume, but only a small amount of it is of the high quality for which Indiana was once noted.

Only 10 stave and heading mills are known to be operating in Indiana. These mills used about 2½ million board-feet of logs and bolts in 1952, worth about 250,000 dollars (approximately 60 cents per cubic foot) delivered at the mills. This industry required about 16,000 man-hours of labor in the woods and mills. Work is usually not steady because the production of staves and heading fluctuates seasonally and from year to year. In fact, the business is now declining and the 1952 production was only about half that of 1949. Also, the mills are portable and many shift from county to county to take advantage of available timber and local markets.

The Handle Industry

A number of plants in Indiana manufacture handles for all kinds of striking tools, shovels, hoes, pitchforks, etc. They do not use a large amount of wood—about 4 million board-feet of logs and bolts annually in recent years—but the timber is usually high quality and meets fairly rigid specifications (fig. 31). More than half the wood used is ash and about one-third is hickory; oak and maple make up most of the remainder. Some manufacturers of small handtools buy lumber or squares cut to the proper dimensions for further manufacture into handles.

Logs and bolts delivered to the handle plants are worth about 200,000 dollars, approximately 40 cents per cubic foot. Nearly 15,000 man-hours of labor are required in the woods and plants.

Other Wood-Using Industries and Wood Uses

The industries so far discussed use about 44 percent of all wood production in Indiana and nearly all of the high-quality wood. Also, they are about the only Indiana industries processing wood for further manufacture. In addition, about 8,600 cords (550,000 cubic feet) of pulpwood were cut and shipped out of the State in 1949. This production increased about 40 percent by 1952. Another 2,800 cords (180,000 cubic feet) were cut for excelsior and 160,000 cubic feet were hewn into railroad ties. These three uses account for about 2 percent of the wood used.

The remaining production is for fuelwood, fence posts, round mine timbers, and miscellaneous farm timbers. These products required about 32 million cubic feet of wood in 1949, about 54 percent of the total, most of which was for fuelwood (fig. 32). Only about half the fuelwood was cut from growing stock. The other half was cut from saplings, dead and cull trees, trees growing in narrow strips and fence rows, and from logging and mill residues. 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. The use of wood for fuel is declining, however, and other uses are needed for the low-quality wood that is accumulating in the stands. Without these other uses it is unlikely that many woodland owners will be able to remove enough of such material from the woods to prevent the low-quality volume from increasing.

F-398610

FIGURE 31.—*Hickory bolts being delivered to an Indiana handle plant. Note the high percentage of white wood in most of the bolts—the wood preferred by the manufacturer.*

F-433155

FIGURE 32.—*Small timber being cut into fuelwood in southern Indiana.*

Farmers cut about 4.3 million fence posts for use on their farms in 1949. About 77 percent of the posts were cut from growing stock, about 13 percent from nonforest land and 8 percent from saplings, and about 2 percent from dead trees and logging or plant residues. Of the posts cut from growing stock, 24 percent were white oak, 41 percent black locust, and the other 35 percent miscellaneous species.

Practically all the mine timbers were cut from poletimber growing stock. Mine-prop producers usually cut heavily in well-stocked, hardwood pole stands. This practice can affect the growth adversely and delay development of high-quality stands of sawtimber. Mine props bring a fair price, however, and afford an opportunity for timber owners interested in making thinnings and improvement cuttings to receive at least some immediate return from these operations.

Wood Used in Manufacturing

Wood is a basic raw material in more than 650 manufacturing plants in Indiana. These plants are well distributed throughout the State and manufacture a wide variety of products. A few of the most important are furniture, containers (fig. 33), railroad cars, cabinets, prefabricated houses, housetrailers, caskets, farming implements, handles, and general millwork. These plants use far more wood than is produced in the State. In 1948 only 56 percent of the wood used in manufacturing was hardwoods native to the region (table 1), and much of this was brought

F-395227

FIGURE 33.—*This worker is assembling wood veneer into strawberry baskets. The veneer used in these baskets was produced from logs such as those shown in figure 30.*

TABLE 1.—*Wood used in Indiana manufacture, 1948* [1]

Class	Total	Lumber	Bolts	Veneer
	Million board-feet	*Million board-feet*	*Million board-feet*	*Million board-feet*
Softwoods	192	178		14
Native hardwoods	252	208	6	38
Foreign hardwoods	3	2		1
Total	447	388	6	53

[1] Source: Gordon D. Merrick. Wood Used in Manufacture—1948. U. S. Dept. Agr. Forest Serv. Forest Resource Rpt. 2, 66 pp. 1951.

from nearby States. A study of revenue freight of major railroads, conducted in 1951 by the Interstate Commerce Commission, indicated that these railroads brought into the State eight carloads of forest products for every carload that was shipped from Indiana.

The wood-using plants of Indiana provide employment for more than 30,000 workers and an annual payroll of more than 70 million dollars. This source of labor and income is greatly needed, especially in the unglaciated section of southern Indiana. In this area it is estimated that the average farm provides only about 70 man-days of labor per year compared to 300 man-days on farms in the corn belt. A higher percentage of the labor force in southern Indiana is unemployed than in the northern part of the State.

Program of Forestry

WHEN FACTORS such as volume per acre, quality of sawtimber, and growth per acre are evaluated, the forests of Indiana are in better overall condition than those of other States of the Central region. They comprise about 10 percent of the regional commercial forest area, have about 14 percent of the sawtimber volume, and account for about 20 percent of the board-foot growth. Because veneer and furniture industries are concentrated in Indiana, there is a strong demand for high-quality logs from local forests. With conditions so favorable, Indiana can well afford to direct her efforts toward growing high-quality timber and toward first priority for management of the better sites.

Adoption of Improved Cutting Practices

One way to enhance the stocking and quality of Indiana forests is to remove culls and low-quality trees so that high-quality trees can take their place (fig. 34).

F-245251

FIGURE 34.—*This stand on the Clark County State Forest is being improved by planned cutting. Mature and defective trees have been removed and white oak is being given preference in the stand.*

Economic considerations prevent some woodland owners from practicing good forest management; some owners are not interested; most need professional assistance. The State Department of Conservation employs several foresters to serve timberland owners that request assistance. These foresters provide a number of services such as cruising timber, marking trees that are ready for harvest, preparing a simple management plan, suggesting possible markets, and ordering planting stock. The foresters now employed are unable to keep up with the requests for such assistance.

For many years the State Agricultural Extension Service also has worked with forest land owners to improve management and cutting practices.

Another source of help available to woodland owners is the Agricultural Conservation Program of the United States Department of Agriculture. Woodland owners may apply to the local county ACP committee for financial assistance in (1) planting trees 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 woodlands from grazing.

Improvement of Markets and Marketing Practices

To aid the woodland owner and timber operator in following improved cutting practices, better markets and marketing services than now available are needed. So that volume of commercial importance may be realized, small-woodland owners find it necessary to cut heavily. Also, an operator may recognize a number of valuable products on these small woodlands, but may be able to pay for and cut only the timber for the one product he uses.

Commercial concentration yards could help to integrate operations and provide for more orderly marketing of small quantities of wood products. Commercial loggers would be able to cut trees and obtain the most valuable products if yards were available where the various products might be concentrated for shipment. Concentration yards could also help the secondary industries by channeling logs and bolts to their best use. In this way the processing of many high-quality logs into low-value products would be prevented.

New markets might help some woodland owners and timber operators to follow improved cutting practices. Because many trees are so poor in quality that it does not pay the operator to cut them for any product, they are left standing. The woodland owner does not fell or girdle these cull trees because he believes that it is more profitable to spend his time doing other things.

Indiana does not need any more markets for high-quality wood—it does need them for low-quality wood. At present such markets are best represented by industries using chipped wood to manufacture roofing felt, insulation board, paper, chemicals, and so on. Wise use of such markets could enable the timber owner to remove culls and low-quality trees from his woods, thereby leaving them in condition to grow more high-quality timber.

Protection of Woodlands from Damaging Agents

Protecting woodlands from fire, insects, diseases, and other damaging agents can help to grow more high-quality timber.

Fire

Indiana is protecting more than 4 million acres of forest land and old fields from fire. This area is all that is considered necessary to protect. Except for abnormal situations, such as occurred during the 1952 fire season, the program to protect Indiana forests from fire is generally considered adequate. Many counties, especially in northern Indiana, have such small, scattered tracts of timber that fire is not a serious problem. Fire is more serious in southern Indiana where the danger is greater and where there is difficulty in maintaining the present program because of increasing costs for labor and equipment. During the past 10 years the average for the area burned has been less than one-half percent of the protected land.

Although this area is not great, its acreage could still be reduced because most of the fires in Indiana are man-caused, generally through carelessness. The State Division of Forestry has the largest fire-fighting and prevention organization within the State. The Wayne-Hoosier National Forest personnel handles fires on lands within its jurisdiction. These two organizations cooperate with each other as the need arises. Since 1942 the State has organized and trained the volunteer Forest Fire Fighters Service. In 1949–50 this Service trained more than 2,500 volunteers, mostly high school students, as fire fighters (fig. 35). Continued training of this kind plus the

FIGURE 35.—*A group being trained in fire fighting.* (*Courtesy of Indiana Department of Conservation.*)

provision of adequate funds for necessary yearlong personnel and modern fire-fighting equipment will help to keep forest fires controlled.

Livestock Grazing

Woodlands must be protected from livestock grazing if the owner is to grow more high-quality timber. In the State, 12 percent of the forest area is heavily grazed, but this damage is most apparent in northern Indiana where nearly one-fourth of the forest area is heavily grazed. Because raising livestock is so important in this State, there is a great demand for pasture. As commonly practiced in the hardwood forests, grazing kills tree reproduction, decreases growth and increases cull in the surviving trees, exposes roots to trampling, compacts the soil thereby increasing water runoff, and destroys ground litter and humus (fig. 36). The amount of damage, of course, depends upon the intensity of grazing.

The Purdue Agricultural Experiment Station and the State Division of Forestry have been working for many years to discourage grazing in woodlands. The Indiana Forest Land Classification Act of 1921 requires that land classified under this act not be grazed. Some 140,000 acres are now under the classification program. Studies conducted in Indiana (*1*) and Illinois have shown that woodland forage is inferior to that on cleared pasture both in quantity and nutrition. An improved pasture may produce 15 to 20

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FIGURE 36.—*Sheep, hogs, cattle, horses—all kinds of livestock—can seriously damage a woodland.*

times as much forage and an even greater amount of protein than an equal area of woodland pasture.

These studies indicate that if the woodland owner chooses to grow hardwood timber, livestock should be kept out. If he prefers to produce forage, he will find it more profitable to convert the area to improved pasture, provided, of course, that the area is suitable for such use. The possibility of erosion must always be considered. Badly eroded areas and slopes too steep to be held in place as an improved pasture should be restored to forest cover and not grazed.

Insects and Diseases

Another way to improve the quality of the trees being grown is to protect them from insects and disease. These enemies of the forest not only kill many trees, but the quality of the logs attacked is reduced by rot and insect activity. Just how much damage these enemies cause is not known, but observations at sawmills and other wood utilization plants indicate great loss.

In Indiana oak wilt is probably the most important tree disease at the present time. Research to find ways of controlling this disease is in progress. Indiana has a small program of work on white pine blister rust. The area devoted to growing white pine is relatively small and almost all of it is in scattered plantations. Phloem necrosis and Dutch elm disease have caused heavy losses of American elm. However, this tree is of minor importance for wood products.

Insects and diseases often attack weakened trees damaged by fire and grazing. Continued protection of the forests from fire and grazing is also good protection from insects and disease. A sound cutting program is another good weapon against insect and disease losses. Harvesting the timber at frequent intervals—every 5 or 10 years—will aid in removing trees before they become severely diseased or defective.

Other Forest Activities

On publicly owned forests, development of recreational facilities ranks high in priority. Water storage and watershed protection are also important to the many cities in the State.

Tree planting for forest, windbreak, and other purposes has been important for many years. In 1953, State nurseries produced more than 10½ million seedlings for use in Indiana. In addition one Federal nursery in the State produced 8½ million seedlings and some of them were planted in Indiana. In this same year the area planted to trees was 8,890 acres, which brought the total to 102,115 acres. Sixty percent of the area planted in 1953 was privately owned.

Research can find better ways to safeguard forests from fire, insects, and disease. Research in management can solve regeneration problems, develop desirable cutting practices for the multitude of stand conditions and forest types, develop ways of increasing the productivity and quality of our forests, and devise land-use practices that will best serve the interests of timber, water, wildlife, and recreation. Research in harvesting, marketing, and utilization can find easier and cheaper ways to do these jobs.

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Appendix

Forest Survey Procedure

AN INVENTORY of the Indiana forests was made during the period of November 1949 to December 1950. The sampling procedure used included an office study of aerial photographs and a field examination of forest and nonforest plots selected at random.

Area Estimates

The amount of forest land was computed by placing a transparent sheet marked with uniformly spaced dots over aerial photographs and counting the 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 figure was later adjusted after field examination of selected plots showed how many of them 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 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 weighted—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 ⅕-acre circular plot at each point. Such data as tree species, size, log quality, cull, and growth of trees were recorded (fig. 37).

The following tabulation shows the number of dots and plots examined for the State.

Photo dots counted for forest-area determination	195,941
Plots stereoscopically examined on photos	9,700
Forest plots field examined	1,789
Nonforest plots field examined	292

Volume Estimates

SAWTIMBER VOLUME.—The gross board-foot and cubic-foot volume tables used in the Indiana Forest Survey were based on the Mesavage-Girard form class tables (*6*). Average form classes were computed from measurements of form class on 1,173 trees for 12-, 14-, and 16-inch and larger diameter groups.

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FIGURE 37.—*Field crew taking sample tree measurements on a plot in Indiana.*

The upper stem volume of all sawtimber trees was computed between the merchantable top and a point on the central stem with a minimum top 4.0 inches in diameter inside bark.

POLETIMBER VOLUME.—Diameter and merchantable height were measured on 1,018 poletimber trees in the State. These measurements were summarized by species group, merchantable height, and by d. b. h. Cubic-foot volume tables were prepared using the volumes computed in other States for trees having the same height and diameter relationships.

Cull Estimates

Allowance for defect in merchantable sawtimber trees was determined by estimating sound and rotten board-foot cull in sample trees. 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 cull allowance determined by the Forest Survey fell between the cull percent found on timber sales from the Wayne-Hoosier Purchase Units and the results of a grade-yield study made by Purdue University.

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.

Trees of pole or sawtimber size that did not qualify as merchantable trees were tallied as cull trees. Eighty percent of the gross volume of sound cull trees was estimated to be sound wood, and 40 percent of the gross volume in rotten cull trees was sound wood.

Growth Estimates

Cores were taken from 1,861 sample trees, and radial growth for the past 10 years was measured. Growth rates were computed by diameter classes and species, by determining ratios of sample tree volume for the last 10 years to the present. These 10-year ratios were converted to annual compound growth rates and plotted over d. b. h. for each species. All trees that died within 4 years prior to the survey and that were formerly merchantable were tallied, and ratios of mortality to stand volume were computed. Growth and mortality percentages were applied to the cubic-foot volume of total growing stock and to the board-foot volume of sawtimber to get the net volume growth.

Timber-Cut Estimates

Estimates of timber cut from Indiana forests in 1949 were made by a sampling survey of wood-product producers and wood users, and studies of logging operations to determine the amount of cutting residue.

The amount of timber cut for sawlogs was determined by supplementing the annual lumber survey of the United States Bureau of the Census. Lumber tally was converted to log volume, International ¼-inch scale, and the volume of logging residue added. 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. One hundred and fourteen area segments of the Master Sample of Agriculture were canvassed with the aid of personnel from the State Extension Service and the State Division of Forestry.

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

The timber cut for round mine timbers was based on the production of coal from deep mines. A study of Illinois deep mines showed that 0.118 cubic foot of wood is required for each ton of coal produced. The 1949 coal production of Indiana's deep mines was multiplied by this factor.

The timber cut for hewn crossties was determined by a canvass of the concentration yards.

Timber cut was also estimated by recording data from stumps found on field plots one-fifth of an acre in size. Analysis of these data gave information on timber cut by tree diameters and by species.

Accuracy of Estimates

Forest area and timber volume.—Statistical analysis of forest area and timber volume data in Indiana shows a sampling error of ± 1.2 percent (± 48.6 thousand acres) for commercial forest area and of ± 1.8 percent (± 46.3 million cubic feet) for growing stock volume. This means that at one standard error the chances are 2 out of 3 that the estimated area 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. Table 2 may be used as a guide in estimating the probable sampling error of the subdivisions of forest areas and volumes in the tables.

Timber cut.—Most of the timber cut was estimated by sampling producers. Possible errors include

TABLE 2.—*Estimates of sampling error for area and volume, Indiana, 1950*

Commercial forest		Growing stock		Sawtimber	
Area	Sampling error	Volume	Sampling error	Volume	Sampling error
Thousand acres	*Percent*	*Million cubic feet*	*Percent*	*Million board-feet*	*Percent*
4,045	1.2	2,598	1.8	11,010	2.5
2,000	1.7	2,000	2.1	5,000	3.7
1,000	2.4	1,000	2.9	1,000	8.3
500	3.4	500	4.1	500	11.7
50	10.8	50	13.0	50	37.0
10	24.1	10	29.0	10	82.9

errors in reporting, in compilation, in determination of overrun and residue factors, and in sampling. The following tabulation shows the computed sampling error by commodity and the percentage that the commodity is of the total timber cut:

Commodity:	*All timber cut from growing stock (percent)*	*Sampling error (percent)*
Sawlogs	59.0	5.0
Fuelwood	24.3	33.9
Fence posts	4.9	22.3
Miscellaneous farm timbers	.4	43.9
Veneer bolts	4.3	4.3
Cooperage bolts	1.7	4.3
Handle bolts	1.5	4.1
Pulpwood	1.2	14.9
Hewn ties	.5	24.7
Round mine timbers	1.8	7.8
Excelsior and other	.4	14.9
Total	100.0	8.8

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 has not been developed for other use; (c) afforested area.

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. (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 excepting longleaf or slash pine, singly or in combination. (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-CYPRESS.—Bottom-land forests in which 50 percent or more of the stand is tupelo, blackgum, sweetgum, oaks, or baldcypress (southern cypress), 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-BIRCH.—Forests in which 50 percent or more of the stand is maple, beech, or yellow birch, 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.—A live softwood (coniferous) tree at least 9 inches d. b. h. or live hardwood (broadleaf) tree at least 11 inches d. b. h. of commercial species, with a sound butt log at least 8 feet long, or with at least half of the gross volume of the tree in sound material.

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 which meet regional specifications of soundness and form and are of the following diameters at breast height: softwoods, 5 to 9 inches; hardwoods, 5 to 11 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, and hophornbeam).

Rotten cull trees.—Live trees of sawtimber size that have less than 50 percent of their gross volume in sound material; live trees of poletimber size that have any unsound defect.

Sound cull trees.—Live trees of sawtimber or poletimber size that are free from unsound defect but will not make at least one merchantable sawlog now or prospectively because of roughness, poor form, or species.

Volumes

ALL-TIMBER VOLUME.—Net volume in cubic feet of live 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 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 sawtimber tree boles between merchantable top and a point on the bole with a minimum top 4.0 inches in diameter inside bark when it exists.

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-stock trees.

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

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 one-half log (8 feet) in length or longer, suitable for crossties or rough lumber were considered to be merchantable. Merchantable heights were estimated to the nearest one-half 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 3 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 averaging 1 to 1½ logs at maturity.

Poor.—Areas that can produce hardwood trees averaging one-half 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 trees (5.0 inches d. b. h. and larger) 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.—Forest land 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. B.).—Tree diameter inside 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 of butt logs is 10 feet, 8 feet for upper logs. Five-sixths of the 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 25 percent for butt logs and 40 percent for upper logs. 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. Minimum standards require that these logs be at least 50 percent sound and qualify at least for manufacture of local-use lumber or railroad ties and timbers. 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 removed from live sawtimber or growing stock on commercial forest land during a specified year through death from natural causes.

Timber Cut

TIMBER CUT FROM LIVE SAWTIMBER.—The board-foot volume of live sawtimber trees removed from commercial forest land during a specified year as timber products and logging waste.

TIMBER CUT FROM GROWING STOCK.—The cubic-foot volume of live sawtimber and poletimber trees removed from commercial forest land during a specified year as timber products and logging waste.

[2] The hardwood log grades used are essentially those published as "Interim Sawlog Grades for Southern Hardwoods," by C. R. Lockard and R. D. Carpenter, Southern Forest Experiment Station, 1947 (*4*). Persons interested in detailed specifications should consult this publication.

Total annual timber cut from growing stock.—The cubic-foot volume of live sawtimber and poletimber trees removed from commercial forest land during a specified year through timber cutting for a product, land clearing, and cultural operations.

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.

Tree Species

Commercial Softwoods

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*
Redcedar, eastern	*Juniperus virginiana*

Commercial Hardwoods

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 (redgum)	*Liquidambar styraciflua*
Water tupelo (tupelo-gum)	*Nyssa aquatica*
Hackberry	*Celtis occidentalis*
Hickory	*Carya* spp.
Honeylocust	*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 Hardwoods

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.

TABLE 3.—*Total land and forest area, by region and county, Indiana, 1950*

NORTHERN REGION

County	Land area			County	Land area		
	Total	Forest			Total	Forest	
	Thousand acres	*Thousand acres*	*Percent*		*Thousand acres*	*Thousand acres*	*Percent*
Adams	221	20	9	Lake	329	30	9
Allen	429	43	10	LaPorte	389	35	9
Bartholomew	257	35	14	Madison	290	15	5
Benton	262	2	1	Marion	257	22	9
Blackford	107	8	7	Marshall	284	28	10
Boone	273	15	5	Miami	243	24	10
Carroll	239	16	7	Montgomery	324	25	8
Cass	266	29	11	Newton	264	27	10
Clinton	260	11	4	Noble	262	29	11
Decatur	237	22	9	Porter	272	33	12
Dekalb	234	29	12	Pulaski	277	32	12
Delaware	256	17	7	Randolph	292	20	7
Elkhart	300	28	9	Rush	262	11	4
Fountain	254	29	11	St. Joseph	299	28	9
Fulton	235	17	7	Shelby	262	16	6
Grant	269	18	7	Starke	199	34	17
Hamilton	258	21	8	Steuben	198	21	11
Hancock	195	15	8	Tippecanoe	321	21	7
Hendricks	267	17	6	Tipton	167	10	6
Henry	256	19	7	Wabash	269	25	9
Howard	188	11	6	Warren	236	19	8
Huntington	250	23	9	Wayne	259	23	9
Jasper	360	48	13	Wells	236	17	7
Jay	247	17	7	White	318	16	5
Johnson	202	17	8	Whitley	215	28	13
Kosciusko	344	39	11				
Lagrange	243	27	11	Total	13,633	1,182	9

SOUTHERN REGION

Brown	207	150	72	Ohio	56	20	36
Clark	246	82	33	Orange	259	124	48
Clay	233	54	23	Owen	250	116	46
Crawford	200	103	52	Parke	289	97	34
Daviess	277	41	15	Perry	246	162	66
Dearborn	196	64	33	Pike	214	43	20
Dubois	277	86	31	Posey	265	38	14
Fayette	138	19	14	Putnam	314	74	24
Floyd	95	36	38	Ripley	283	66	23
Franklin	252	72	29	Scott	123	43	35
Gibson	319	43	14	Spencer	253	47	19
Greene	351	101	29	Sullivan	293	49	17
Harrison	307	123	40	Switzerland	141	45	32
Jackson	333	121	36	Union	108	15	14
Jefferson	234	81	35	Vanderburgh	154	19	12
Jennings	241	75	31	Vermillion	168	31	18
Knox	331	34	10	Vigo	266	45	17
Lawrence	294	127	43	Warrick	250	50	20
Martin	221	126	57	Washington	330	118	36
Monroe	264	132	50				
Morgan	260	84	32	Total	9,538	2,958	31

TABLE 4.—*Land area, by region and major class of land, Indiana, 1950*

Class of land	State		Northern	Southern
Forest:	*Thousand acres*	*Percent*	*Thousand acres*	*Thousand acres*
Commercial	4,082	17.6	1,171	2,911
Productive reserved	58	.3	11	47
Total	4,140	17.9	1,182	2,958
Nonforest	19,031	82.1	12,451	6,580
Total land area	23,171	100.0	13,633	9,538

TABLE 5.—*Commercial forest area, by ownership, region, and stand-size class, Indiana, 1950*

Ownership	State		Region		Stand-size class			
			Northern	Southern	Sawtimber stands	Poletimber stands	Seedling and sapling stands	Nonstocked stands [1]
Federal:	*Thousand acres*	*Percent*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*
National forest	103	2.5	0	103	24	28	14	37
Other	60	1.5	11	49	31	18	10	1
Total	163	4.0	11	152	55	46	24	38
State	93	2.3	14	79	48	45	----	----
County and municipal	2	(2)	1	1	1	1	(3)	----
Private	3,824	93.7	1,145	2,679	1,980	1,245	576	23
Total	4,082	100.0	1,171	2,911	2,084	1,337	600	61

[1] Includes areas not classified elsewhere.
[2] Less than 0.05 percent.
[3] Less than 500 acres.

TABLE 6.—*Area of commercial forest land, by stand-size class and region, Indiana, 1950*

Stand-size class	State		Northern		Southern	
	Thousand acres	*Percent*	*Thousand acres*	*Percent*	*Thousand acres*	*Percent*
Large sawtimber stands	1,384	34	648	55	736	25
Small sawtimber stands	700	17	131	11	569	19
Poletimber stands	1,337	33	262	23	1,075	37
Seedling and sapling stands	600	15	117	10	483	17
Nonstocked stands	61	1	13	1	48	2
Total	4,082	100	1,171	100	2,911	100

TABLE 7.—*Area of commercial forest land, by forest type and stand-size class, Indiana, 1950*

Forest type	Total	Sawtimber stands		Poletimber stands	Seedling and sapling stands	Nonstocked stands
		Large	Small			
	Thousand acres	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*
White-red-jack pine	29	----	----	3	26	----
Loblolly-shortleaf pine	26	----	5	16	5	----
Oak-pine	75	----	5	42	28	----
Oak-hickory	2,362	658	464	789	401	50
Oak-gum-cypress	138	61	21	43	13	----
Elm-ash-cottonwood	993	414	136	334	100	9
Maple-beech-birch	418	248	69	92	7	2
Aspen-birch	41	3	----	18	20	----
All types	4,082	1,384	700	1,337	600	61

TABLE 8.—*Net volume of live sawtimber and growing stock on commercial forest land, by ownership and region, Indiana, 1950*

Ownership	Sawtimber				Growing stock
	State		Northern	Southern	
	Million board-feet	*Percent*	*Million board-feet*	*Million board-feet*	*Million cubic feet*
Federal:					
National forest	99	0.9		99	34.5
Other	158	1.4	46	112	39.5
All Federal	257	2.3	46	211	74.0
State	174	1.6	26	148	60.0
County and municipal	6	.1	4	2	1.6
Private:					
Farm	7,522	68.3	4,552	3,522	1,988.2
Nonfarm	3,051	27.7		2,499	663.9
All private	10,573	96.0	4,552	6,021	2,652.1
All ownerships	11,010	100.0	4,628	6,382	2,787.7

TABLE 9.—*Net live sawtimber volume on commercial forest land, by species and region, Indiana, 1950*

Species	State		Northern		Southern	
	Million board-feet	*Percent*	*Million board-feet*	*Percent*	*Million board-feet*	*Percent*
Pine	40	0.4			40	100
Other softwoods	[1] 11	.1			11	100
White oak	1,297	11.8	403	31	894	69
Chestnut oak	101	.9	3	3	98	97
Other white oaks	382	3.5	248	65	134	35
Black oak	1,165	10.6	448	38	717	62
Northern red oak	985	8.9	362	37	623	63
Other red oaks	327	3.0	138	42	189	58
Hickory	876	7.9	242	28	634	72
Ash	530	4.8	262	49	268	51
Elm	1,101	10.0	828	75	273	25
Cottonwood	153	1.4	85	56	68	44
Yellow-poplar	579	5.3	73	13	506	87
Basswood	135	1.2	101	75	34	25
Sweetgum	161	1.5	6	4	155	96
Blackgum	123	1.1	5	4	118	96
Sugar maple	857	7.8	503	59	354	41
Soft maple	448	4.1	241	54	207	46
Sycamore	390	3.5	162	42	228	58
Beech	708	6.4	263	37	445	63
Black walnut	208	1.9	89	43	119	57
Other hardwoods	433	3.9	166	38	267	62
Total	11,010	100.0	4,628		6,382	

[1] Includes 2 million board-feet of cypress.

TABLE 10.—*Net live sawtimber volume on commercial forest land, by species and stand-size class, Indiana, 1950*

Species	State		Sawtimber stands		Poletimber stands	Seedling and sapling stands	Nonstocked stands
			Large	Small			
	Million board-feet	*Percent*	*Million board-feet*	*Million board-feet*	*Million board-feet*	*Million board-feet*	*Million board-feet*
Pine	40	0.4		36	2	2	
Other softwoods	11	.1	5		5	1	
White oak	1,297	11.8	826	358	113		
Chestnut oak	101	.9	31	63	7		
Other white oaks	382	3.5	332	29	15	5	1
Black oak	1,165	10.6	702	349	110	2	2
Northern red oak	985	8.9	773	185	26		1
Other red oaks	327	3.0	238	62	22	1	4
Hickory	876	7.9	553	227	84	12	
Ash	530	4.8	366	116	30	15	3
Elm	1,101	10.0	901	125	70	2	3
Cottonwood	153	1.4	129	17	7		
Yellow-poplar	579	5.3	396	99	78	6	
Basswood	135	1.2	110	17	8		
Sweetgum	161	1.5	129	26	6		
Blackgum	123	1.1	102	10	11		
Sugar maple	857	7.8	697	128	29	3	
Soft maple	448	4.1	389	44	15	[1]	
Sycamore	390	3.5	305	40	38	4	3
Beech	708	6.4	623	51	21	13	
Black walnut	208	1.9	130	46	29	[1]	3
Other hardwoods	433	3.9	268	108	53	1	3
Total	11,010	100.0	8,005	2,136	779	67	23
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
All species	100.0		72.7	19.4	7.1	0.6	0.2

[1] Less than 0.5 million board-feet.

TABLE 11.—*Net live sawtimber volume on commercial forest land, by species and tree-diameter class, Indiana, 1950*

Species	State	Tree-diameter class (inches)					
		[1] 10	12–14	16–18	20–22	24–26	28+
	Million board-feet	*Million board-feet*	*Million board-feet*	*Million board-feet*	*Million board-feet*	*Million board-feet*	*Million board-feet*
Pine	40	13	17	5	5		
Other softwoods	11	4	4	1	2		
White oak	1,297		506	378	240	89	84
Chestnut oak	101		67	27	7		
Other white oaks	382		64	98	83	59	78
Black oak	1,165		440	371	212	112	30
Northern red oak	985		257	310	185	116	117
Other red oaks	327		95	92	51	46	43
Hickory	876		426	257	109	46	38
Ash	530		238	159	61	55	17
Elm	1,101		326	307	214	166	88
Cottonwood	153		31	32	35	21	34
Yellow-poplar	579		191	192	136	18	42
Basswood	135		50	38	24	17	6
Sweetgum	161		58	54	38	11	
Blackgum	123		39	41	19	17	7
Sugar maple	857		291	276	188	54	48
Soft maple	448		111	139	107	59	32
Sycamore	390		105	127	79	54	25
Beech	708		99	243	169	160	37
Black walnut	208		92	84	25	7	
Other hardwoods	433		251	116	44	17	5
Total	11,010	17	3,758	3,347	2,033	1,124	731
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
All species	100.0	0.2	34.1	30.4	18.5	10.2	6.6

[1] Ten-inch diameter class shown separately because in this diameter class sawtimber volume includes softwood trees but not hardwoods.

TABLE 12.—*Hardwood sawtimber volume by log grades, Indiana, 1950*

Item	State	Log grade 1		Log grade 2		Log grade 3	
	Million board-feet	*Million board-feet*	*Percent*	*Million board-feet*	*Percent*	*Million board-feet*	*Percent*
SPECIES GROUP							
White oaks [1]	1,780	67	3.8	144	8.1	1,569	88.1
Red oaks [2]	2,477	118	4.8	199	8.0	2,160	87.2
Other hardwoods	6,702	347	5.2	646	9.6	5,709	85.2
Total	10,959	532	4.9	989	9.0	9,438	86.1
TREE-DIAMETER CLASS							
12–14 inches d. b. h.	3,737		0.0	44	1.2	3,693	98.8
16 inches	1,854	6	.3	219	11.8	1,629	87.9
18 inches and up	5,368	526	9.8	726	13.5	4,116	76.7
Total	10,959	532	4.9	989	9.0	9,438	86.1
REGION							
Northern	4,628	292	6.3	531	11.5	3,805	82.2
Southern	6,331	240	3.8	458	7.2	5,633	89.0
Total	10,959	532	4.9	989	9.0	9,438	86.1

[1] Includes white oak, chestnut oak, and post oak group.
[2] Includes black oak, northern red oak, and other red oaks.

TABLE 13.—*Cubic-foot volume of sound wood on commercial forest land, by species and class of material, Indiana, 1950*

Species	All material	Growing stock			Cull trees	Hardwood limbs
		Total	Sawtimber trees	Poletimber trees		
	Million cubic feet	*Million cubic feet*	*Million cubic feet*	*Million cubic feet*	*Million cubic feet*	*Million cubic feet*
Pine	17.2	16.8	9.0	7.8	0.4	
Other softwoods [1]	8.2	7.0	3.2	3.8	1.2	
White oak	458.0	336.9	227.1	109.8	9.5	111.6
Chestnut oak	45.3	34.3	18.3	16.0	1.4	9.6
Other white oaks	123.7	83.5	64.5	19.0	4.9	35.3
Black oak	405.4	284.8	204.5	80.3	13.2	107.4
Northern red oaks	288.4	196.2	166.5	29.7	7.3	84.9
Other red oaks	122.3	85.2	56.6	28.6	5.5	31.6
Hickory	346.8	261.8	154.5	107.3	8.5	76.5
Ash	219.1	162.8	95.1	67.7	7.6	48.7
Elm	400.3	265.3	188.2	77.1	27.2	107.8
Cottonwood	48.4	31.9	26.4	5.5	2.1	14.4
Yellow-poplar	182.2	128.7	101.0	27.7	4.5	49.0
Basswood	51.9	31.3	23.3	8.0	4.4	16.2
Sweetgum	66.1	50.8	29.6	21.2	1.2	14.1
blackgum	46.4	31.2	21.8	9.4	2.6	12.6
Sugar maple	349.9	220.1	144.1	76.0	31.1	98.7
Soft maple	206.6	106.6	78.2	28.4	31.7	68.3
Sycamore	118.5	76.0	67.6	8.4	6.0	36.5
Beech	323.0	126.6	114.5	12.1	64.3	132.1
Black walnut	91.7	62.9	36.9	26.0	6.4	22.4
Other hardwoods	261.8	187.0	80.0	107.0	25.6	49.2
Noncommercial species	10.5				9.4	1.1
Total	4,191.7	2,787.7	1,910.9	876.8	276.0	1,128.0
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
All species	100.0	66.5	45.6	20.9	6.6	26.9

[1] About 94 percent redcedar and 6 percent cypress.

TABLE 14.—*Net growing stock volume on commercial forest land, by species and region, Indiana, 1950*

Species	State		Northern		Southern	
	Million cubic feet	*Percent*	*Million cubic feet*	*Percent*	*Million cubic feet*	*Percent*
Pine	16.8	100			16.8	100.0
Other softwoods	7.0	100	(1)		7.0	100.0
White oak	336.9	100	86.9	25.8	250.0	74.2
Chestnut oak	34.3	100	1.6	4.7	32.7	95.3
Other white oaks	83.5	100	47.0	56.3	36.5	43.7
Black oak	284.8	100	98.2	34.5	186.6	65.5
Northern red oak	196.2	100	65.0	33.1	131.2	66.9
Other red oaks	85.2	100	36.1	42.4	49.1	57.6
Hickory	261.8	100	64.3	24.6	197.5	75.4
Ash	162.8	100	70.7	43.4	92.1	56.6
Elm	265.3	100	177.2	66.8	88.1	33.2
Cottonwood	31.9	100	14.7	46.1	17.2	53.9
Yellow-poplar	128.7	100	14.6	11.3	114.1	88.7
Basswood	31.3	100	20.6	65.8	10.7	34.2
Sweetgum	50.8	100	2.4	4.7	48.4	95.3
Blackgum	31.2	100	1.2	3.8	30.0	96.2
Sugar maple	220.1	100	95.9	43.6	124.2	56.4
Soft maple	106.6	100	48.3	45.3	58.3	54.7
Sycamore	76.0	100	30.1	39.6	45.9	60.4
Beech	126.6	100	44.3	35.0	82.3	65.0
Black walnut	62.9	100	22.6	35.9	40.3	64.1
Other hardwoods	187.0	100	62.9	33.6	124.1	66.4
All species	2,787.7		1,004.6		1,783.1	

[1] Less than 0.05 million cubic feet.

TABLE 15.—*Net growing stock volume on commercial forest land, by species and tree-diameter class, Indiana, 1950*

Species	State		Tree-diameter class (inches)						
			6–8	10	12–14	16–18	20–22	24–26	28+
	Million cubic feet	*Percent*	*Million cubic feet*	*Million cubic feet*	*Million cubic feet*	*Million cubic feet*	*Million cubic feet*	*Million cubic feet*	*Million cubic feet*
Pine	16.8	0.6	7.8	3.5	3.7	1.0	0.8		
Other softwoods	[1] 7.0	.3	3.8	1.3	1.2	.3	.4		
White oak	336.9	12.1	62.5	47.3	97.5	63.8	38.5	14.0	13.3
Chestnut oak	34.3	1.2	7.9	8.1	12.9	4.4	1.0		
Other white oaks	83.5	3.0	10.3	8.7	12.9	16.4	13.7	9.5	12.0
Black oak	284.8	10.2	41.5	38.8	84.8	62.4	34.4	18.0	4.9
Northern red oak	196.2	7.0	15.1	14.6	48.0	51.2	30.1	18.5	18.7
Other red oaks	85.2	3.1	15.6	13.0	18.5	15.7	8.1	7.5	6.8
Hickory	261.8	9.4	63.1	44.2	80.7	43.0	17.8	7.0	6.0
Ash	162.8	5.8	41.8	25.9	45.8	27.4	9.9	9.2	2.8
Elm	265.3	9.5	47.3	29.8	61.0	51.6	35.0	26.6	14.0
Cottonwood	31.9	1.2	3.1	2.4	6.4	5.6	5.8	3.4	5.2
Yellow-poplar	128.7	4.6	14.4	13.3	37.5	32.4	22.0	2.7	6.4
Basswood	31.3	1.1	4.1	3.9	9.4	6.4	3.9	2.7	.9
Sweetgum	50.8	1.8	14.0	7.2	12.0	9.5	6.3	1.8	
Blackgum	31.2	1.1	5.8	3.6	7.6	7.1	3.0	3.0	1.1
Sugar maple	220.1	7.9	47.4	28.6	51.3	46.0	30.4	8.8	7.6
Soft maple	106.6	3.8	17.5	10.9	21.7	24.0	17.4	9.8	5.3
Sycamore	76.0	2.7	5.0	3.4	20.9	21.3	12.9	8.5	4.0
Beech	126.6	4.6	6.5	5.6	16.9	39.4	27.1	25.5	5.6
Black walnut	62.9	2.3	15.9	10.1	17.1	14.4	4.3	1.1	
Other hardwoods	187.0	6.7	69.5	37.5	49.7	19.5	7.3	2.7	.8
Total	2,787.7	100.0	519.9	361.7	717.5	562.8	330.1	180.3	115.4
	Percent		*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
All species	100.0		18.7	13.0	25.7	20.2	11.8	6.5	4.1

[1] Includes 400,000 cubic feet of cypress.

TABLE 16.—*Average volume of growing stock per acre, by stand-size class and region, Indiana, 1950*

BOARD-FOOT VOLUME

Standard-size class	State	Northern	Southern
Large sawtimber stands	5,784	6,247	5,376
Small sawtimber stands	3,051	3,206	3,016
Poletimber stands	583	458	613
Seedling and sapling stands	112	188	93
Nonstocked stands	377	1,385	104
Average	2,697	3,952	2,192

CUBIC-FOOT VOLUME

Large sawtimber stands	1,165.4	1,207.1	1,128.7
Small sawtimber stands	919.7	922.1	919.2
Poletimber stands	372.4	355.7	376.5
Seedling and sapling stands	48.2	47.0	48.4
Nonstocked stands	68.9	223.1	27.1
Average	682.9	857.9	612.5

TABLE 17.—*Average 10-year diameter growth, by species and tree-size class, Indiana, 1950*

Species	Sawtimber	Poletimber	Seedling and sapling
	Inches	*Inches*	*Inches*
Pine	1.40	3.40	3.18
Other softwoods	1.60	1.24	1.10
White oak	2.12	1.34	1.06
Chestnut oak	1.72	1.18	.90
Other white oaks	2.04	1.16	1.76
Black oak	2.16	1.94	2.00
Northern red oak	2.34	2.28	1.64
Other red oaks	2.94	2.72	2.34
Hickory	1.46	1.38	1.12
Ash	2.00	1.62	1.30
Elm	2.38	1.94	1.70
Cottonwood	4.18	3.32	1.60
Yellow-poplar	2.50	2.50	1.72
Basswood	1.88	1.84	1.64
Sweetgum	2.12	2.18	1.72
Blackgum	1.40	1.34	1.14
Sugar maple	1.68	1.56	1.18
Soft maple	2.84	2.44	1.74
Sycamore	2.54	2.58	3.50
Beech	1.62	1.70	.84
Black walnut	2.04	2.08	1.94
Other hardwoods	2.44	2.06	1.60
Average, all species	2.14	1.78	1.48

TABLE 18.—*Average growth per acre of sawtimber and growing stock, by region, Indiana, 1950*

SAWTIMBER

Region	Growth on present inventory volume	Ingrowth	Mortality	Net growth
	Board-feet	*Board-feet*	*Board-feet*	*Board-feet*
Northern	108	84	7	185
Southern	67	52	4	115
State	79	61	5	135

GROWING STOCK

	Cubic feet	*Cubic feet*	*Cubic feet*	*Cubic feet*
Northern	26.7	2.8	1.9	27.6
Southern	23.3	3.6	1.4	25.5
State	24.3	3.3	1.5	26.1

TABLE 19.—*Number of sound trees on commercial forest land, by species and tree-diameter class, Indiana, 1950*

Species	State	D. b. h. class in inches							
		2	4	6	8	10	12–14	16–18	20+
	Million trees	*Million trees*	*Million trees*	*Million trees*	*Million trees*	*Million trees*	*Million trees*	*Million trees*	*Million trees*
Pine	21.9	8.4	10.0	2.2	0.9	0.3	0.1	(1)	(1)
Other softwoods	12.3	7.9	1.8	1.5	0.6	0.4	0.1	(1)	(1)
Chestnut oak	10.4	3.1	2.1	1.6	1.5	1.1	0.8	0.2	(1)
White oak	84.3	26.9	20.1	13.9	8.2	5.5	6.3	2.2	1.2
Other white oaks	9.7	7.6	4.8	2.1	1.8	1.3	0.9	0.6	0.6
Black oak	58.1	19.4	11.8	8.0	6.0	4.5	5.3	2.1	1.0
Northern red oak	35.0	12.5	8.9	4.0	2.5	2.2	2.6	1.4	0.9
Other red oaks	26.1	13.2	4.1	2.9	2.2	1.6	1.3	0.5	0.3
Hickory	166.1	93.3	32.8	17.0	10.2	6.3	4.9	1.2	0.4
Ash	94.6	54.2	17.4	10.4	5.2	3.0	2.8	1.2	0.4
Elm	121.8	61.8	24.5	14.1	8.4	5.1	4.5	2.0	1.4
Cottonwood	5.7	3.2	0.7	0.7	0.3	0.2	0.3	0.2	0.1
Yellow-poplar	22.1	8.8	4.2	2.5	1.7	1.4	2.0	0.9	0.6
Basswood	8.3	3.5	1.9	1.1	0.5	0.4	0.7	0.1	0.1
Sweetgum	18.6	7.0	5.0	3.2	1.8	0.8	0.6	0.1	0.1
Blackgum	19.0	10.9	4.1	1.8	0.9	0.5	0.5	0.3	(1)
Sugar maple	144.6	95.1	23.4	11.5	5.9	3.4	3.1	1.3	0.9
Soft maple	38.3	17.6	8.6	5.1	2.7	1.5	1.6	0.8	0.4
Sycamore	10.4	4.6	1.1	1.5	0.8	0.4	1.1	0.6	0.3
Beech	23.8	11.8	3.7	2.2	1.2	1.1	1.3	1.4	1.1
Black walnut	32.5	16.0	6.5	4.0	2.7	1.4	1.2	0.6	0.1
Post species	161.3	114.4	33.4	8.9	2.7	1.0	0.9	(1)	(1)
Other hardwoods	233.6	171.3	36.2	12.3	6.3	4.0	2.7	0.6	0.2
Total	1,368.5	772.5	267.1	132.5	75.0	47.4	45.6	18.3	10.1
Trees per forest acre	335.3	189.2	65.4	32.5	18.4	11.6	11.2	4.5	2.5

[1] Less than 0.05 million trees.

TABLE 20.—*Net volume of timber on commercial forest land, by class of material and species group, Indiana, 1950*

Class of material	State	Softwoods	Hardwoods
	Million cubic feet	*Million cubic feet*	*Million cubic feet*
Growing stock:			
Sawtimber trees:			
Sawlog portion	1,671.9	9.3	1,662.6
Upper stem portion	239.0	2.9	236.1
Total sawtimber	1,910.9	12.2	1,898.7
Poletimber trees	876.8	11.6	865.2
Total growing stock	2,787.7	23.8	2,763.9
Other material:			
Sound cull trees	52.7	1.6	51.1
Rotten cull trees	223.3	(1)	223.3
Hardwood limbs	1,128.0		1,128.0
Salvable dead trees			
Total other material	1,404.0	1.6	1,402.4
Total, all timber	4,191.7	25.4	4,166.3

[1] Less than 50,000 cubic feet.

TABLE 21.—*Net annual growth, mortality, and cut of live sawtimber and growing stock on commercial forest land, by species group, Indiana, 1950* [1]

Item	Sawtimber			Growing stock		
	State	Softwoods	Hardwoods	State	Softwoods	Hardwoods
	Million board-feet	*Million board-feet*	*Million board-feet*	*Million cubic feet*	*Million cubic feet*	*Million cubic feet*
Net annual growth	551	15	536	106.6	1.8	104.8
Annual mortality	19		19	6.2	.1	6.1
Annual cut:						
Timber products	218.1	.4	217.7	40.5	.2	40.3
Logging residue	36.1		36.1	6.0		6.0
Total	254.2	.4	253.8	46.5	.2	46.3

[1] Although timber cut was determined for the year 1949, the total cut figure is considered representative of the total cut in 1950.

TABLE 22.—*Output of timber products and annual cut of live sawtimber and growing stock, Indiana, 1949*

Product	Output of timber products [1]					Annual cut					
	Volume in standard units		Roundwood volume			Sawtimber			Growing stock		
	Standard units	Number	State	Softwoods	Hardwoods	State	Softwoods	Hardwoods	State	Softwoods	Hardwoods
			Thousand cubic feet	*Thousand cubic feet*	*Thousand cubic feet*	*Thousand board-feet*	*Thousand board-feet*	*Thousand board-feet*	*Thousand cubic feet*	*Thousand cubic feet*	*Thousand cubic feet*
Sawlogs	M board-feet [2]	161,146	22,381	56	22,325	190,950	401	190,549	27,424	57	27,367
Veneer logs and bolts	do	11,596	1,611		1,611	13,921		13,921	2,000		2,000
Cooperage logs and bolts	do	4,637	644		644	5,567		5,567	799		799
Pulpwood	Standard cords [3]	8,688	556		556	22		22	556		556
Fuelwood	do	437,962	27,595		27,595	34,945		34,948	11,304		11,304
Piling	M linear feet	0	0	0	0						
Poles	M pieces	0	0	0	0						
Posts	do	4,340	2,938	94	2,844	2,658		2,658	2,266	94	2,172
Hewn ties	do	26	160	0	160	1,313		1,313	215		215
Mine timbers	M cubic feet	821	821	0	821				821		821
Miscellaneous [4]	do	1,072	1,072	0	1,072	4,875		4,875	1,086		1,086
Total			57,778	150	57,628	254,251	401	253,850	46,471	151	46,320

[1] Includes material from both growing stock and other miscellaneous sources.
[2] International ¼-inch rule.
[3] Rough wood basis.
[4] Includes chemical wood, excelsior, handle stock, shingle bolts, etc.

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