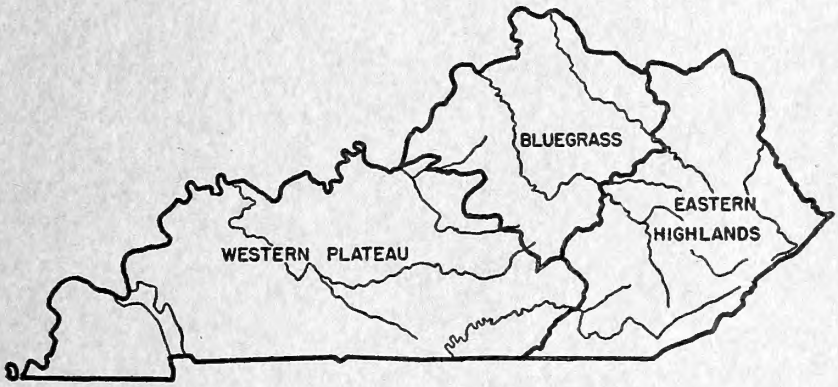
Kentucky's FOREST RESOURCES *and* INDUSTRIES



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Kentucky's Forest Resources and Industries

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CENTRAL STATES FOREST EXPERIMENT STATION

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Preface

THROUGH the McSweeney-McNary Act of 1928, Congress authorized the Secretary of Agriculture to conduct a comprehensive survey of the forest resources of the United States. The purpose of this survey is (1) to make a field inventory of the present supply of standing timber; (2) to find out how fast this supply is being increased through growth; (3) to find out how much it is being diminished through industrial and domestic uses, fire, insects, disease, and other causes; (4) to determine the present consumption of and the probable future trend in requirements for forest products; and (5) to interpret and correlate these findings to aid in the formulation of private and public forest policies.

This report covers the first complete and comprehensive inventory of the forests of Kentucky. Its statistics, based on a scientifically designed sampling procedure using both aerial photographs and ground plots, provide reliable data on a statewide basis. The estimates of timber volume reported here are higher than estimates compiled for the 1945 reappraisal project by the Forest Service in cooperation with the American Forestry Association. Some part of this increased volume is probably due to the inclusion in the Forest Survey estimate of relatively low-quality logs that were not considered merchantable in the earlier estimate. The greater part of the increase, however, is due to the fact that the 1945 figure was based on the best general information then available and not on a sampling survey covering all parts of the State.

Contents

Summary

Importance of the Forest.—There are approximately 11½ million acres of commercial forest land in Kentucky. This is 45 percent of the total land area. The forests support a total volume of 6½ billion cubic feet of growing stock, which includes nearly 25 billion board feet of sawtimber. More than 90 percent of the growing stock is in hardwood species. In 1948 the value of all primary forest products produced (all round products) was 42 million dollars. About 3⅓ million man-days of labor were required to cut these primary wood products and deliver them to the mills or users.

Ownership of the Forest.—Ninety-four percent of Kentucky's forest area is privately owned—about half by farmers. The Federal Government owns 671,000 acres, mostly in the Cumberland National Forest. The State owns 56,000 acres. All of the forest land is capable of producing commercial timber, but 51,000 acres, mostly in the Mammoth Cave National Park, are reserved from timber cutting.

Most of the forest area owned by farmers is in small tracts, averaging about 30 acres per farm. Some coal and lumber companies own tracts of timber ranging from 10,000 to 50,000 acres and larger in size. Most of these larger ownerships are in the eastern part of the State.

Condition of the Forest.—In general the forest is understocked, of poor quality, and averages only 2,154 board feet per acre. Of the forest area 43 percent bears sawtimber stands. Stands of large sawtimber average 5,300 board feet per acre, and small sawtimber stands average 3,000 board feet per acre. Pole stands, found on 36 percent of the forest area, average 432 cubic feet per acre, including 726 board feet per acre in scattered sawtimber trees. Seedling and sapling, and nonstocked stands occur on one-fifth of the forest area.

In general the stands have an abnormally high proportion of small trees. The average acre has 364 sound trees: 80 percent are in the 2- and 4-inch diameter classes, 16 percent are pole size, and 4 percent are sawtimber size. In addition, the average acre has 3 or 4 sawtimber-size cull trees.

Nearly 85 percent of the 23 billion board feet of hardwood sawtimber volume is in grade 3 logs—logs that on the average yield about 20 percent of their volume in No. 1 Common or better lumber. However, more than 40 percent of this low-quality volume is in trees too small to contain high-quality logs. Future growth will convert much of this volume into logs of higher quality.

The forests are made up chiefly of two types—oak–hickory and mixed hardwoods. All other types account for 23 percent of the commercial forest area. They include the redcedar–hardwoods, bottom-land hardwoods, pine, oak–pine, white oak, and beech–maple.

Harvest and Manufacture of Timber.—In 1948 more than 208 million cubic feet of wood was cut for primary wood products. Of this volume 77 percent represented the cut of live sawtimber and poletimber. The remainder was saplings, upper stems and limbs, dead trees, and wood cut from nonforest areas such as fence rows and scattered trees. Of the wood cut, 46 percent was used for fuelwood, but less than half of this came from growing stock; 34 percent was cut for sawlogs and all of this came from growing stock; 20 percent was cut for all other products, including mine timbers, fence posts, stave bolts, veneer logs, and miscellaneous farm timbers, and almost all of this came from growing stock.

Primary wood products were further processed at about 2,000 sawmills, 87 stave and heading mills, 6 veneer mills, and 3 handle plants. These plants used about 1.1 million man-days of labor. In addition, Kentucky has a number of remanufacturing plants that turn out finished products such as furniture, millwork, containers, flooring, and sporting goods and playground equipment.

Annual Growth-Drain Balance.—The net growth of sawtimber was nearly 1.2 billion board feet, while in 1948 timber cutting removed 734 million board

feet. Thus sawtimber growth exceeded drain by more than 60 percent. However, because more than one-third of the sawtimber drain was in high-quality logs, and because much of the growth was in small timber, the growth of high-quality logs failed by 84 million board feet (32 percent) to equal drain.

The net growth of growing stock exceeded drain by more than 65 percent. The growth of growing stock was 267 million cubic feet, while timber cutting removed 161 million cubic feet. Of this, 56 million cubic feet was cut from pole trees, mainly for fuelwood and mine timbers.

A Forest Improvement Program.—The generally understocked condition of Kentucky forests and the generally low volume and quality of the sawtimber indicate that forest production can be greatly increased. Under good management and protection the forests of the State could double or triple their sawtimber volume. Even now the growing-stock volume is increasing, but special effort is needed to concentrate this growth on larger, high-quality trees. Several things can be done to build up the growing-stock volume and to improve the timber quality: (1) Adopt cutting practices, starting on good sites, that will remove the low-quality and cull trees and allow the rapid-growing potentially high-quality trees to grow to a diameter of at least 16 inches and larger before harvesting; (2) protect all forest land from fire, insects, and disease; (3) discourage livestock grazing on hardwood timberland; (4) conduct research to determine the best management and utilization practices for the forests of Kentucky; and (5) encourage integrated harvesting, marketing, and utilization of forest products to help channel high-quality timber to uses requiring high-quality timber and to expand the use of low-quality wood.

General Description of the State

TO UNDERSTAND the place of the forest resource in Kentucky's economy it is necessary to know something about the land and the people. The Bluegrass State extends from the western slopes of the Appalachian Mountains to the Mississippi River. The State is about 350 miles long and 175 miles wide, and has a total area of about 25½ million acres.

Three forest regions merge in Kentucky. Although most of the State lies in the Central Hardwoods forest region, a belt of southern hardwoods extends across the western end. The Northeastern Hardwoods region, which extends along the Appalachian Mountain chain, laps over into eastern Kentucky.

Physical Characteristics

Kentucky has a climate very favorable for tree growth. Rainfall averages about 40 inches annually and is well distributed geographically and seasonally. The growing season is long, ranging from about 175 days in the higher mountains of eastern Kentucky to nearly 200 days along the Mississippi River in the southwest.

The Eastern Highlands

This region is also known as the Eastern Coal Fields region. It is by far the most heavily forested part of Kentucky. Although the Eastern Highlands has only 29 percent of the total area, it has nearly half of the forest land (fig. 1). It includes large areas of continuous forest. Some counties are more than 90 percent forested, and the region averages 76 percent. It is rugged and mountainous. The region is dissected by narrow valleys and coves, with steep, sharp ridges rising 500 to 1,500 feet. Tree growth is excellent in the valleys and coves where the soils are fertile though limited in extent. On the ridges tree growth is slower and less desirable tree species are usually found. Though some slopes and ridgetops are cultivated (fig. 2), most of the region is too rough and therefore has never been cleared of timber. The soils erode easily and quickly lose their fertility, so forests are gradually reclaiming

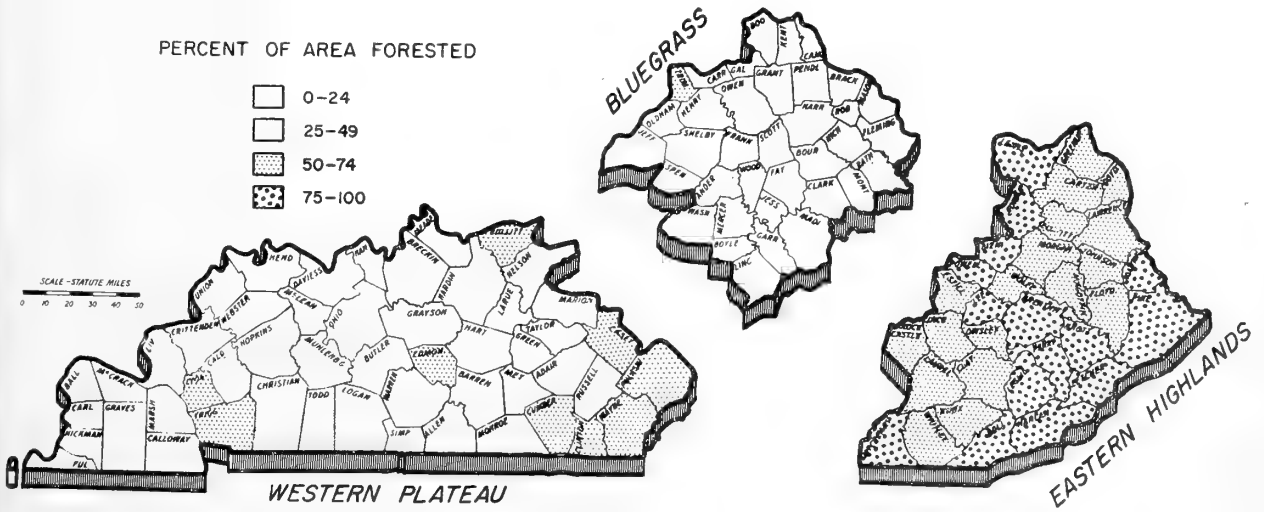

FIGURE 1.—*The forest regions of Kentucky, showing percent of land forested, by county, 1949.*

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FIGURE 2.—*When planted to corn, slopes like this one in Clay County erode rapidly and eventually are abandoned.*

much land that was once farmed. Farming is only locally important in this region. Coal is the most important resource and mining the chief occupation. Rugged topography has hindered highway and railroad building, and poor transportation has in turn retarded forest industry. Cumberland National Forest, Kentenia State Forest, and Kentucky Ridge State Forest are all located here.

The Bluegrass

This famous region, the most lightly forested area of the State, has 22 percent of the total land area but only 11 percent of the forest land. It is the wealthiest, most industrialized, and most heavily populated region in the State. The original forests were cut and the land cleared because the fertile soils and gentle terrain that predominate made such fine farm and pasture land (fig. 3). In 1949 nearly half the State's farm products were grown in this region.

Because this is the State's best farmland, forests are restricted to the steeper slopes and poorer soils. The proportion of land in forest varies from 2 percent in Bourbon County to 52 percent in Trimble County. The timbered areas are mostly small farm woodlands, and many are so heavily grazed that they resemble well-shaded pastures rather than forests.

FIGURE 3.—*Fine pastures like this are common in the Bluegrass region. Many of these pastures are partially timbered to provide protection and shade for the livestock.*

The Western Plateau

The Western Plateau region has nearly half of the total land and 40 percent of the forest land. The proportion of land in forest varies from 12 percent in Simpson County to 64 percent in Wayne County.

This region includes four distinct types of topography. Along the northeast border of the region is a narrow band of hills 10 to 20 miles wide and about 230 miles long. These steep, conical, limestone and sandstone capped hills, rising 400 to 700 feet above the Bluegrass Plateau are known as the knobs (fig. 4). For the most part they are timbered; their thin, stony, shale-loam soils are too poor and their slopes too steep for farming. Stream and sheet erosion in the area have developed broad bottom lands of deep, heavy-clay soils.

In the north-central part of the Western Plateau region is the Western Coal Field, an area of rounded hills 400 to 500 feet high dissected by the Ohio, Green, and Tradewater Rivers and their tributaries. The area is known mainly for its minerals but is also an important farming area. Oil, gas, and rock asphalt, as well as coal, are produced. The alluvial bottom-land soils are deep and fertile, though some of them require draining. Many of the undrained areas support fine stands of bottom-land hardwoods. The upland soils, though fertile, are thin, light-textured, and subject to severe erosion (fig. 5).

In the extreme western part of the region, west of the Tennessee River, is a low, undulating plain susceptible to rapid erosion. Sharp gullies develop rapidly where the soil is not protected. The soils were formed mostly from unconsolidated sandstone and shale covered with loess. They are fertile except where poorly drained. The bottom-land areas are very fertile but are exposed to flooding, and drainage is slow. As a result, much of the bottom land has not been cleared and is supporting good stands of hardwoods.

The southeastern part of this region is a gently rolling upland plain with a belt of rough topography bordering the Western Coal Field. Thousands of limestone sink holes are found here. Underground drainage is common and there are many caves, Mammoth Cave being the best known. Most soils of Kentucky developed under forest cover, but this area had a few small natural prairies in the headwaters of the Barren River. Except in the rough part of the region, farming is important though the soils are not quite as productive as those of the Bluegrass.

Economic and Social Characteristics

Kentucky is a State of small towns and villages. In 1950 the total population was 2.9 million. About one-third of the people live in towns. Only 15 towns have a population of 10,000 or more and only 3 cities have more than 50,000. The labor force totals about 1 million persons.

Manufacturing and agriculture are the two most important economic activities in Kentucky. Manu-

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FIGURE 4.—*A typical knob above the agricultural lands of the Bluegrass Plateau. Site conditions and tree growth are generally poor on these knobs.*

FIGURE 5.—*Erosion occurring on a 5-percent slope in Grayson County. Many areas of Kentucky must be kept under grass or timber cover to prevent erosion such as this.*

facturing leads in value of product but agriculture is first in number of workers. Only about 2 percent of the total labor force is engaged in harvesting and processing primary forest products.

Since 1900 farming has declined in importance while other industries, especially coal mining, have increased. In 1910, more than 450 thousand persons were farming in Kentucky. By 1950, this number had dropped to less than 300 thousand. On the other hand, in 1900 there were less than 10,000 miners in the State, but by 1950 this number had increased to about 75,000.

Although the average income per person in Kentucky has been increasing, it is still falling farther and farther behind the national average (fig. 6).

Agriculture

In Kentucky 26 percent of the 19.4 million acres in farms is in crops (*8*).[1] The important crop is tobacco (fig. 7). North Carolina is the only State producing more tobacco than Kentucky. In 1949 tobacco from less than one-third of a million acres was worth 176 million dollars; corn from more than 2 million acres was worth only 96 million dollars.

More than 8 million acres are devoted to pasture and to growing hay for Kentucky's important live-

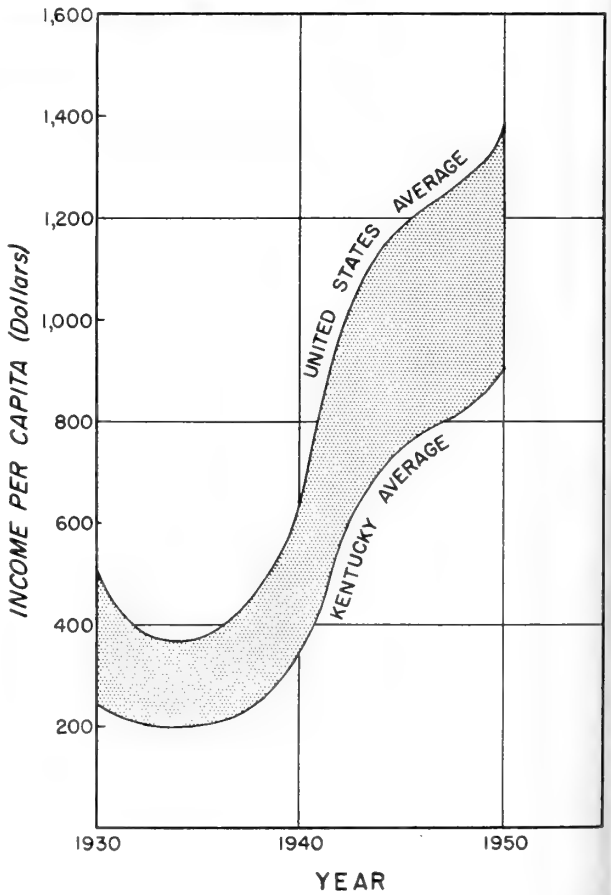

FIGURE 6.—*Trend in average personal income: United States and Kentucky.*

[1] Italic numbers in parentheses refer to Literature Cited, p. 35.

stock industry. Some of the livestock farms, especially in the Bluegrass region, are showplaces developed by capital gained through means other than farming.

FIGURE 7.—*Kentucky ranks second among tobacco producing States.*

The area of cropland increased during the settlement period to a peak of more than 14 million acres in 1910. However, during the past 40 years more than 2 million acres have reverted to woodland, unimproved pasture, idle land, or other noncrop use (fig. 8).

Kentucky's rough topography greatly limits cultivation. The 1950 Census of Agriculture found that about 36 percent of the area in farms was left in pasture and about 7 percent was idle. Woodland grazing is common throughout the State, but it is most common in the Bluegrass region where more than 40 percent of the forest area is heavily grazed. If heavy grazing is continued, the forest cover will eventually be eliminated.

Kentucky has many small farms, especially in the mountains where only narrow ridgetops and valley bottoms are tillable. According to the 1950 Census of Agriculture only three States had more farms less than 10 acres in area than Kentucky. Partly because of this small size, the cash income per farm is low. In 1949 the average income per farm in Kentucky was about $2,500. This is less than half the average farm income for the Nation as a whole.

Because of this low farm income and because of local custom, many farmers work part time at some nonfarm occupation. In 1950 nearly one-fifth of the farmers in Kentucky worked 100 days or more off the farm. In the Eastern Coal Field region especially, many rural dwellers are primarily miners or loggers. But they are also part-time farmers, thereby meeting the Census Bureau definition of a farm operator. In general, these workers expect only a bare subsistence from the land; they depend upon work in the mines, the woods, or sawmills to supply cash income for the family. Although the population of this region is too great for the work available, many of the people do not wish to leave their mountain country.

In spite of the need for supplemental cash income and the fact that 25 percent of the farm area is growing timber, it appears that few farmers are making their woodlands contribute adequately to their cash income. For example, in 1949, according to the Census of Agriculture, Kentucky farmers got an average cash return of about 65 cents per acre of farm woodland. However, farmers cut for their own use fuelwood, posts, and other products worth several times this amount every year.

Minerals and Mining

In 1950 Kentucky produced about 460 million dollars worth of minerals. More than 85 percent of Kentucky's mineral income is from coal, most of which is mined in the Eastern Coal Field region. Other minerals produced are oil, rock asphalt, fluorspar, natural gas, and clay.

More than 16 million cubic feet of round or split wood were used in 1948 in Kentucky's coal mines. Of this volume, 90 percent was used in the deep mines of the Eastern Coal Field region. Most of this wood is taken from forests near the mines and is cut by the miners or local farmers. Little wood is used in strip-mining operations.

Manufacturing

The 1947 Census of Manufactures lists 2,244 manufacturing establishments in Kentucky, not including small sawmills producing less than 200 M board feet a year. Of the 130,000 persons employed in manufacturing in 1947, approximately 15 percent were in the primary forest products industries (7).

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FIGURE 8.—*Many of Kentucky's abandoned fields will eventually revert to forest cover.*

More than 3,000 persons are employed, part time at least, in Kentucky sawmills. The furniture industry employed more than 6,000 persons in 1947. And the whisky barrel manufacturers employed about 2,500.

Transportation

Kentucky now has a modern highway system, even though many of the roads are steep and winding. Although the State has more than 3,600 miles of modern railway lines, it has a higher proportion (66 percent) of communities without rail facilities than any other State in the Union. Only 5 States shipped more total tonnage in 1947 than Kentucky; 90 percent of Kentucky's freight shipment was coal. Three main north-south rail lines cross Kentucky, but none of the main east-west lines pass through the State.

Except in the mountainous eastern part of Kentucky, the road and railroad systems are generally adequate to transport forest products—in dry weather at least. Because of the rough topography and high cost of construction in eastern Kentucky, access-road building has lagged there. However, because of the increased demand for coal during the past decade, motor truck roads have been constructed to connect small coal mines, formerly called "wagon" mines (fig. 9), with the valley rail lines. These roads, for the most part, have been available for transporting logs and other forest products.

Eight streams provide more than 3,000 miles of navigable water. Most of Kentucky's larger industrial plants are located on or adjacent to these rivers, and many products, including lumber and other wood products, are shipped by river barge.

Electric Power

River development in recent years by the Tennessee Valley Authority and the Corps of Engineers has brought electricity to most communities and many farms in Kentucky and has made electric power available for industry, including small woodworking plants.

The success of these hydroelectric developments depends greatly upon the forests on the upstream watersheds. Good forest cover helps prevent soil erosion, thereby reducing sedimentation in the reservoirs. The forests also increase the water-storing capacity of the watershed and regulate the flow of water in the streams.

Multiple Land Use

One of the big problems of the State is to obtain the most effective use of its 24 million acres of agricultural and forest land. To do this requires multiple use of much of the land. Forests can protect watersheds, shelter wildlife, and provide recreation facilities as well as produce forest products. However, because much forest land of Kentucky is in small tracts and so intermingled with agricul-

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FIGURE 9.—*Truck roads now reach the small coal mines that were called "wagon" mines a few years ago.*

tural land, watershed-management practices on forest lands cannot give the desired results unless agricultural lands are managed for the same objective.

Much land in Kentucky is so rough that watershed protection may be its primary use. Flash floods are very destructive in some places. For example, the annual flood damage in the Kentucky River watershed is estimated to be about 12 million dollars. More than half of this loss is caused by flooding annual crops and pasture. Misuse of the so-called "hill land" in the upper watersheds contributes greatly to the damage caused by these floods. Experts believe that good land management could reduce flood damage in the Kentucky River watershed by half. Inasmuch as 40 to 45 percent of this watershed is in forest cover, forest management and good timber cutting practices are important in any flood control program.

Flood damage, while spectacular, is not necessarily the greatest loss suffered from the misuse of land. In some parts of Kentucky the underground water table has recently been dropping 2 feet or more a year. Many communities are short of water during dry periods and so cannot accommodate new industries. Surface water can be impounded to furnish a water supply, but this might not be dependable unless the watershed is protected. Forests provide good protection. London and Morehead have both built reservoirs only to have them silt up in a few years and become nearly useless. Morehead built a second impoundment with the watershed area protected by the Cumberland National Forest. Where watersheds are not protected by natural forests, communities may find it profitable to establish forest plantations to provide watershed protection.

Recreation is important in Kentucky even though recreational facilities are not yet fully developed. In 1951 more than 2 million persons visited the State parks. In addition, many visited Mammoth Cave National Park, the Cumberland National Forest, and privately owned attractions. The forests, streams, geological attractions, and historical points of interest could accommodate an even larger tourist trade.

All together, there are about 727,000 acres of forests in public ownership. Most of this acreage is in the Cumberland National Forest. Kentucky's State parks and national parks contain more than 50,000 acres. Without these forests the State's playgrounds would lose much of their appeal to the tourist (fig. 10). Thousands of people also use the forests as a place to hunt and fish. During the

FIGURE 10.—*Swimming is only one of many forms of recreation available at the Pennyrile State Forest in Christian and Caldwell Counties. (Courtesy of Kentucky Division of Publicity.)*

1950–51 hunting season, hunters killed more than 7 million quail, rabbits, and squirrels. Since many of the desirable game animals once common to Kentucky are no longer available for hunting, the Kentucky Department of Fish and Wildlife Resources is restocking some areas with grouse, turkey, beaver, and deer. Many streams in the State have become so polluted that game fish cannot live in them. Steps are being taken to reduce or eliminate the pollution and to restock these streams.

Kentucky's Forest Resources

Forest Area and Ownership

THE FOREST area of Kentucky is 11½ million acres—45 percent of the total land area (fig. 11). No other State in the Central States region has so much of its land in forest. All of the forest area is productive and accessible. However, some 51,000 acres, mainly in State and Federal parks, are reserved from timber cutting.

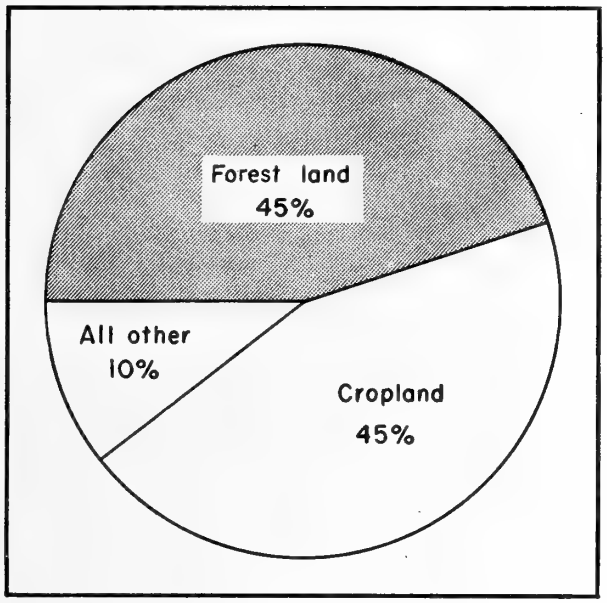

FIGURE 11.—*Major land uses.*

Forestry problems must be considered in the light of forest ownership. In general, public forests are dedicated to the public welfare, whereas private forests are operated for the immediate economic gain of the owner. Ninety-four percent of the forest land[2] in Kentucky is privately owned. Of this, about half is held by farmers (fig. 12) and the remainder by industrial operators and others.

[2] The definition of "forest land" and other Forest Survey terms used in this report are in the appendix, pp. 36 to 40. Because the terminology differs somewhat from that in earlier reports, the definitions should be studied carefully.

Farm woodlands average about 30 acres. Because of their small size, and also because diversified markets are lacking, annual or even frequent periodic sales of forest products are not often possible. Lump-sum sales are common and returns are usually small when compared with income from other products. As a result, many farm woodland owners have scant incentive to practice forestry.

Coal companies are perhaps the most important single class of nonfarm owners. Many of their ownerships are large. In 21 counties of the Eastern Highlands region, more than a million acres are in ownerships of 1,000 acres and larger. Coal and lumber companies own most of this land. In addition, the coal companies have leased the mineral rights on privately owned land concentrated in the Eastern Highlands and in the north-central part of the Western Plateau.

Some of the coal companies cut mine timbers from their own land and from leased land. The rights of access and of free use of small timber held

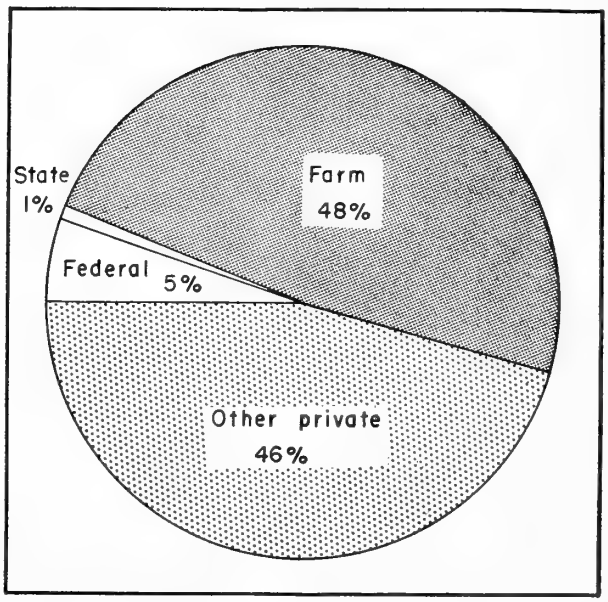

FIGURE 12.—*Forest land ownership.*

FIGURE 13.—*All vegetation is destroyed in strip-mining operations, and unless steps are taken to rehabilitate areas such as this, many years will pass before nature produces a useful crop.*

by mineral-right lessors tend to discourage the landowner from forestry. Many landowners hesitate to plant trees on land covered by a mineral lease for fear that subsequent mining operations may wipe out their investments (fig. 13). It is estimated that the area of leased land is more than a million acres.

Six percent of the forest area is in public ownership. Of this more than half is in the Cumberland National Forest. Less than 1 percent is State-owned —largely in State forests and State parks.

Forest Types

The Forest Survey recognized eight forest types in Kentucky. The oak-hickory and mixed-hardwoods types together cover more than 75 percent of the commercial forest area (fig. 14). The oak-hickory type, found chiefly on the dry uplands, contains a number of species of oak in mixture with hickory and other hardwoods (fig. 15). In eastern Kentucky, chestnut oak and black oak are the pre-

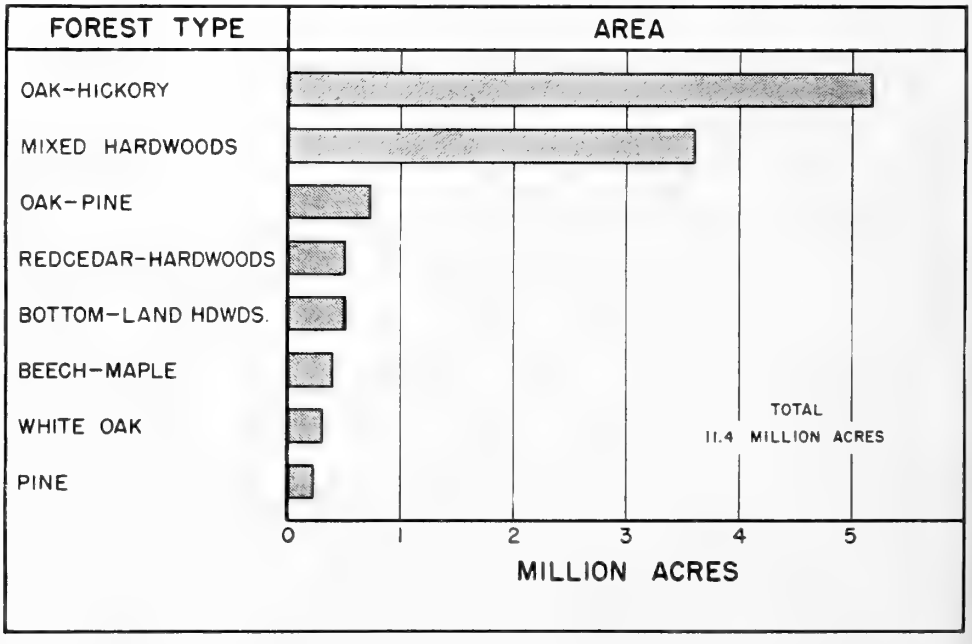

FIGURE 14.—*Kentucky's commercial forest area by forest type.*

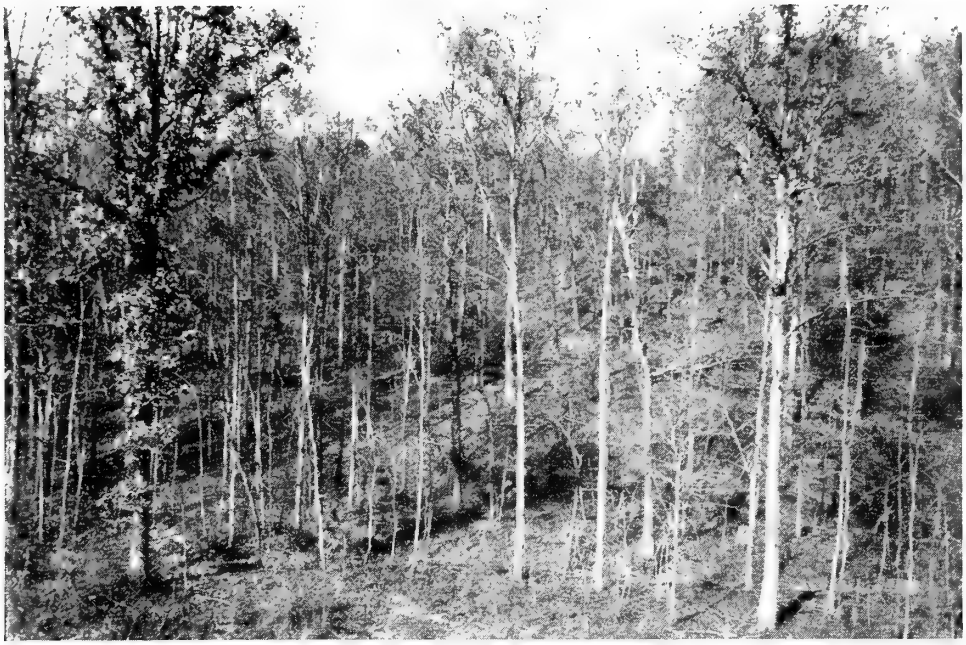

FIGURE 15.—*An oak-hickory stand near Kentucky Dam in the Western Plateau region.*

dominant species in this type; elsewhere black oak and the hickories predominate.

The mixed-hardwoods type contains several important timber species including yellow-poplar, white oak, black walnut, ash, beech, and maple. This type reaches its best development in the deep coves of the Eastern Highlands region. Two-thirds of the yellow-poplar in Kentucky is found here. This type also contains a large volume of beech.

About 80 percent of the pine and oak-pine forest is located in the Eastern Highlands region. Shortleaf pine is the major species, although Virginia pine is common (fig. 16). Some eastern white pine is found in the Eastern Highlands. Some pine is

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FIGURE 16.—*Pine grows well on the ridges of the Eastern Highlands and is increasing in importance. This stand of shortleaf pine is in Jackson County.*

being planted in the Western Plateau region, chiefly on State-owned land.

Most of the redcedar-hardwood type is scattered on the limestone knobs and rock outcroppings bordering the Bluegrass region and throughout the Western Plateau. This type is not commercially important at present. Although some redcedar is cut for fence posts, only a small volume is in trees large enough to produce sawlogs. This species is usually associated with noncommercial or poor-quality hardwoods.

More than 80 percent of the area of bottom-land hardwoods type is in the Western Plateau region, and occurs mainly on the flood plains of the larger streams (fig. 17). The principal species found in this type include sweetgum, sycamore, elm, hickory, soft maple, ash, cottonwood, and various oaks. The locally important container-veneer industry depends upon the soft-hardwood species found growing in this type.

About two-thirds of the area of the beech-maple type is found in the Western Plateau region. Half of the area in this type is classified as large sawtimber. Much of the timber, especially the beech, is in large overmature trees that were left by earlier loggers.

FIGURE 17.—*The bottom-land type occurs on excellent sites where tree growth is rapid. Good management practices could improve the species composition and growth of many bottom-land stands such as this of blackgum, hickory, and oak found along Pond River in McLean County.*

Stand-Size Classes

The distribution of forest area by stand-size class is important because, in general, the present sawtimber must carry the dependent industries until the poletimber grows to sawtimber size. Considering the State as a whole, 43 percent (5 million acres) of the forest area now bears sawtimber stands (fig. 18). Of this area, 2¾ million acres support large sawtimber, that is, stands having at least one-half of the board-foot volume in trees 15 inches d.b.h. or larger.

More than 60 percent of the large sawtimber area is in the mountainous Eastern Highlands region. The Western Plateau region has about 35 percent of the large sawtimber area. The rest is in the Bluegrass region.

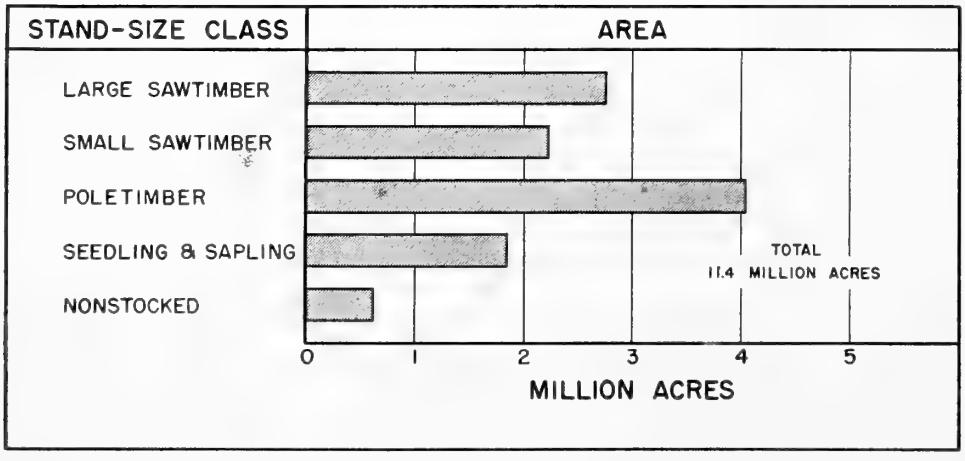

FIGURE 18.—*Commercial forest area of Kentucky by stand-size classes.*

The large sawtimber stands could furnish most of the crop trees for many years. Many of the sawtimber trees in these stands are mature and can furnish high-quality logs. About 140,000 acres of large sawtimber stands would be required each year to maintain the present sawtimber cut in Kentucky. At this rate of cut, these stands would last about 30 years. In the meantime, proper management of the small sawtimber, pole, and seedling and sapling stands would assure high-quality stands for the future. In 5 to 15 years many of the areas in each of these stand-size classes will grow into the next larger stand-size class.

Stocking

The Forest Survey in Kentucky recognized three degrees of stocking (good, fair, and poor), based upon the percentage of ground area covered by crowns of living trees of commercial species. According to this method, more than 75 percent of the forest area in the State has good stocking. However, crown closure does not always give an adequate measure of stocking. For instance, one old, residual tree with a large, spreading crown may occupy as much space as several thrifty, younger trees that may someday be commercially valuable.

On the basis of volume and number of stems per acre, the forest in Kentucky is generally understocked. The forest area averages 364 trees per acre. This is not good stocking for the present diameter distribution. The average tree diameter is about 5 inches. A study of even-aged upland oak forests indicates that stands with an average tree diameter of 5 inches would contain 600 to 700 trees per acre when fully stocked (*6*). The present diameter distribution, however, indicates that the growing stock may improve sharply in the next decade or two if managed for sawlog production. About 80 percent of the trees are in the 2- and 4-inch diameter classes. The 6-, 8-, and 10-inch diameter classes have more than three times as many trees as the 12-inch and larger diameter classes. Under good protection and management nearly all stands would improve rapidly in density and quality.

What is the best stocking by diameter classes for uneven-aged hardwood stands in this region? Research has not yet answered this important question. However, some of the good sawtimber plots measured in Kentucky may serve as a guide.

Figure 19 compares the stocking of the good sawtimber plots with the average stocking of all plots measured in Kentucky. The good sawtimber plots average more than 8,000 board feet per acre and 73 square feet of basal area. About 60 percent of this basal area is in 16-inch and larger diameter trees. Even these plots are probably not more than 75-percent stocked. The average stand in Kentucky has slightly more than 2,000 board feet per acre and less than 50 square feet of basal area. About 20 percent of this basal area is in the larger-size trees. For better sawtimber growth in Kentucky, management should aim at the stocking shown for the good sawtimber plots.

Site Quality

Site quality of forest land indicates the ability of an area to produce timber. This ability is influenced chiefly by the soil, topography, elevation, and exposure. In Kentucky the Forest Survey recognized the following hardwood sites according to the average merchantable height of mature hardwood trees: very good, good, fair, and poor. On very good sites hardwood trees averaged 3 or more 16-foot logs, on good sites 2 logs, on fair sites 1 log, and on poor sites one-half log.

About 20 percent of the forest area in Kentucky is classed for site quality as very good, 65 percent as good, and 15 percent as fair. There is almost no poor-site quality recorded for the State. The Eastern Highlands region rates the best: 95 percent of its forest is good or better site quality. The Western Plateau region has 83 percent of its forest on good or better sites and the Bluegrass region only 44 percent.

Timber Volume

Board-Foot Volume

The forests of Kentucky are not supporting as much timber as they could if properly protected and managed. Total sawtimber volume is nearly 25 billion board feet, including 23 billion board feet of hardwoods and 2 billion board feet of softwoods. The average volume per acre is slightly more than 2,000 board feet. Although this is more than some parts of the Central States and the South aver-

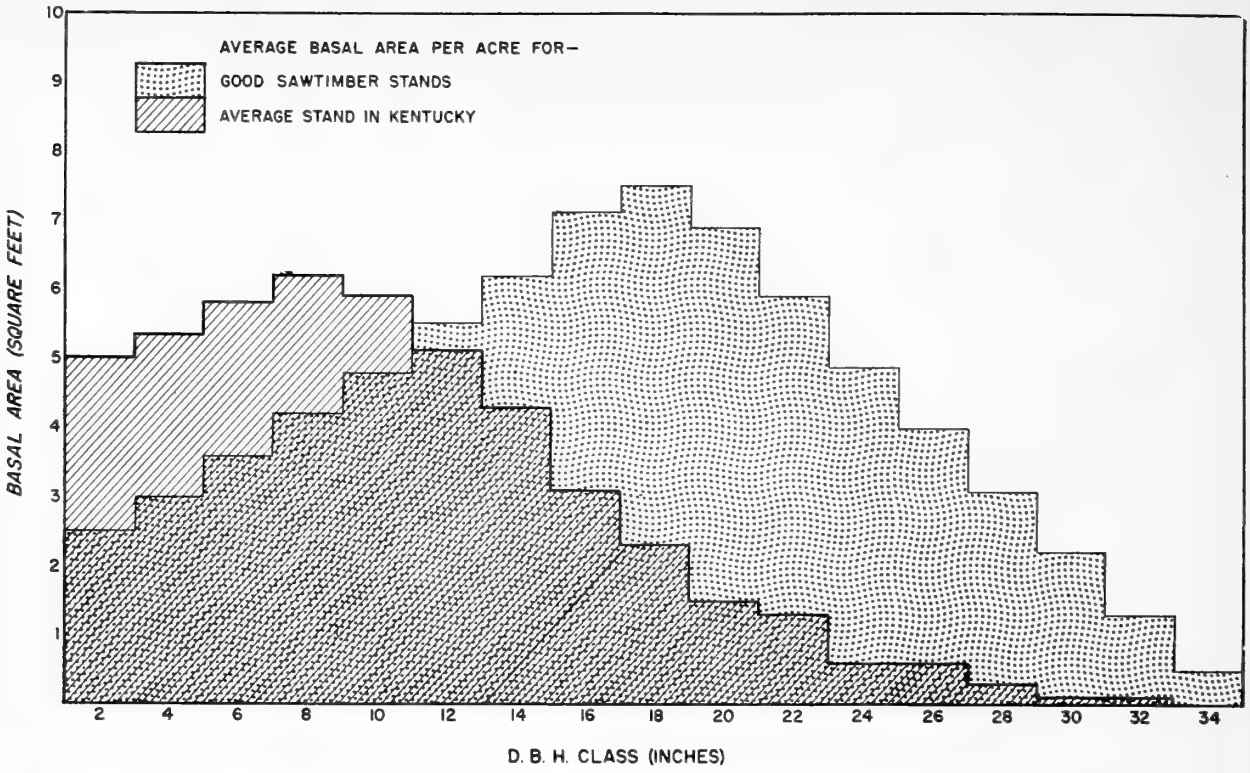

FIGURE 19.—*Average basal area per acre by diameter class.*

age, it is still only one-third to one-half what the forest area could support. Virgin stands probably averaged 8,000 to 10,000 board feet per acre with individual stands going higher than 40,000 board feet.

Because the volume and quality of Kentucky timber has been so greatly reduced in the past 100 years, most of the large sawmills have moved out leaving many small, portable sawmills to take their place.

Board-foot volume by region.—About 55 percent of the State's sawtimber is in the Eastern Highlands region. Here the average per acre is nearly 2,500 board feet. More than 60 percent of the sawtimber area is classed as large sawtimber (stands with more than half their board-foot volume in trees 15 inches d.b.h. and larger). Much of this large sawtimber is in stands that were considered inaccessible during early logging periods, or in species that were not wanted at the time of earlier logging.

Forty percent of the sawtimber is in the Western Plateau region. The forest area of this region averages about 2,000 board feet per acre, with nearly half of the sawtimber area classed as large sawtimber. Almost all of the stands are readily accessible and have been cut over a number of times.

The remaining 5 percent of the sawtimber is in the Bluegrass region. Because this is a farming region and almost all of the timber is readily accessible, the demand for fencing and farm construction materials is great. As a result the average volume per acre is only 1,000 board feet. Only 35 percent of the sawtimber area is classified as large sawtimber.

Board-foot volume by species.—Nearly half the 25 billion board feet of sawtimber is made up of oak—chiefly black oak, white oak, and chestnut oak (fig. 20). The latter is found mostly on the dry ridgetops in the Eastern Highlands region.

Hardwood species that are suitable for pulp and for container veneers, as well as for lumber, make up more than 6 billion board feet. Such species are beech, yellow-poplar, gum, cottonwood, basswood, and soft maple, and most of them are found chiefly in the Western Plateau region. Yellow-poplar and basswood are most common in the coves of the Eastern Highlands region.

Board-foot volume by diameter class.—Nearly 40 percent of the board-foot volume is in sawtimber

trees less than 14 inches in diameter (fig. 21). For the most part, thrifty, well-formed trees 14 inches and smaller in size should be saved to build up the sawtimber stands and to produce a future crop of high-quality sawlogs. It will take only 10 to 15 years for many of these small, thrifty trees to grow into the 16- and 18-inch diameter classes.

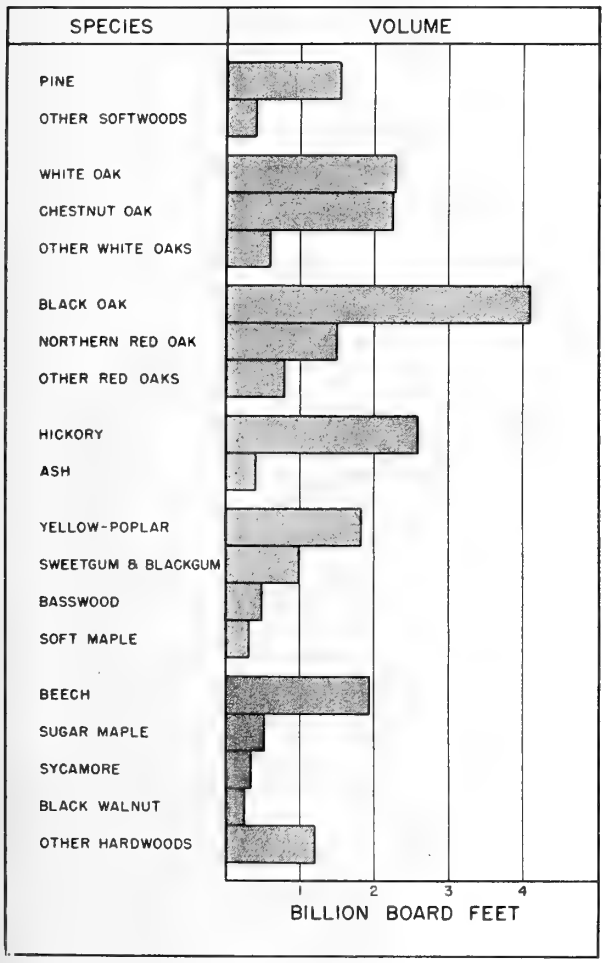

FIGURE 20.—*Net board-foot volume on commercial forest land by species.*

Nearly 30 percent of the sawtimber volume is in 16- and 18-inch trees. These trees have reached the minimum diameter limit required by some users of high-quality logs and are now adding quality growth. The remaining 30 percent of the board-foot volume is in trees 20 inches and larger. The volume in these trees (nearly 8 billion board feet) could sustain the present industry for more than 10 years if all the trees were accessible and available to existing markets. More than 60 percent of the volume in the 20-inch and larger trees is in the Eastern Highlands region.

Board-foot volume by stand-size class.—Most of the sawtimber volume in Kentucky occurs in stands heavy enough to be cut at a profit (fig. 22). More than 85 percent of the sawtimber volume is in sawtimber stands. Nearly 60 percent is in large sawtimber stands that average more than 5,000 board feet per acre; about 25 percent is in small sawtimber stands that average about 3,000 board feet per acre.

Poletimber stands average only a little more than 700 board feet per acre. Nearly 70 percent of this volume is in 12- and 14-inch trees. Ordinarily these trees will not be cut until more trees in the stand reach sawtimber size.

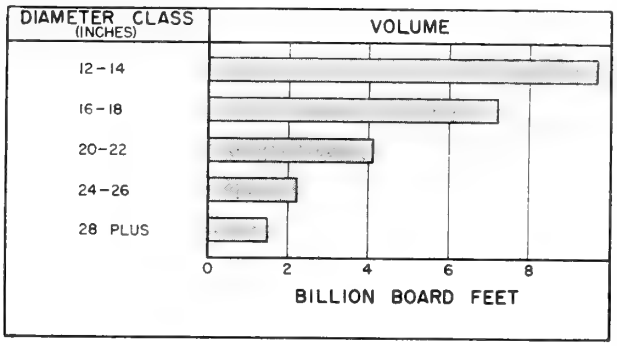

FIGURE 21.—*Distribution of board-foot volume by tree-diameter class. (The 12- to 14-inch class includes 406 million board feet of conifers in the 10-inch class.)*

Seedling and sapling stands and nonstocked stands have only scattered sawtimber trees. It will be several decades before these stands become sawtimber.

Quality of the Timber

Timber buyers and woods operators look for quality timber when they appraise a forest. Only on a small part of the forest land, chiefly on the Cumberland National Forest and on State-owned forests, are efforts generally directed toward growing quality timber. Private timber owners usually allow timber buyers to cut the choice timber, whether mature or not, and leave culls and undesirable species standing in the woods. As a result nearly 85 percent of the hardwood sawtimber volume in Kentucky is in low-quality logs. Such logs

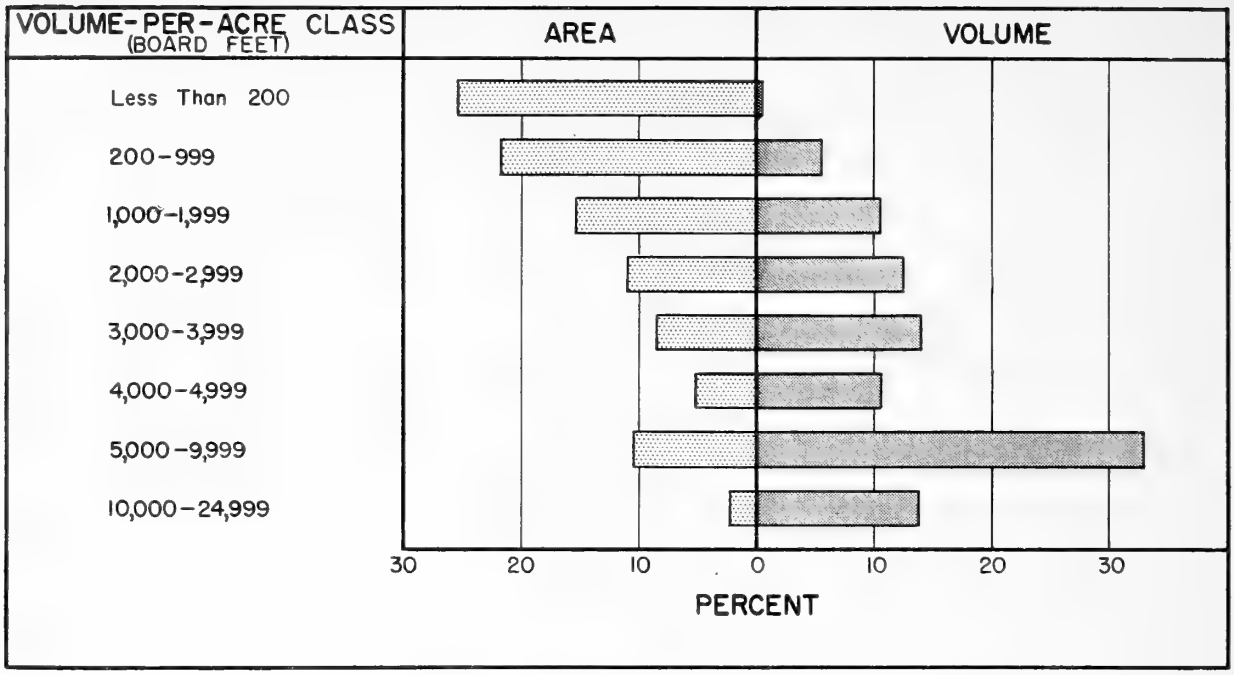

FIGURE 22.—*Proportion of commercial forest area and board-foot volume by volume-per-acre class.*

will yield only about 20 percent of their volume in No. 1 Common or better lumber.[3]

Only 15 percent of Kentucky's sawtimber is in high-quality logs. This amounts to 3½ billion board feet. Of this nearly 2.2 billion board feet occur in the Eastern Highlands region (fig. 23). Much of this volume is residual timber left after logging during earlier days. Pioneer loggers passed it up because it was inaccessible at that time or was of an unwanted species. A little more than 1 billion board feet of high-quality timber is left in the Western Plateau region and only 100 million in the Bluegrass region.

Red and white oaks make up about half of the high-quality sawtimber. A large part of the remaining volume of quality timber is in yellow-poplar, sweetgum, blackgum, soft maple, beech, and cottonwood.

Forty-three percent of the volume in low-quality logs is in trees in the 12- and 14-inch diameter classes. Future growth will improve the quality of many of these. Nearly 40 percent of the low-quality hardwood volume is in trees 18 inches and larger. Many of the trees containing this volume will never improve in quality and if allowed to remain in the

[3] For a more precise definition of log grades, see appendix, p. 39.

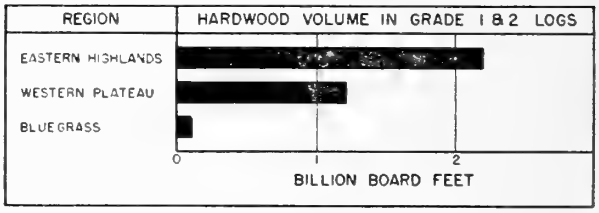

FIGURE 23.—*Distribution of high-quality hardwood sawtimber volume by region.*

stand will retard the growth of small trees of potentially high quality. The remaining low-quality volume is in trees of the 16-inch diameter class. These trees are just beginning to put on quality growth and many of them will quickly improve in quality.

Kentucky's forests average only about 20 sawtimber-size trees per acre. Of these, about 4 are culls. Culls are not included in the above-mentioned low-quality volumes. Although these cull trees are not considered merchantable, they do contain nearly 2 billion cubic feet of sound wood.

Volume of Growing Stock

The volume of growing stock (sawtimber and poletimber combined) is about 6½ billion cubic feet, an average of less than 600 cubic feet per acre. This low average volume per acre indicates that

Kentucky's forests are generally understocked. Considered from the standpoint of the capacity of the land to grow timber, the stands probably should support an average closer to 2,000 cubic feet per acre although research has yet to determine the optimum volume. More than 40 percent of the cubic-foot volume is in pole trees—6, 8, and 10 inches in diameter (fig. 24). About 25 percent is in small sawtimber (12 and 14 inches d.b.h.), 17 percent in 16- and 18-inch sawtimber, and 17 percent in trees 20 inches and larger in diameter. Since 65 percent of the volume is in poles and young sawtimber, the stands are in a condition to respond rapidly to good management.

The large sawtimber stands, averaging about 1,000 cubic feet per acre, have the best stocking. Seedling and sapling stands and nonstocked stands average only about 65 cubic feet and 50 cubic feet per acre, respectively.

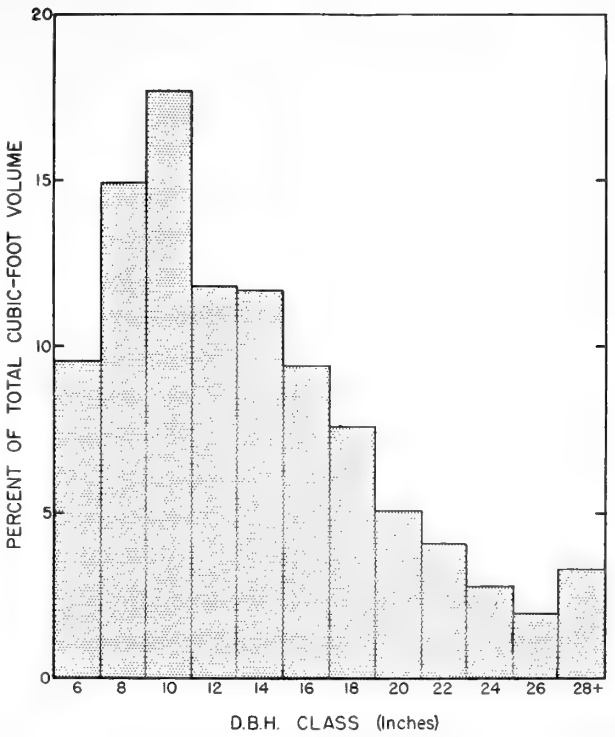

FIGURE 24.—*Distribution of growing-stock volume by tree-diameter class.*

Timber Growth

Sawtimber Growth

The annual net growth of sawtimber in 1949 exceeded 1 billion board feet. About 45 percent of this is ingrowth, i.e., the total volume of those trees that grew into the sawtimber class during the year. About 55 percent is growth of trees that were of sawtimber size at the beginning of the growth year. The annual net board-foot growth rate is 4.8 percent of the inventory volume. Cottonwood, sycamore, and the red oaks show the most rapid rates of diameter growth.

The net sawtimber growth per acre is about 100 board feet per year. Providing that drain does not increase greatly, this growth could probably be doubled or tripled in 30 to 40 years if the forests were protected from fire and grazing, and were well managed. Mortality could be reduced and the growth rate increased by removing the slow-growing and defective trees to make room for the faster growing ones. Furthermore, better protection would help eliminate fire damage to trees and the resulting retarding effect on growth.

Approximately 15 percent (180 million board feet) of the total board-foot growth is high-quality material (log grades 1 and 2). There are two reasons for this relatively low proportion of quality growth: (1) About 70 percent of the board-foot growth is on trees too small to contain high-quality logs, and (2) most of the larger trees are too poor to put on quality growth. Removal of low-quality trees and lighter cutting of high-quality material over a period of years will help improve the situation.

Growth of Growing Stock

The total growth of the growing stock is 267 million cubic feet per year. About 50 percent of this is on poletimber trees, 15 percent is ingrowth, and 35 percent is on sawtimber. Although pole trees have only 40 percent of the cubic-foot volume of growing stock, they are producing most of the growth. However, pole trees are growing an average of only 1.66 inches in diameter in 10 years while sawtimber trees are growing 2.12 inches. This apparent inconsistency is explained by the greater height growth and the denser stocking of pole trees.

The net growth of the growing stock amounts to 23 cubic feet per acre annually—only 30 to 40 percent of what it could be. This average growth is low because the average stocking of desirable trees in the forests is low.

Mortality

Timber volume is reduced in several ways other than by cutting. The average annual loss during recent years from fire, insects, and disease has been about 83 million board feet, or about 0.3 percent of the inventory volume.

In 1951 about 250,000 acres of forest land burned in the State (*5*). This was about the average burn for recent years. The mortality rate does not reflect losses of abnormal years such as 1952, when forest fires got out of control and burned nearly 1½ million acres. The State Division of Forestry estimated the 1952 damage at more than 12½ million dollars. While lack of rain and poor visibility during the critical period contributed to the difficulty in controlling the fires, the fire control organization was inadequate to handle the situation. Only 39 counties are in the State's protection program, leaving 81 counties without organized fire control.

Most of Kentucky's fires are man-caused; some of them are set intentionally. If protection from fire were extended to all forest land, most of the timber that is now lost to fire every year could be saved. Moreover, if fire damage to soil and trees were eliminated, the trees would be more vigorous and less scarred, and so less susceptible to insect and disease attacks.

Decay has reduced the volume of merchantable material in sawtimber trees by 2 billion board feet or about 7 percent of gross volume. In addition, the gross volume of rotten cull trees is estimated at about 2 billion cubic feet. Much of this loss from decay starts with fire damage.

At the present time elm and the oaks are threatened by diseases in Kentucky, and research is under way to find controls. How disastrous some tree diseases can be is evidenced by the chestnut blight that has destroyed 10 percent of the sawtimber in the Eastern Highlands region (*2*).

Timber Drain

For the State as a whole, sawtimber drain in 1948 totaled 734 million board feet. This includes the material that actually went into finished products plus the merchantable material wasted in the woods and mills. Not included is the volume of products made from dead and cull trees or trees from land not classified as forest. Approximately 75 percent of the board-foot drain went into lumber and 14 percent into fuelwood. Hardwood species made up more than 90 percent of the sawtimber drain; the oaks accounted for about half of it.

More than 35 percent of the total sawtimber drain was in high-quality logs (grades 1 and 2). Most of this material—more than 200 million board feet—was sawed into lumber. About 44 million board feet—almost entirely white oak—went into cooperage; more than 9 million board feet was cut into veneer; and 5½ million board feet of hickory and ash was used by handle manufacturers.

The drain on the growing stock amounted to 161 million cubic feet (fig. 25). Of this about 56 million cubic feet was cut from pole trees. Most of this poletimber drain was from oak, and was used for fuelwood and mine timbers. Nearly all of the minetimber drain was concentrated in the Eastern Highlands region.

Logging waste, i.e., high stumps, unused top logs, and miscut logs, does not appear to be great in Kentucky. In 1948 the total volume of such material left after logging in sawtimber stands was 42 million board feet, less than 6 percent of the total drain. In Kentucky much of the wood normally left as waste is later cut into fuelwood, resulting in the low logging waste figure.

Trends in Timber Volume

In 1948 the annual timber growth of Kentucky amounted to 1.2 billion board feet and exceeded the drain by 455 million board feet. This increased the inventory volume by nearly 2 percent. All species except beech grew faster than they were cut (fig. 26). The pine volume shows an increase mainly because so much of it is in the national or State forests where the growing stock is being built up systematically. The white oak group shows an especially favorable growth-drain balance largely because post oak and chestnut oak are not being heavily cut. Yellow-poplar is in great demand and is cut about as fast as it grows. The other hardwoods as a group show a large increase because the demand for many of these species is not great since their quality is generally low.

The board-foot growth-drain balance appears to be more favorable than it actually is. Most of the increase in sawtimber volume is in trees of small diameter and consequently of low quality. The annual ingrowth of poles into the sawtimber class amounts to about 538 million board feet and the growth of trees in the 12- and 14-inch diameter

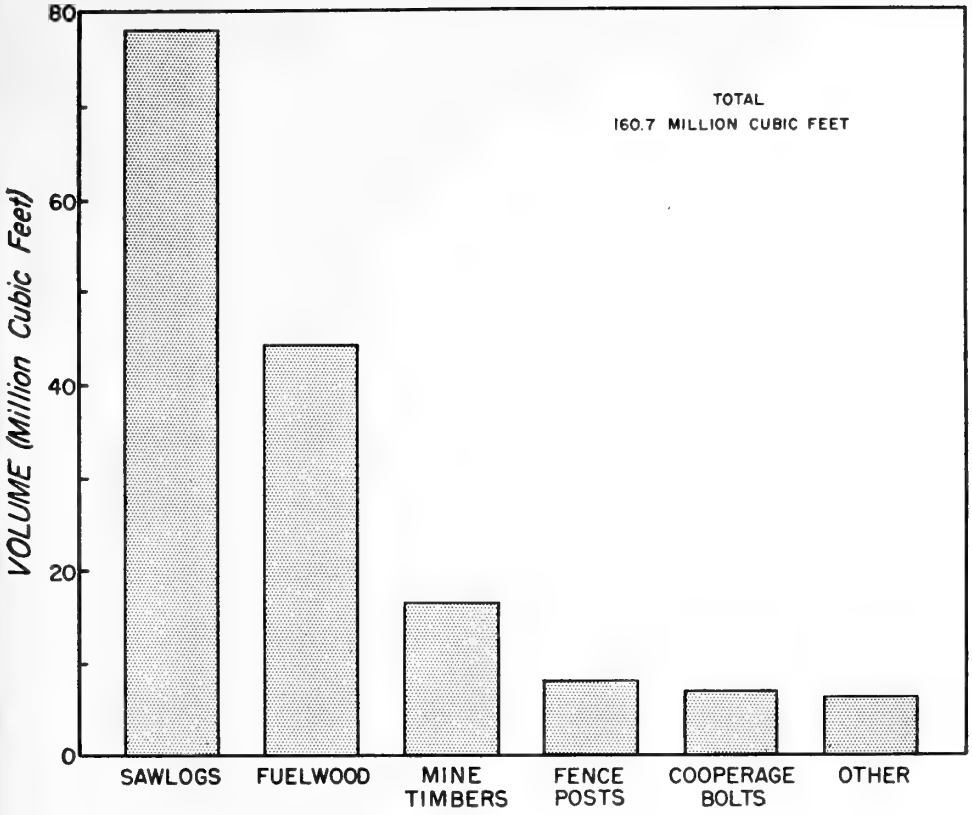

FIGURE 25. — *Growing-stock drain by commodity, 1948.*

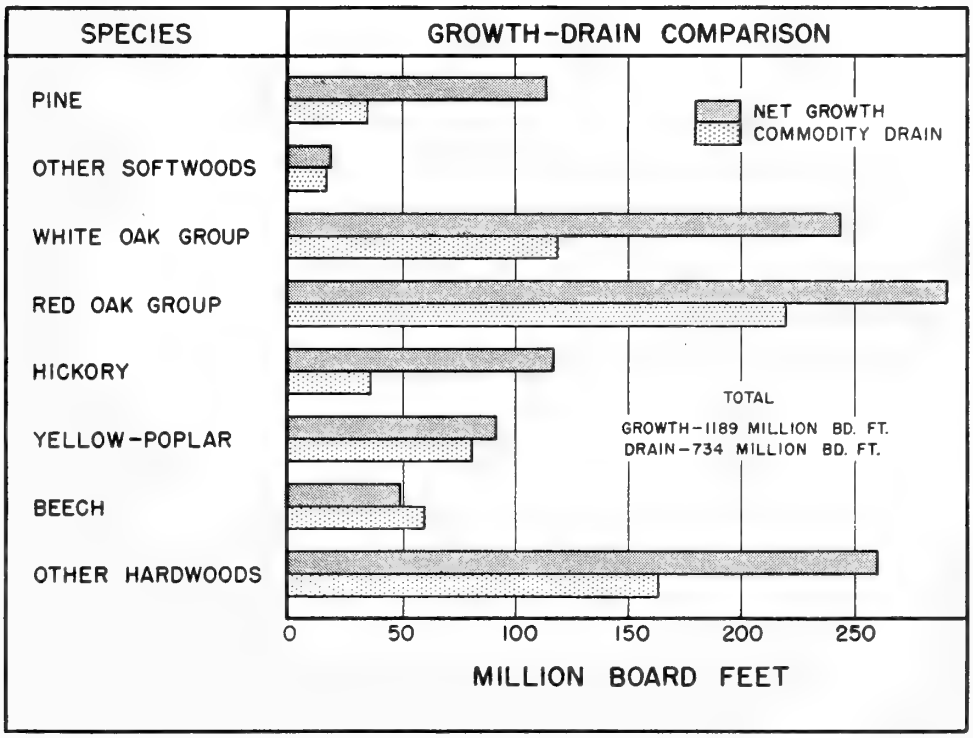

FIGURE 26.—*Net annual timber growth and commodity drain by major species, 1948.*

classes accounts for another 318 million board feet. Most of these smaller trees should be left to produce more and better material. This would mean that the existing industries would have to depend more on the large, high-quality timber, now growing about 180 million board feet per year, in order to maintain their cut. Even now this large high-quality timber is being overcut by about 80 million board feet per year (fig. 27).

On the other hand the growing stock of thrifty young sawtimber trees is being built up. Within one or two decades the growth of these trees should result in a sharp rise in the volume of high-quality timber. Of course, good forest management would speed up this process greatly. Nevertheless, barring catastrophic losses or too rapid expansion of local forest industries, some increase in the volume of high-quality growth is in prospect.

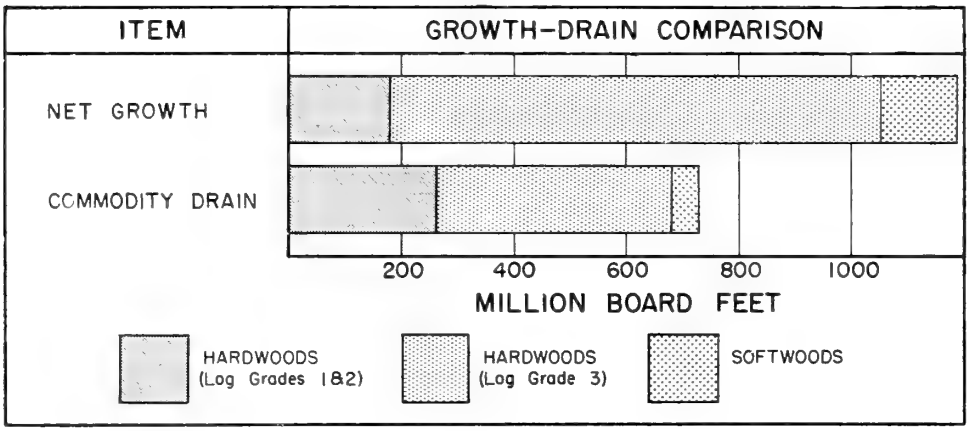

FIGURE 27.—*Net annual timber growth and commodity drain, by log-quality class, 1948.*

Wood Harvest and Manufacture in Kentucky

THE FOREST offered the pioneer settlers of Kentucky an unlimited supply of wood for home building, fences, heating, and cooking. In fact there was too much wood. Forests were a hindrance to the farmer, so he cut and burned them to make room for crops and pasture. As topsoil eroded and soil became sterile, old fields were abandoned and new land was cleared. The settlers welcomed the lumber industry because it helped them clear the land.

Early lumbermen found an abundance of high-quality, virgin timber. Because the timber supply exceeded local demand, the growing lumber industry began seeking out-of-State markets about 1870. White oak, walnut, yellow-poplar, chestnut, and pine brought good prices on these markets. However, as time passed, the demand for some wood products decreased. Rail fences were no longer made. Coal, oil, gas, and electricity replaced wood for power and to some degree for heating and cooking.

Land clearing is now much less common; in fact, a lot of former cropland has already reverted to forest. Preservative treatment of railroad crossties, poles, timbers, and fence posts is prolonging the life of such items, thereby reducing the volume of wood used. The total demand for Kentucky wood has certainly been reduced, but there is still a great demand for quality hardwood suitable for such products as veneer, tight cooperage, furniture, and interior finishing.

Primary Forest-Products Industries

In 1948, more than 208 million cubic feet of wood from Kentucky forests were used in wood products. About 45 percent was burned as fuel (fig. 28). Sawlogs, including those sawed into crossties, accounted for an additional 35 percent of the total. The remaining 20 percent was distributed among other products, such as mine timbers, fence posts, cooperage bolts, and miscellaneous farm timbers.

To produce these logs and bolts and deliver them to mills or road sidings, about 3⅓ million man-days were required, the equivalent of full-time employment for more than 13,000 men. In its primary form, this wood was worth more than 40 million dollars. This is an average value of 20 cents per cubic foot of wood used. Some of the products, such as sawlogs, cooperage bolts, handle bolts, and veneer bolts were further processed locally into products of still greater value.

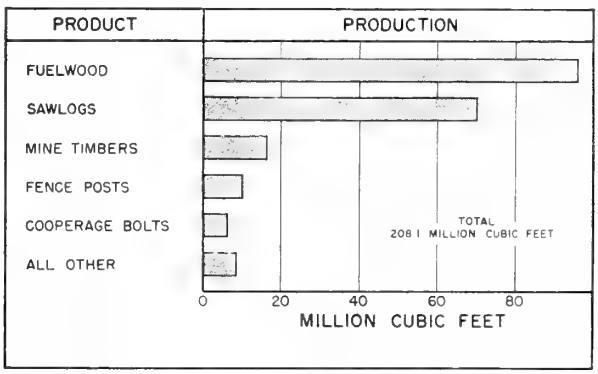

FIGURE 28.—*Production of primary forest products in Kentucky, 1948.*

In addition to the wood used by the individual primary forest-product industries discussed below, a small amount of dogwood and persimmon are cut for shuttles and golf club heads. For the most part, the wood of these species is exported to other States for manufacture.

Lumber

Lumber production in Kentucky reached a peak of nearly 1 billion board feet in the early years of the present century, declined to 200 million board feet during the depression of the 1930's, and has recently climbed to the range of 500 to 600 million board feet per year (fig. 29). Most of the lumber is produced in the southeastern part of the State (fig.

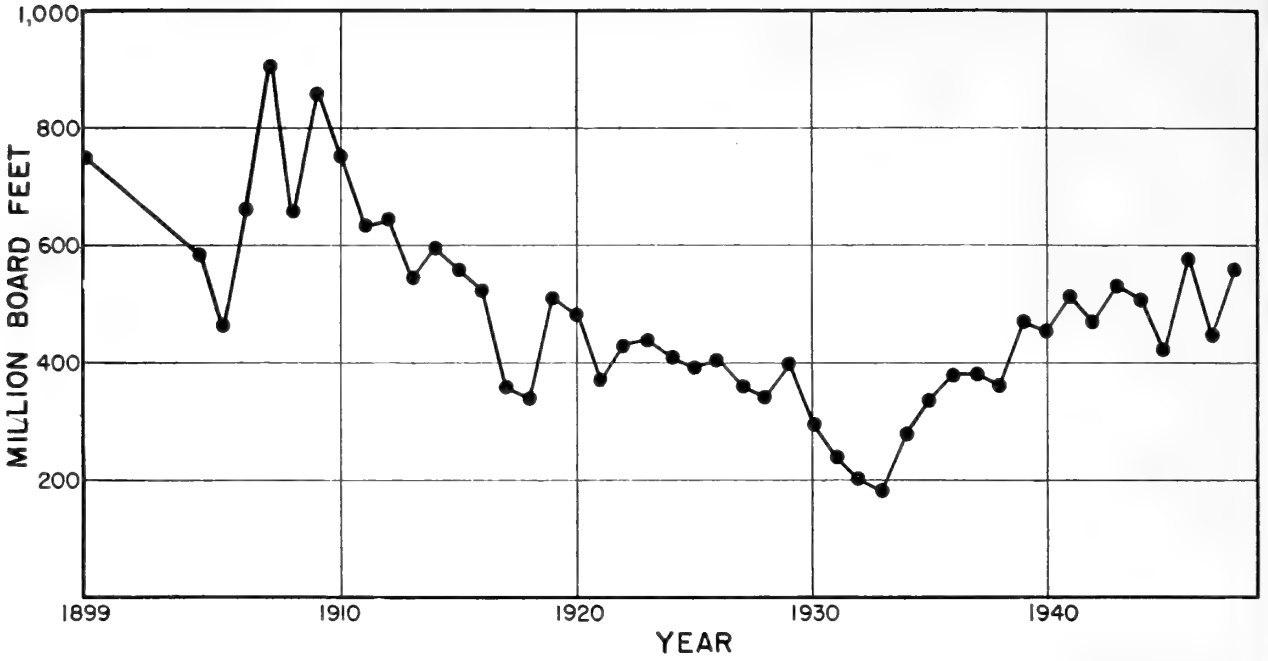

FIGURE 29.—*Lumber production in Kentucky, 1899–1948. (Source: Lumber Production in the United States, 1799–1946, U. S. Dept. Agr. Misc. Pub. 669. 1948.)*

30). During recent years, about 45 percent of the total production has been oak. Beech, yellow-poplar, and pine follow in order of importance.

During the peak years of lumber production the typical large stationary mill cut mostly high-quality, old-growth timber. Today there are left in the State only a few large mills that annually cut more than 1 million board feet (fig. 31). Most common, by far, are the portable, circular mills that operate on the residual low-quality stands found throughout most of the State. In 1947 about two-thirds of the lumber produced in Kentucky came from mills cutting less than 1 million board feet per year. These mills saw mainly for the local markets that can use low-quality lumber. In 1948 there were about 2,000 sawmills active in Kentucky.

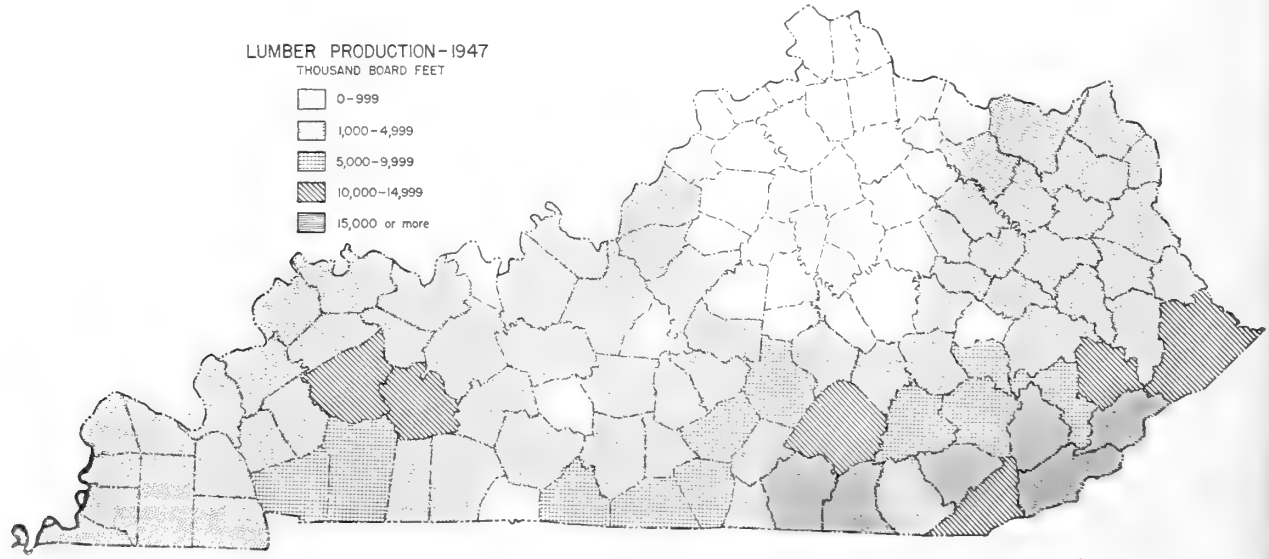

FIGURE 30.—*Lumber production by counties, 1947. (Source: Bureau of the Census, U. S. Dept. Com.)*

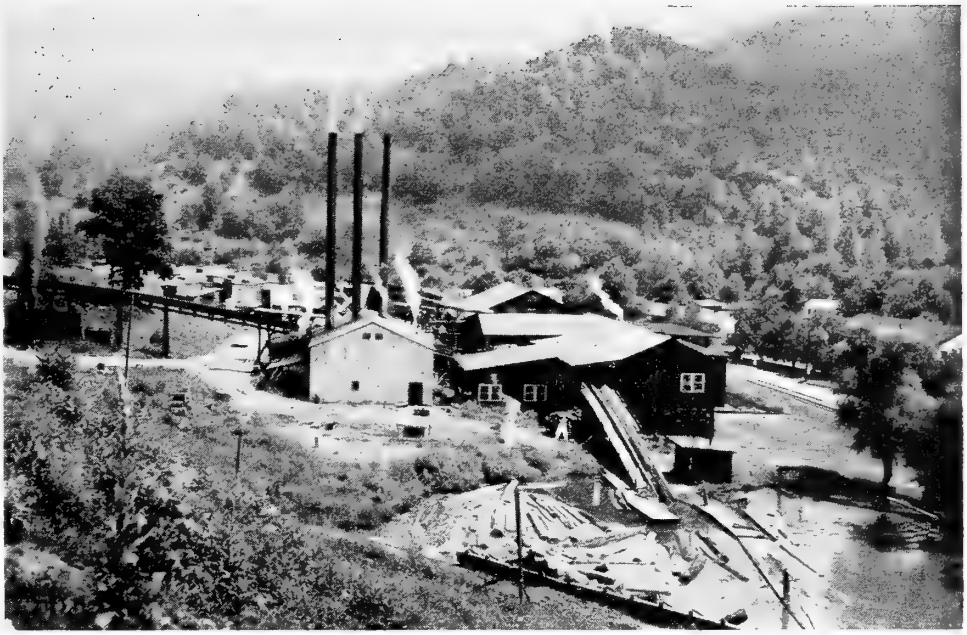

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FIGURE 31. — *Kentucky has about 25 large, permanent sawmills that provide dependable, yearlong employment.*

Sawlogs worth nearly 14 million dollars were delivered to Kentucky's sawmills in 1948. This amounted to 19 cents per cubic foot. The rough, green lumber cut from these logs was worth approximately $50 per thousand board feet at the mill. If such material were dried, graded, and sold on the national market, the high-quality lumber would bring more than twice that amount. However, more than 8 percent went into railroad crossties and some went into mine timbers, with a value close to that of other rough, green lumber. Most mills produce little high-quality lumber. Moreover they have no organized outlets for quality material. Concentration yards are needed to accumulate and process these products in commercial quantities.

In 1948 about 727,000 man-days of labor were required to cut and deliver sawlogs to Kentucky's mills and 934,000 man-days to saw the logs into lumber. This is the equivalent of full-time employment for about 6,600 men. However, many more than this actually worked in the lumber industry, because most of the mills operate only part time.

Although precise information on the quality of lumber produced is not available, a study of the quality of sawlogs reaching the mills indicates that the mill operators must find ways to dispose of a lot of low-grade lumber. More than half the sawlog volume going to Kentucky mills is in grade 3 logs. For most species cut in Kentucky, the lumber yield from grade 3 logs will not average more than 20 percent No. 1 Common or better.

Fuelwood

About 1½ million cords of wood were used in Kentucky in 1948 for heating, cooking, burning tobacco seedbeds, and curing tobacco. Less than 50 percent of the fuelwood came from growing stock. About 20 percent of the wood was cut from dead timber, and the remaining 30 percent was cull trees, limbs, small saplings, logging slash, and slabs and edgings from sawmills and stave mills.

The value of fuelwood is low, but this use provides an outlet for much low-quality wood that might not be used otherwise. The stands now contain 2 to 4 billion cubic feet of low-quality wood. The use of wood for fuel is declining, and the volume of low-quality wood in the stands is increasing. Unless other ways are found to economically use low-quality wood, it is unlikely that many woodland owners will be able to follow good forest cutting practices, and this low-quality volume will continue to increase.

The total production of fuelwood in Kentucky in 1948 was worth about 15 million dollars (assuming a value of $10 per cord). Partly because of the large volume produced and the inefficient methods of cutting, fuelwood requires more labor than all

other products combined. Nearly 2 million man-days were required to produce the fuelwood. Practically all of it was cut by farmers for home use.

Round and Split Mine Timbers

Coal mining has made the local forests more and more important as a source of mine props and shoring material. In 1948 the coal mines of Kentucky used 16½ million cubic feet of round and split props, collars, and hewn ties. About 90 percent of this volume was used in the Eastern Coal Field region. The underground coal mines of this region require about one-fourth of a cubic foot of round or split wood for every ton of coal produced; the Western Coal Field mines require only about one-tenth of a cubic foot per ton. Variations in the rock strata above the coal veins between the two regions account for this difference. A new method of bolting the roofs of mines with metal pins may eventually reduce the amount of wood required. At least one mining company is using pins made of hickory.

Although large, high-quality timber is not required in the mines, the operators do cut heavily in well-stocked hardwood pole stands. This practice may be adversely affecting the growth of future high-quality stands.

Though the stumpage value of these young stands is low, the value of delivered mine props compares favorably with that of other products based on an equal volume of wood. The round and split props produced in Kentucky in 1948 were worth more than 4 million dollars. This amounts to about 25 cents per cubic foot of wood used.

Almost 200,000 man-days were required to produce mine props in Kentucky in 1948. Nearly all of the wood used in Kentucky mines is produced from local forests. The round and split wood is produced by farmers, timber operators, and mine employees.

In addition to round or split wood, coal mines require large amounts of lumber and other sawed products such as caps, wedges, crossbars, and ties. This is one outlet for much of the low-quality lumber produced by Kentucky sawmills. According to a 1942 study by the United States Forest Service, 22 mines in West Virginia, Virginia, and eastern Kentucky required an average of 1½ board feet of sawed wood for each ton of coal produced. At that time oak was the species used most, followed by hickory, chestnut, yellow-poplar, gum, maple, and pine.

Fence Posts

More than 13 million fence posts, requiring 10 million cubic feet of wood, were produced from live timber in Kentucky in 1948. About 80 percent of these posts were cut from pole-size trees, less than 10 percent from sawtimber-size trees, and the remainder from saplings. Nearly half the posts were black locust, more than one-third were redcedar, and the remainder were from other species. In addition to the posts cut from live timber, more than half a million were cut from dead trees, mostly chestnut. Since most of the fence posts are produced from locust and redcedar (species that seldom grow to large size in Kentucky), cutting these trees does not reduce the volume of potential high-quality sawtimber.

The total roadside value of these posts was nearly 3½ million dollars, or about 33 cents per cubic foot of wood. Only veneer logs and stave and handle bolts brought more per cubic foot. Almost 169,000 man-days were required to cut these posts, and farmers did most of the work.

Cooperage Stock

Large, high-quality, white oak sawtimber is needed to furnish barrels for the important whisky industry of Kentucky. White oak should be at least 16 inches in diameter before it is cut for cooperage (fig. 32). Even then the trees must be straight-grained and free of knots and other serious defects. Such high-quality white oak is becoming increasingly difficult to find.

In 1948 approximately 44 million board feet of oak from Kentucky forests was used by tight cooperage plants, 80 percent of it by plants in the State. In addition several large distilling companies operate rough stave mills in adjoining States and ship rough staves into Kentucky to be manufactured into barrels.

The stave bolts delivered to Kentucky mills in 1948 were worth about 3½ million dollars. The value per cubic foot of wood (58 cents) was the greatest of any product. Although stave bolts bring a high price, they also require more labor per unit

FIGURE 32.—*White oak is in demand for tight cooperage for storing and aging whisky. Here are some logs and bolts with sawed heading piled in the background.*

of wood produced than any other product. Approximately 154,000 man-days were required in 1948 to produce about 6 million cubic feet of stave bolts.

Nearly all the staves produced in Kentucky were white oak. A small volume of red oak was cut for export to produce wine kegs. In 1948, 87 tight stave and heading mills were reported to be operating in Kentucky (fig. 33). These mills are portable and many shift from county to county to take advantage of local markets and available timber. The production of staves fluctuates seasonally and from year to year.

Veneer

Veneer is of two general kinds: (1) Face or sliced veneer, used chiefly in furniture manufacture, and (2) rotary-cut veneer, used in fruit and vegetable

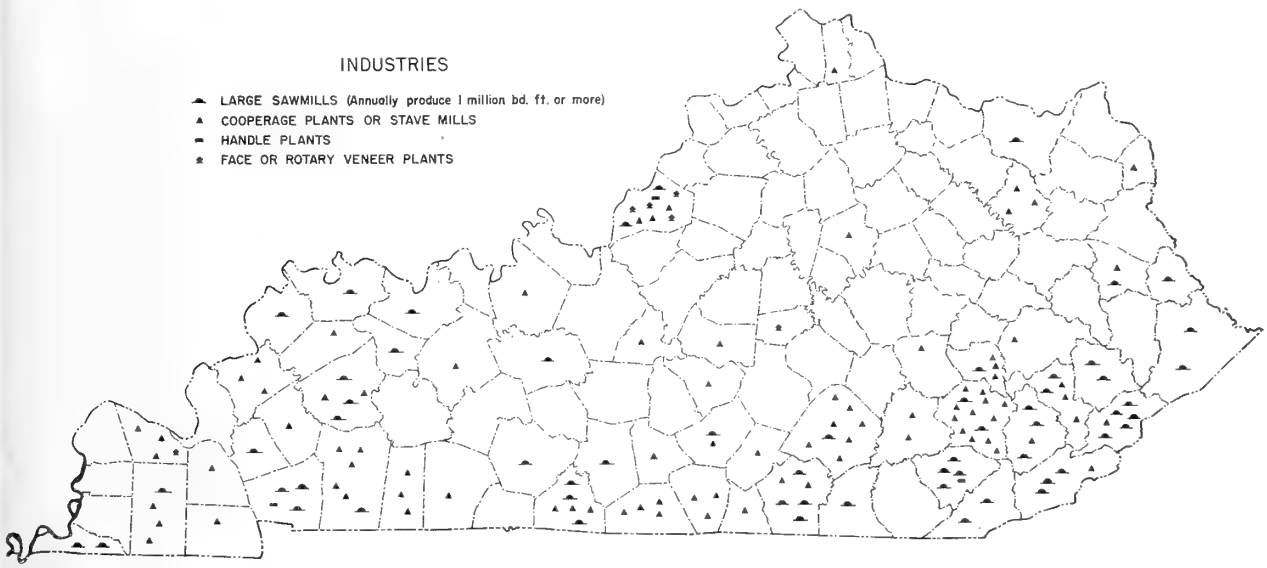

FIGURE 33.—*Distribution of primary wood-using industries, 1948. Only sawmills that cut more than 1 million board feet of lumber in that year are shown.*

baskets and containers, and plywood. To produce either kind, clear bolts at least 16 inches in diameter are desired.

In 1948 veneer mills used nearly 10 million board feet of veneer logs from Kentucky's forests. About 60 percent of this was cut into veneer in Kentucky's 6 veneer plants. The rest was shipped to neighboring States for manufacture.

Black walnut and white oak are in greatest demand for face veneer. Yellow-poplar, cottonwood, and soft maple are most popular for rotary veneer. The following tabulation shows the 1948 veneer log production by species from Kentucky's forest.

Species:	Volume M bd. ft.	Percent
White oak	1,357	14
Yellow-poplar	1,150	12
Sweetgum	1,077	11
Black walnut	975	10
Red oak	254	3
Other hardwoods	4,496	47
Redcedar	305	3
Total	9,614	100

The volume shown as "other hardwoods" is made up mainly of soft hardwoods, such as cottonwood, soft maple, and sycamore, used principally for rotary-cut, container veneer.

Veneer logs and bolts from Kentucky forests were valued at $721,000 at railside. This averages 54 cents per cubic foot of wood. Face veneer quality logs are worth about $1 per cubic foot. Soft hardwoods used for rotary-cut veneer average about 36 cents per cubic foot. In spite of the fact that these prices are higher than for most other products, very few timber owners make any effort to save young, potential veneer-log trees.

In 1948 some 19,000 man-days of labor were required to produce veneer logs. Trees that contain veneer logs are usually scattered and great care is required in cutting them, so the labor per unit of wood produced is greater than for sawlogs (fig. 34).

Pulpwood

At present there are no pulp mills in Kentucky, and what pulpwood is produced is shipped to adjoining States for manufacture. In 1948 Kentucky shipped about 47,000 standard cords of pulpwood and chestnut extract wood to 6 plants in adjoining States. Three of the plants buy dead chestnut for tannin extract and make corrugated paper with the residual chips. Chestnut extract wood made up 51

FIGURE 34.—*Red oak veneer flitches at a sawmill in Allen County. They have been carefully sawed from high-quality logs and will be shipped to a veneer mill for further manufacture.*

FIGURE 35. — *Chestnut, killed by blight about 1920, is still in demand for tannin extract. Kentucky has about 134 million cubic feet of dead chestnut, mostly in the Eastern Highlands region.*

percent of the pulpwood cut (fig. 35). Mixed hardwoods accounted for 45 percent of the pulpwood and the remaining 4 percent was pine. Most of the mixed hardwoods production was cottonwood, yellow-poplar, willow, soft maple, and sweetgum. Only 43 percent of the wood cut was from growing stock, mostly from poles. Most of the remaining 6 percent was from limbs of sawtimber trees.

More pine will be available in Kentucky for pulpwood in the future. In the Eastern Highlands region alone there are nearly 100 million cubic feet of pine, in 6- and 8-inch trees. These trees are growing at the rate of about 8 million cubic feet per year, or about 100,000 cords. Many of these young stands need thinning. Furthermore, limby or otherwise defective pines should be cut to promote the growth of higher-value trees. In addition to the natural pine stands, many pine plantations will need thinning soon. Kentucky has also a large volume of soft hardwoods that are suitable for pulping.

The total value of the wood produced for pulp and tannin extract was about $534,000 delivered at a loading point. This amounts to 16 cents per cubic foot—a much lower price than is brought by some other products cut from trees of similar quality.

About 47,000 man-days of labor were required to produce the pulpwood and extract wood in 1948. This is the equivalent of full-time employment for about 188 men.

Handle Bolts

Tool-handle plants used 5½ million board feet of high-quality timber from Kentucky in 1948. Of this 95 percent was hickory and 5 percent was ash; all of it came from live sawtimber-size trees. In general, timber owners make no provision to save potentially high-quality timber for this use.

This wood was worth about $273,000 delivered at plants or loading points. The value per cubic foot was 36 cents.

About 13,000 man-days of woods labor were required to produce and transport this stock. Local handle factories used about one-fifth of the material; the rest was shipped out of the State for manufacture.

Hewn Ties

When the price for railroad ties is high and other work is slack, woods workers often hew a few ties (fig. 36). However, most railroad crossties are now sawed by portable sawmills. Both the "tie hack," and the mill operator who saws ties prefer to work in stands of small, well-formed, oak sawtimber. This of course removes much potentially high-quality wood. The tie hack boxes the heart of the log by hewing off the outer slabs, which ordinarily cannot be used. If the log is large enough in diameter, the sawmill operator usually cuts high-quality lumber from the slab material.

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FIGURE 36.—*Hewing crossties is a slack-time job for people living within the forest. The ties are usually hewn from small sawtimber and few tools are needed.*

From 5 to 10 percent of the railroad crossties handled by concentration yards and treating plants in Kentucky are hewn. It is estimated that in 1948 about 75,000 ties were hewn from nearly 3 million board feet of timber. These ties were worth about $113,000. Their value per cubic foot was 26 cents, about the same as for mine props. Approximately 5,000 man-days were required to produce the hewn ties.

Miscellaneous Farm Timbers

In 1948 about 3 million cubic feet of wood, worth $281,000, was cut for miscellaneous uses such as for fencing and construction of feed lots and buildings on the farms of Kentucky. Farmers cut almost all of the wood for their own use, with a labor expenditure of about 35,000 man-days. Seventy-one percent of the production came from poletimber, 23 percent from saplings, and 6 percent from sawtimber. The species used were mainly hickory, red oak, white oak, locust, redcedar, and pine.

Secondary Forest-Products Industries

The industries that further process wood products such as lumber, rough staves, and veneer into more finished products can make an important contribution to the income a community receives from its forests. Lumber and veneer are used in the manufacture of a large variety of wood products in Kentucky. In 1948 the manufacturers of wood products, such as boxes, furniture, and millwork, required about 142 million board feet of wood, mostly in the form of lumber. Thirty-six percent of the lumber was used in the manufacture of furniture—an important industry in Kentucky. Millwork accounted for nearly 50 percent of the veneer used; much of the veneer had previously been manufactured into plywood.

In 1947 these secondary industries added about 37 million dollars to the value of manufactured products in Kentucky. This amount does not quite equal the value of the primary (round) wood products cut in 1948. In some States where secondary manufacturing is well developed, the value added in the manufacture of secondary wood products far exceeds the value of the primary wood products.

To take advantage of transportation, power, water facilities, and labor supply, secondary manufacturing plants tend to concentrate in the larger urban areas. This is true in Kentucky where at least 61 of the 114 plants are in the Louisville area. These 61 plants employ more than 90 percent of all the employees engaged in remanufacturing. The development of better transportation, power, and water facilities in other urban areas of the State may encourage some wood remanufacturing plants to locate closer to their source of primary wood products.

A Forestry Program for Kentucky

THE PRESENT large forest area in Kentucky (45 percent of the land area) is likely to remain—it may even increase. During the past two or three decades much cultivated land on the steeper slopes has been abandoned because of severe erosion and the resultant loss of soil fertility. On much of this area a new forest cover is being established. Many farmers from low-income areas are seeking higher-paying industrial employment, which usually means moving to an urban area. This may mean that more marginal farmland will revert to forest.

The importance of the forest area to the State is likely to increase as more and more woodland owners realize the value of timber as a crop. For some time a number of organizations, the United States Forest Service, the State of Kentucky, the Tennessee Valley Authority, the American Forest Products Industries, the Illinois Central Railroad, and others have been active in forestry education programs. As a result of these programs and the current high prices for forest products, forest-land owners are beginning to recognize the value of timber as a paying crop.

Varied evidence of the increase of public interest in forestry education and in protection of forests from fire can be found in Kentucky. Publicly financed fire protection of private and State lands now extends to one-third of the counties in the State, as well as to the national forest. The Kentucky Division of Forestry has 8 foresters working under the Cooperative Forest Management Act of 1950 to give on-the-ground assistance to woodland owners. The extension service of the University of Kentucky has 2 foresters assigned to teaching and demonstration work. The State employs 3 district foresters whose primary task is fire protection; the TVA employs 2 foresters in western Kentucky. Planting stock is made available to private forest owners from publicly supported tree nurseries.

Kentucky's forests are in condition for a marked improvement in their character. About 80 percent of the trees are in the 2- and 4-inch diameter classes. Two things account for this abnormally large proportion of small trees: (1) Improved fire protection during the past 10 to 15 years has permitted established seedlings and sprouts to grow into the 2- and 4-inch diameter classes, and (2) heavy past cutting has reduced the number of trees in the larger diameter classes. Furthermore, the desirable commercial species are as well or better represented in the pole trees as they are in the sawtimber trees. Sound management of these stands could accelerate the buildup of Kentucky's forests.

The forest growing stock has been increasing for some time, though mainly in small and low-quality trees. Approximately 70 percent of the growth is in 12- and 14-inch trees. Given time to grow, these trees could soon reach the size necessary for quality timber. Under reasonably good management enough of these trees would grow into the larger diameter classes to bring high-quality growth up to the present level of high-quality drain. Premature cutting of small but thrifty, well-formed trees retards such progress.

However, restricting the cut to large, mature trees would lead to practical difficulties in some stands. Since a commercial cut usually requires removal of fairly large volumes, cutting in many stands would leave such a small residual stand that future cuts would be long delayed. For example, the present small sawtimber stands average about 3,000 board feet per acre. If in harvesting these stands, all sawtimber were cut, the residual growing stock would average only slightly more than 350 cubic feet per acre. This would, of course, leave the stands badly understocked. By restricting the cut in small sawtimber stands to trees 20 inches d.b.h. and larger, the residual growing stock (about 800 cubic feet per acre) would be in a fair condition to produce another crop in a reasonable period of time. But the present cut would amount to only 200 board feet per acre, scarcely a commercial operation.

On the other hand, if cutting is confined to stands of large sawtimber and to trees 20 inches and larger in diameter, as much as 2,000 board feet per acre

could be taken. This would still leave a growing stock of about 650 cubic feet per acre. Operating in this manner, the present cut could be maintained for 8 to 10 years. Going even part way in this direction by concentrating more of the cut on the larger diameter classes and in the heavier stands would aid materially in improving the condition of Kentucky forests.

Approximately one-fifth of the forest growing space is now occupied by cull trees, and 85 percent of the merchantable hardwood sawtimber volume is in log grade 3. Starting on the better sites, good forest management requires that cull trees and much of this low-quality volume be removed. A continued demand for forest products, and a desire on the part of the landowner to improve his forest could lead to cutting practices that will improve forest conditions in Kentucky.

Watershed Protection

Because forests have such great influence on water supply, streamflow, and flood conditions, high priority should be given to the development of forests on watershed areas. Although dams and reservoirs also help to regulate streamflow and control floods, these devices cannot be entirely successful unless upstream farm and forest lands are managed properly. In the long run, improving the watershed conditions of an area will also improve that area for recreation, hunting, fishing, and timber production.

Timber Production

In the light of the forest situation in Kentucky as developed thus far, a program to make the forest resource contribute more would involve (1) improved forest practices needed to produce more and better quality timber and (2) improvements in harvesting, processing, and marketing of forest products.

Adopt Better Cutting Practices

The average forest stand in Kentucky has not enough growing stock. About one-fifth of the growing space is occupied by cull trees. Furthermore, the present quality of the sawtimber growing stock is low, and present cutting practices are further deteriorating it. To grow more and better timber, several courses of action can be taken.

Starting on the better sites the cull trees can be killed or cut to make room for young, potentially valuable trees. In spite of the present demand for most forest products, cull trees are ordinarily not salable. However, if the landowner is interested in continuous forest production, he may wish to invest some current income in stand improvement to increase future growth.

More of these cull trees could be used for fuel. About 45 million cubic feet of wood cut from growing-stock trees was burned as fuel in 1948. This fuelwood could have come from the more than 1½ billion cubic feet of cull tree volume, and from mill waste, woods waste, dead trees, and limbs. Because of the higher cost of cutting fuelwood from such material rather than from small, sound, growing-stock trees, change in practice will no doubt be slow. The increasing use of power saws may tend to stimulate the cutting of cull trees for fuelwood and for stand improvement.

Forest income can be increased considerably by saving more of the thrifty, well-formed young trees until they grow into larger and hence more valuable trees. For example, past studies of trees manufactured into lumber show that the rate of increase in value is much greater than the annual growth rate. In Kentucky 12- and 14-inch trees are growing in volume at the rate of 3 to 5 percent annually. If these trees are kept until they become 16 inches or larger, their annual rate of increase in value for lumber, due to increase in quality and declining costs per unit of wood harvested as the trees become larger, will be substantially greater than the growth rate. The rate of increase will be even greater when the trees are suitable for such products as veneer logs and tight stave bolts.

Bringing in new industries that can use low-quality timber, and developing less costly methods of handling this material, will make it possible for timber owners to follow better cutting practices. Such industries include the manufacturers of wood insulation, building board, roofing paper, corrugated board, and small dimension stock, including flooring. As new equipment is developed to handle wood products more cheaply, it may become more economical to harvest, transport, and process this low-quality timber. Already new processes are making possible the use of hardwoods for items formerly made from other species or other materials.

Although the bulk of the timber volume in Ken-

tucky is and probably always will be hardwood, special mention should be made of the softwood timber resource. The amount of pine in hardwood stands on sites adapted to pine can be increased by: (1) Releasing pine reproduction overtopped by hardwoods, (2) planting pine in appropriate openings in hardwood stands that have no adequate pine seed source, and (3) cutting hardwoods heavily where pine seed trees are available to establish a new crop.

To encourage timberland owners to practice forestry, some States are deferring or reducing taxes on forest land and timber crops. Since owners of young timber usually must wait a number of years to harvest a crop, tax deferment may be a matter of equity as well as an inducement to grow trees. Although the initial cost of stand improvement may seem high to some woodland owners, tax deferment or reduction might encourage them to go ahead with such work.

Protect the Forest from Fire, Insects, and Disease

Uncontrolled fire in a forest retards tree growth, kills reproduction, paves the way for insect and disease attacks, and—because of the resulting rot—lowers the quality and reduces the volume of merchantable material. Much of Kentucky's forest is understocked because fire killed the young trees. Almost all fires in Kentucky are man-caused and can be prevented. In 1951, debris burning, smoking, and incendiarism caused 82 percent of the fires. Reducing fires alone will go far toward increasing the stocking and reducing the annual loss due to fire, insects, and disease.

Kentucky is making progress in its program to protect its forests from fire. In 1942, when only about 1½ million acres were under organized protection, the State had 6,751 fires—6,000 of them on unprotected land. More than 633,000 acres burned that year but only 33,000 acres were on protected area. In 1951 more than 5,600,000 acres of forest land were systematically protected from fire. On this area some 14,000 acres burned during 1951. Of the 6,200,000 acres of forest land still in need of organized protection from fire, about 238,000 acres burned in 1951.

Some 670,000 acres were added to the protected area in 1952. Organized protection from fire should also be extended to the remaining 5,500,000 acres in need of protection. All forest land would then be under organized protection, except an estimated 100,000 acres in scattered small woodlands in the heart of the Bluegrass region.

Discourage Livestock Grazing on Timberland

Grazing as commonly practiced in hardwood forests kills reproduction of desirable tree species, decreases growth and increases cull in the surviving trees; in extreme cases it exposes tree roots to trampling and other injury, compacts the soil, and destroys ground litter and humus (fig. 37). The degree of damage, of course, depends upon the intensity of grazing. Studies conducted in Indiana (*1*) and Illinois have shown that woodland forage is inferior to that on cleared pasture both in quantity and in nutrition. However, further research is needed in Kentucky to determine whether some degree of livestock grazing may be compatible with optimum timber production and watershed protection.

If a landowner chooses to grow hardwood timber, livestock should be kept out of his woodlands. If he prefers to produce forage rather than timber, he should convert the area to pasture—provided, of course, that it 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 under ordinary pasture use should be restored to forest cover and not grazed.

Encourage Integrated Harvesting, Marketing, and Utilization Systems

Effective marketing of timber in Kentucky is difficult, partly at least, because of the pattern of small woodland ownerships. A commercial operator may recognize a number of valuable products on these small woodlands, but can afford only to pay for and cut the timber for the one product he uses. Concentration yards and cooperative harvesting and marketing systems might lead to more orderly and profitable marketing of timber from small woodlands. Also, because most woodland owners cut timber so seldom, ordinarily they cannot own equipment to handle heavy timber products. Cooperative ownership might enable a number of woodland owners to own such equipment and to have a better income from their woods by harvesting and marketing the timber themselves.

Much of the timber in Kentucky is low in quality, so it is difficult to sell and brings a low price at best.

FIGURE 37. — *Tree reproduction is practically absent in heavily grazed farm woodlands.*

New industries are needed that can use low-quality wood. Such industries could remove low-quality trees from the woods to make more room for high-quality timber.

Conduct Research

Research is needed to determine the best timber management and utilization practices for the various forest types in order to increase timber production and forest income. Such research should be comprehensive enough to cover all the timber, water, forage, and recreational aspects of forest land use. Forest research takes time, and delay in beginning this research merely postpones the time when Kentucky forest land can be made fully productive.

Experimental forests are needed in typical forest-problem areas throughout the State to provide the necessary sites for carrying on research work and to demonstrate the results. Demonstration or "show me" trips are now conducted on State forests and on the Cumberland National Forest, but areas specifically set up for research and demonstration are also needed.

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Appendix

Forest Survey Procedure

Inventory

The inventory of Kentucky's forest resources was begun in May 1948 and completed in June 1951. The volume data can be generally interpreted as applying to the stands as they existed January 1, 1949.

The amount of forest land in each county was estimated from aerial photographs by a simple dot-count method. Nearly 150,000 dots were counted on the photos to get this preliminary estimate of forest area. A photo interpreter examined about 12,500 of these stereoscopically. He classified the acre of timber surrounding each dot by stand size on the basis of tree height, crown width, and number of trees per acre.

Finally, about 2,600 plots were selected to be examined in the field. This selection was weighted—the larger stand size classes were sampled more intensively than the smaller. Crews of two men each located and examined these plots on the ground. They gathered such information as tree diameters, merchantable heights, log grades, and amount of cull. Each plot was 1/5-acre in area.

In addition, nearly 700 plots classified as nonforest on the photos were examined in the field to check on changes in land use since the photos were taken.

Volume Tables

SAWTIMBER VOLUME.—The board-foot volume tables used in the Kentucky Forest Survey were based on the Mesavage-Girard form class tables (*4*). Average form classes were computed from estimates and measurements on more than 2,000 trees, for 12-, 14-, and 16-inch and larger diameter groups. Gross cubic-foot tables were prepared from the Mesavage cubic-foot form class tables.

The volume for softwood upper stems was computed directly from measurements of 30 trees. It was found to average 0 to 3 cubic feet per tree depending on species and tree size.

POLETIMBER VOLUME.—Diameters and merchantable height were measured on more than 1,200 pole trees in the State. These estimates were summarized by geographical units, by species, and by diameters breast high. Average curves of merchantable height over breast-high diameter were prepared and cubic-foot volumes were computed by species and diameters.

Cull

Trees of pole or sawtimber size that did not qualify as merchantable trees were tallied as cull trees. The sound volume in these trees was not included in the volume of growing stock or in the growth and drain estimates.

In addition nearly every merchantable tree has some cull volume. Field crews estimated both sound and rotten board-foot cull in sawtimber trees. To allow for unseen defects, the cull allowance was adjusted in the various Forest Survey units according to the recommendations of local foresters. Average cull factors were computed for groups of species having similar cull characteristics.

A similar procedure was followed to adjust the cubic-foot volumes. However, estimates of cubic-foot cull in sawtimber trees allowed for rotten defects only.

The cull percent for pole trees was assumed to be the same as that for the smallest diameter sawtimber trees of corresponding species.

To determine the cubic volume of sound wood in trees tallied as sound and rotten culls, the cull percent in these trees was assumed to be the same as used in Missouri and Illinois. Twenty percent of the gross volume of sound cull trees was considered to be rot, and in rotten cull trees the amount of rot was estimated at 60 percent of the gross volume.

Growth and Mortality

Cores were taken from 4,622 sample trees and growth for the past 10 years was measured. Growth rates were computed by determining the ratio of

the predicted 10-year future volume to the present volume of sample trees. These 10-year ratios were converted to annual compound interest rates and then plotted over breast-high diameters for each species. All formerly merchantable trees that died within 4 years prior to the survey were tallied and ratios of mortality to stand volume computed. Growth and mortality percentages were applied to volume to get net volume growth.

Commodity Drain

The commodity drain from Kentucky forests in 1948 was obtained by a sampling survey of wood-product producers and wood users, and of logging operations to determine the amount of logging waste.

Commodity drain of sawlogs was obtained by sampling sawmills for lumber production. It was assumed that exports of sawlogs equaled imports. Lumber tally was converted to log volume, International one-quarter-inch scale.

Estimates of fuelwood, fence posts, and miscellaneous farm-timber production were based on area sampling using the Master Sample of Agriculture.

The production of round mine timbers was estimated by multiplying the amount of wood used per ton of coal produced by total number of tons produced. For the Eastern Coal Field the factor used was 0.26 cubic feet of wood per ton of coal produced; it was derived from a Forest Service estimate of the amount of wood used in eastern Kentucky mines in 1942. For the Western Coal Field the factor used was 0.118 cubic feet per ton of coal produced; it was derived from a Forest Service study of the amount of wood used by Illinois underground mines. Cross-boundary drain was assumed to be in balance.

Production of all other commodities was based upon a complete canvass of producers, concentrators, or processors that might have used Kentucky timber in the form of logs or bolts. Although numerous inquiries were made, no production of poles, piling, chemical wood, charcoal, or excelsior wood was reported.

Production was converted to drain by applying factors derived from field studies of mill overrun, distribution of trees cut, logging waste, and the proportion of the product that came from upper stems, limbs, saplings, and so on.

Accuracy of Data

Statistical analysis of forest area and timber volume data in Kentucky shows a sampling error of ±0.9 percent (±103.5 M acres) for commercial forest area and of ±1.5 percent (±100.1 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. The following tabulation may be used as a guide in estimating the probable sampling error of the subdivisions of forest areas and volumes in the tables:

Commercial forest		Growing stock		Sawtimber growing stock	
Area	Sampling error	Volume	Sampling error	Volume	Sampling error
Thousand acres	*Percent*	*Million cubic feet*	*Percent*	*Million board feet*	*Percent*
11,446	0.9	6,570	1.5	24,655	2.2
5,000	1.4	5,000	1.7	20,000	2.4
1,000	3.0	1,000	3.9	10,000	3.5
500	4.3	100	12.2	1,000	10.9
50	13.6	10	38.5	100	34.5
10	30.5	1	121.6	10	109.3

Explanation of Terms Used

Forest Land Classes

FOREST LAND AREA.—Includes (*a*) lands 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.

AREA RESERVED FROM COMMERCIAL TIMBER USE.—Forest land withdrawn from timber utilization through statute, ordinance, or administrative order, but which otherwise qualifies as commercial forest land.

Forest Types

PINE.—Stands in which pine species comprise at least 60 percent of the dominant and codominant trees.

REDCEDAR–HARDWOOD.—Stands in which redcedar comprises at least 20 percent of the dominant and codominant trees.

OAK–PINE.—Stands in which 40 percent or more of the species is hardwood, usually upland oaks, but in which southern pines make up 20-60 percent.

OAK–HICKORY.—Hardwood stands in which oaks and hickories comprise at least 60 percent of the dominant and codominant trees.

WHITE OAK.—Hardwood stands in which white oak (*Quercus alba*) comprises at least 60 percent of the dominant and codominant trees.

BEECH–MAPLE.—Hardwood stands in which beech and sugar maple comprise at least 60 percent of the dominant and codominant trees.

MIXED HARDWOODS.—Stands of mixed hardwood species not qualifying for other hardwood types. Principal species include yellow-poplar, elm, maple, basswood, ash, beech, hemlock, and black locust in mixture with oaks and hickories.

BOTTOM-LAND HARDWOODS.—Stands on the alluvial bottoms of rivers and streams. The principal species include sycamore, willow, elm, blackgum, sweetgum, soft maples, oaks, hickory, cottonwood, and cypress.

Tree Classes

SAWTIMBER TREE.—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.

POLETIMBER TREES.—Trees 5 inches d.b.h. and larger of commercial species that do not meet the specifications for sawtimber trees but do meet regional specifications of species, soundness, and freedom from defect.

SEEDLING AND SAPLING TREES.—Trees of commercial species less than 5 inches in diameter at breast height, but not less than 1 inch.

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 winged elm.

ROTTEN CULL TREES.—Live trees of sawtimber or poletimber size that fail to meet regional specifications of proportion of sound volume to total volume.

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

Volume Estimates

SAWTIMBER VOLUME.—Net volume in board feet, International ¼-inch rule, of live sawtimber trees to a minimum top diameter inside bark of 6 inches for softwoods and 8 inches for hardwoods.

GROWING STOCK.—Net volume in cubic feet of live sawtimber trees and live poletimber trees from stump to a minimum 4.0-inch top (of central stem) inside bark. (Note: In the statistics presented in this report, the volume of upper stems of hardwoods is included with limbs rather than with the sawtimber volume.)

TOTAL VOLUME.—The volume of sound wood inside bark in both sound and cull living trees 5 inches d.b.h. and larger, from the stump to a minimum top diameter of 4 inches inside bark, expressed in cubic feet. It includes the upper stems of softwood trees and the upper stems and limbs of hardwoods.

Stocking Classes

STOCKING.—Stocking is the extent to which growing space is effectively utilized by present or potential growing-stock trees of commercial species. Three degrees of stocking were recognized:

Good.—At least 70 percent crown cover.

Fair.—From 40 to 70 percent crown cover.

Poor.—Less than 40 percent crown cover.

Site Classes

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 three or more logs at maturity.

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

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

Poor.—Areas that can produce hardwood trees that average one-half log at maturity.

Stand-Size Classes

LARGE SAWTIMBER STANDS.—Stands having a minimum net volume of 1,500 board feet per acre in sawtimber trees, with more than half of this volume in trees 15 inches d.b.h. and larger.

SMALL SAWTIMBER STANDS.—Stands having a net volume of 1,500 board feet per acre in sawtimber trees, with at least half of this volume in trees smaller than 15 inches d.b.h.

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

SEEDLING AND SAPLING STANDS.—Stands not qualifying as either sawtimber or poletimber, but having at least 10-percent stocking of trees, at least 300 seedlings of commercial species, and with at least half the minimum stocking in seedling and sapling trees.

NONSTOCKED AND OTHER AREAS NOT ELSEWHERE CLASSIFIED.—Areas not qualifying as sawtimber, poletimber, or seedling and sapling stands.

Diameter Measurement and Classes

DIAMETER AT BREAST HEIGHT (D.B.H.).—Tree diameter, outside bark, measured at 4.5 feet above average ground level.

DIAMETER CLASS.—Trees were recorded in 2-inch diameter classes, each class including 1 inch below and 0.9 inch above the midpoint of the class; e.g., the 8-inch class included all trees ranging from 7 to 8.9 inches d.b.h.

DIAMETER INSIDE BARK (D.I.B.).—Tree diameter inside the bark at any point specified.

Hardwood Log Grades [4]

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 in Kentucky will normally yield about 20 percent No. 1 Common and better lumber.

Growth

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.

[4] 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 (*3*). Persons interested in detailed specifications should consult this publication.

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 exclusive of catastrophic losses.

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 exclusive of catastrophic losses.

Mortality

ANNUAL MORTALITY OF SAWTIMBER. — The net board-foot volume removed from live sawtimber during a specified year through death from natural causes, but not as the result of catastrophes.

ANNUAL MORTALITY OF GROWING STOCK.—The net cubic-foot volume removed from growing stock during a specified year through death from natural causes, but not as the result of catastrophes.

Drain

COMMODITY DRAIN ON 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.

COMMODITY DRAIN ON 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.

Principal Commercial Tree Species of Kentucky [5]

SOFTWOODS

Baldcypress		*Taxodium distichum*
Hemlock, eastern		*Tsuga canadensis*
Pine	eastern white	*Pinus strobus*
	pitch	*P. rigida*
	shortleaf	*P. echinata*
	Virginia	*P. virginiana*
Redcedar, eastern		*Juniperus virginiana*

HARDWOODS [6]

Ash		*Fraxinus* spp.
Basswood		*Tilia* spp.
Beech, American		*Fagus grandifolia*
Blackgum		*Nyssa sylvatica*
Boxelder		*Acer negundo*
Cottonwood, eastern		*Populus deltoides*
Elm		*Ulmus* spp.
Hickory		*Carya* spp.
Maple	red	*Acer rubrum*
	silver	*A. saccharinum*
	sugar	*A. saccharum*
Oak	black	*Quercus velutina*
	bur	*Q. macrocarpa*
	cherrybark	*Q. falcata* var. *pagodaefolia*
	chestnut	*Q. prinus*
	chinkapin	*Q. muehlenbergii*
	northern red	*Q. rubra*
	overcup	*Q. lyrata*
	pin	*Q. palustris*
	post	*Q. stellata*
	scarlet	*Q. coccinea*
	shingle	*Q. imbricaria*
	southern red	*Q. falcata*
	swamp chestnut	*Q. michauxii*
	swamp white	*Q. bicolor*
	water	*Q. nigra*
	white	*Q. alba*
	willow	*Q. phellos*

See footnotes on p. 41.

Sweetgum	*Liquidambar styraciflua*
Sycamore, American	*Platanus occidentalis*
Tupelo, water	*Nyssa aquatica*
Walnut, black	*Juglans nigra*
Yellow-poplar	*Liriodendron tulipifera*

[5] Noncommercial species include species that do not normally have commercial value, such as hawthorn, redbud, hornbeam, hophornbeam, alder, and serviceberry.

[6] Other hardwoods include all other commercial hardwood species.

Supplementary Tables

TABLE 1.—*Land and forest area by county and physiographic region, Kentucky, 1949*

WESTERN PLATEAU REGION

County	Land area			County	Land area		
	Total	Forest			Total	Forest	
	Thousand acres	*Thousand acres*	*Percent*		*Thousand acres*	*Thousand acres*	*Percent*
Adair	252	108	43	Larue	166	54	33
Allen	233	81	35	Livingston	203	78	38
Ballard	166	46	28	Logan	360	106	29
Barren	311	68	22	Lyon	163	86	53
Breckinridge	362	148	41	McCracken	161	43	27
Bullitt	192	103	54	McLean	164	45	27
Butler	284	127	45	Marion	220	82	37
Caldwell	228	84	37	Marshall	194	68	35
Calloway	244	75	31	Meade	197	75	38
Carlisle	125	33	26	Metcalfe	189	77	41
Casey	278	155	56	Monroe	214	101	47
Christian	465	135	29	Muhlenberg	308	134	44
Clinton	122	62	51	Nelson	280	105	38
Crittenden	234	93	40	Ohio	381	150	39
Cumberland	197	108	55	Pulaski	403	209	52
Daviess	298	63	21	Russell	155	76	49
Edmonson	195	116	59	Simpson	153	19	12
Fulton	131	33	25	Taylor	182	68	37
Graves	358	72	20	Todd	241	64	27
Grayson	329	133	40	Trigg	292	156	53
Green	180	57	32	Union	220	37	17
Hancock	120	53	44	Warren	349	86	25
Hardin	394	148	38	Wayne	282	180	64
Hart	272	118	43	Webster	217	63	29
Henderson	282	53	19				
Hickman	159	35	22	Total	12,460	4,636	37
Hopkins	355	167	47				

TABLE 1.—*Land and forest area by county and physiographic region, Kentucky, 1949—Continued*

BLUEGRASS REGION

County	Land area			County	Land area		
	Total	Forest			Total	Forest	
	Thousand acres	*Thousand acres*	*Per-cent*		*Thousand acres*	*Thousand acres*	*Per-cent*
Anderson	132	33	25	Lincoln	218	60	28
Bath	184	64	35	Madison	285	52	18
Boone	161	38	24	Mason	153	24	16
Bourbon	192	4	2	Mercer	164	22	13
Boyle	116	25	22	Montgomery	131	25	19
Bracken	132	37	28	Nicholas	131	26	20
Campbell	97	28	29	Oldham	118	27	23
Carroll	84	26	31	Owen	225	89	40
Clark	166	21	13	Pendleton	178	62	35
Fayette	179	7	4	Robertson	65	17	26
Fleming	224	68	30	Scott	182	30	16
Franklin	135	46	34	Shelby	246	26	11
Gallatin	64	17	27	Spencer	123	23	19
Garrard	151	25	17	Trimble	93	48	52
Grant	160	34	21	Washington	196	42	21
Harrison	197	37	19	Woodford	123	14	11
Henry	185	39	21				
Jefferson	240	52	22				
Jessamine	113	9	8				
Kenton	106	24	23	Total	5,649	1,221	22

EASTERN HIGHLANDS REGION

Bell	237	201	85	Letcher	217	178	82
Boyd	102	58	57	Lewis	310	235	76
Breathitt	316	260	82	McCreary	261	248	95
Carter	257	166	65	Magoffin	194	139	72
Clay	303	223	74	Martin	148	132	89
Elliott	154	110	71	Menifee	134	108	81
Estill	166	121	73	Morgan	236	154	65
Floyd	257	191	74	Owsley	126	92	73
Greenup	224	154	69	Perry	219	173	79
Harlan	300	273	91	Pike	503	422	84
Jackson	216	156	72	Powell	111	83	75
Johnson	169	116	69	Rockcastle	199	130	65
Knott	228	191	84	Rowan	186	151	81
Knox	239	154	64	Whitley	293	214	73
Laurel	284	185	65	Wolfe	145	97	67
Lawrence	272	177	65				
Lee	134	106	79				
Leslie	264	242	92	Total	7,404	5,640	76

TABLE 2.—*Land area by major use and physiographic region, Kentucky, 1949*

Land use	State total		Western Plateau	Bluegrass	Eastern Highlands
	Thousand acres	*Percent*	*Thousand acres*	*Thousand acres*	*Thousand acres*
Forest:					
Commercial	11,446	44.9	4,586	1,221	5,639
Reserved	51	.2	50	[1]	1
Total	11,497	45.1	4,636	1,221	5,640
Nonforest	14,016	54.9	7,824	4,428	1,764
Total	25,513	100.0	12,460	5,649	7,404
Percent	100		49	22	29

[1] Less than 0.5 thousand acres.

TABLE 3.—*Commercial forest area by ownership and physiographic region, Kentucky, 1949*

Ownership	State total		Western Plateau	Bluegrass	Eastern Highlands
	Thousand acres	*Percent*	*Thousand acres*	*Thousand acres*	*Thousand acres*
Federal:					
National forest	406	3.5	38	14	354
Other	217	1.9	206		11
Total	623	5.4	244	14	365
State	53	.5	15		38
Private	[1] 10,770	94.1	4,327	1,207	5,236
Total	11,446	100.0	4,586	1,221	5,639
Percent	100		40	11	49

[1] Includes less than 1,000 acres of county and municipal forest land.

TABLE 4.—*Commercial forest area by forest type and physiographic region, Kentucky, 1949*

Forest type	State total	Western Plateau		Bluegrass		Eastern Highlands	
	Thousand acres	*Thousand acres*	*Percent*	*Thousand acres*	*Percent*	*Thousand acres*	*Percent*
Pine	234	57	24.4	19	8.1	158	67.5
Redcedar–hardwoods	490	275	56.1	197	40.2	18	3.7
Oak–pine	726	82	11.3	26	3.6	618	85.1
Oak–hickory	5,186	2,152	41.5	237	4.6	2,797	53.9
White oak	311	182	58.5	12	3.9	117	37.6
Beech–maple	393	263	66.9	7	1.8	123	31.3
Mixed hardwoods	3,603	1,148	31.9	690	19.1	1,765	49.0
Bottom-land hardwoods	503	427	84.9	33	6.6	43	8.5
Total	11,446	4,586		1,221		5,639	
Percent	100	40		11		49	

TABLE 5.—*Commercial forest area by stand-size class and physiographic region, Kentucky, 1949*

Stand-size class	State total	Western Plateau		Bluegrass		Eastern Highlands	
	Thousand acres	*Thousand acres*	*Percent*	*Thousand acres*	*Percent*	*Thousand acres*	*Percent*
Large sawtimber stands	2,753	954	34.6	74	2.7	1,725	62.7
Small sawtimber stands	2,211	1,025	46.4	138	6.2	1,048	47.4
Poletimber stands	4,040	1,759	43.5	573	14.2	1,708	42.3
Seedling and sapling stands	1,830	621	34.0	244	13.3	965	52.7
Nonstocked and other areas	612	227	37.1	192	31.4	193	31.5
Total	11,446	4,586		1,221		5,639	
Percent	100	40		11		49	

TABLE 6.—*Commercial forest area by forest type and stand-size class, Kentucky, 1949*

Forest type	Total		Sawtimber stands		Pole-timber stands	Seedling and sapling stands	Non-stocked stands
			Large	Small			
	Thousand acres	*Percent*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*
Pine	234	2.1	4	116	80	34	
Redcedar–hardwoods	490	4.3	6	19	275	125	65
Oak–pine	726	6.3	50	256	220	166	34
Oak–hickory	5,186	45.3	1,321	1,109	1,868	687	201
White oak	311	2.7	27	117	167		
Beech–maple	393	3.4	202	81	80	20	10
Mixed hardwoods	3,603	31.5	906	388	1,235	786	288
Bottom-land hardwoods	503	4.4	237	125	115	12	14
Total	11,446	100.0	2,753	2,211	4,040	1,830	612
Percent	100		24	19	36	16	5

TABLE 7.—*Net board-foot volume on commercial forest area by ownership and physiographic region, Kentucky, 1949*

Ownership	State total		Western Plateau	Bluegrass	Eastern Highlands
	Million bd. ft.	*Percent*	*Million bd. ft.*	*Million bd. ft.*	*Million bd. ft.*
Federal:					
National Forest	1,109	4.5	105	38	966
Other	476	1.9	443		33
Total	1,585	6.4	548	38	999
State	141	.6	34		107
Private	[1] 22,929	93.0	9,196	1,230	12,503
Total	24,655	100.0	9,778	1,268	13,609
Percent	100		40	5	55

[1] Includes less than 0.5 million board feet of county and municipally owned timber.

TABLE 8.—*Net board-foot volume on commercial forest area by species and physiographic region, Kentucky, 1949*

Species	State total	Western Plateau		Bluegrass		Eastern Highlands	
	Million bd. ft.	*Million bd. ft.*	*Percent*	*Million bd. ft.*	*Percent*	*Million bd. ft.*	*Percent*
Shortleaf, pitch, and white pines	[1] 1,039	76	7.3	35	3.4	928	89.3
Virginia pine	523	145	27.7	80	15.3	298	57.0
Other softwoods	[2] 392	117	29.9	15	3.8	260	66.3
White oak	2,315	1,239	53.5	162	7.0	914	39.5
Chestnut oak	2,256	175	7.8	46	2.0	2,035	90.2
Other white oaks	611	458	75.0	76	12.4	77	12.6
Black and scarlet oaks	4,121	1,467	35.6	75	1.8	2,579	62.6
Northern red and cherrybark oaks	1,526	599	39.2	102	6.7	825	54.1
Other red oaks	810	715	88.3	32	3.9	63	7.8
Hickory	2,631	964	36.7	85	3.2	1,582	60.1
Ash	418	217	51.9	70	16.8	131	31.3
Elm	357	249	69.7	62	17.4	46	12.9
Cottonwood	124	124	100.0				
Yellow-poplar	1,830	533	29.1	57	3.1	1,240	67.8
Basswood	509	13	2.6	20	3.9	476	93.5
Sweetgum	462	407	88.1	6	1.3	49	10.6
Blackgum and tupelo	584	136	23.3	8	1.4	440	75.3
Sugar maple	526	289	55.0	27	5.1	210	39.9
Soft maple	326	188	57.7	6	1.8	132	40.5
Sycamore	347	219	63.1	68	19.6	60	17.3
Beech	1,959	1,020	52.1	25	1.3	914	46.6
Black walnut	266	117	44.0	41	15.4	108	40.6
Other hardwoods	723	311	43.0	170	23.5	242	33.5
Total	24,655	9,778		1,268		13,609	
Percent	100	40		5		55	

[1] About 6 percent white pine.
[2] Approximately 74 percent hemlock, 16 percent redcedar, and 10 percent baldcypress.

TABLE 9.—*Net board-foot volume on commercial forest area by species and stand-size class, Kentucky, 1949*

Species	Total		Sawtimber stands		Pole-timber stands	Seedling and sapling and non-stocked stands
			Large	Small		
	Million bd. ft.	*Percent*	*Million bd. ft.*	*Million bd. ft.*	*Million bd. ft.*	*Million bd. ft.*
Shortleaf, pitch, and white pines	[1] 1,039	4.2	198	697	124	20
Virginia pine	523	2.1	13	380	114	16
Other softwoods	[2] 392	1.6	276	51	64	1
White oak	2,315	9.4	1,129	817	326	43
Chestnut oak	2,256	9.2	1,632	400	193	31
Other white oaks	611	2.5	312	151	129	19
Black and scarlet oaks	4,121	16.7	2,319	1,221	514	67
Northern red and cherrybark oaks	1,526	6.2	969	386	167	4
Other red oaks	810	3.3	512	209	89	
Hickory	2,631	10.7	1,562	713	308	48
Ash	418	1.7	246	125	46	1
Elm	357	1.4	187	97	63	10
Cottonwood	124	.5	105	4	13	2
Yellow-poplar	1,830	7.4	1,164	413	213	40
Basswood	509	2.1	434	53	22	
Sweetgum	462	1.9	271	122	65	4
Blackgum and tupelo	584	2.4	391	125	59	9
Sugar maple	526	2.1	388	91	26	21
Soft maple	326	1.3	187	75	62	2
Sycamore	347	1.4	202	84	58	3
Beech	1,959	7.9	1,545	286	96	32
Black walnut	266	1.1	127	71	51	17
Other hardwoods	723	2.9	390	178	130	25
Total	24,655	100.0	14,559	6,749	2,932	415
Percent	100		59	27	12	2

[1] About 6 percent white pine.
[2] Approximately 74 percent hemlock, 16 percent redcedar, and 10 percent baldcypress.

TABLE 10.—*Net board-foot volume on commercial forest area by species and tree-diameter class, Kentucky, 1949*

[Million board feet, i.e. 000,000 omitted]

Species	Total	Tree diameter class (inches)					
		10 [1]	12–14	16–18	20–22	24–26	28+
Shortleaf, pitch, and white pines	[2] 1,039	171	527	220	92	.....	29
Virginia pine	523	184	292	47	.....	.....	.....
Other softwoods	[3] 392	51	100	104	73	49	15
White oak	2,315	.....	1,171	604	255	148	137
Chestnut oak	2,256	.....	566	513	412	336	429
Other white oaks	611	.....	307	188	87	22	7
Black and scarlet oaks	4,121	.....	1,628	1,512	654	286	41
Northern red and cherrybark oaks	1,526	.....	413	516	273	181	143
Other red oaks	810	.....	267	264	150	85	44
Hickory	2,631	.....	1,219	720	379	197	116
Ash	418	.....	155	129	77	27	30
Elm	357	.....	170	75	60	25	27
Cottonwood	124	.....	28	43	31	19	3
Yellow-poplar	1,830	.....	636	681	315	174	24
Basswood	509	.....	122	228	129	30	.....
Sweetgum	462	.....	186	167	66	30	13
Blackgum and tupelo	584	.....	227	176	107	61	13
Sugar maple	526	.....	163	118	122	59	64
Soft maple	326	.....	145	117	49	5	10
Sycamore	347	.....	89	77	77	54	50
Beech	1,959	.....	411	503	470	342	233
Black walnut	266	.....	144	78	44	.....	.....
Other hardwoods	723	.....	314	171	140	38	60
Total	24,655	406	9,280	7,251	4,062	2,168	1,488
Percent	100	2	38	29	16	9	6

[1] Ten-inch diameter class shown separately because in this diameter class sawtimber volume includes softwood trees, but not hardwoods.
[2] About 6 percent white pine.
[3] Approximately 74 percent hemlock, 16 percent redcedar, and 10 percent baldcypress.

TABLE 11.—*Net board-foot volume on commercial forest area by tree-diameter class and physiographic region, Kentucky, 1949*

Tree-diameter class (inches)	State total		Western Plateau		Bluegrass		Eastern Highlands	
	Million bd. ft.	*Percent*	*Million bd. ft.*	*Percent*	*Million bd. ft.*	*Percent*	*Million bd. ft.*	*Percent*
10 [1]	406	1.7	83	0.9	46	3.6	277	2.0
12–14	9,280	37.6	4,042	41.3	610	48.1	4,628	34.0
16–18	7,251	29.4	2,896	29.6	336	26.5	4,019	29.5
20–22	4,062	16.5	1,469	15.0	179	14.1	2,414	17.8
24–26	2,168	8.8	829	8.5	79	6.3	1,260	9.3
28+	1,488	6.0	459	4.7	18	1.4	1,011	7.4
Total	24,655	100.0	9,778	100.0	1,268	100.0	13,609	100.0
Percent	100		40		5		55	

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

TABLE 12.—*Net board-foot volume on commercial forest area by forest type and physiographic region, Kentucky, 1949*

Forest type	State total		Western Plateau	Bluegrass	Eastern Highlands
	Million bd. ft.	*Percent*	*Million bd. ft.*	*Million bd. ft.*	*Million bd. ft.*
Pine	684	2.8	146	108	430
Redcedar–hardwoods	213	9	180	33	
Oak–pine	1,288	5.2	96	12	1,180
Oak–hickory	11,360	46.1	3,784	429	7,147
White oak	627	2.5	389	24	214
Beech–maple	1,680	6.8	1,132	17	531
Mixed hardwoods	6,799	27.6	2,343	577	3,879
Bottom-land hardwoods	2,004	8.1	1,708	68	228
Total	24,655	100.0	9,778	1,268	13,609
Percent	100		40	5	55

TABLE 13.—*Hardwood sawtimber volume by log grades, Kentucky, 1949*

Species group	Log grade 1		Log grade 2		Log grade 3		Total
	Million bd. ft.	*Percent*	*Million bd. ft.*	*Percent*	*Million bd. ft.*	*Percent*	*Million bd. ft.*
White oaks [1]	347	6.7	547	10.6	4,288	82.7	5,182
Red oaks [2]	267	4.2	551	8.5	5,639	87.3	6,457
Other hardwoods	694	6.3	1,132	10.2	9,236	83.5	11,062
Total	1,308	5.8	2,230	9.8	19,163	84.4	22,701

Physiographic region	Log grade 1		Log grade 2		Log grade 3		Total
	Million bd. ft.	*Percent*	*Million bd. ft.*	*Percent*	*Million bd. ft.*	*Percent*	*Million bd. ft.*
Western Plateau	375	4.0	851	9.0	8,214	87.0	9,440
Bluegrass	49	4.3	80	7.0	1,009	88.7	1,138
Eastern Highlands	884	7.3	1,299	10.7	9,940	82.0	12,123
Total	1,308	5.8	2,230	9.8	19,163	84.4	22,701

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

TABLE 14.—*Cubic volume of sound wood on commercial forest area by species and class of material, Kentucky, 1949*

Species	All material	Growing stock			Hardwood upper stems and limbs	Cull trees [2]
		Total [1]	Sawtimber trees [1]	Poletimber trees		
	Million cu. ft.	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*
Shortleaf, pitch, and white pines	222.8	222.1	175.2	46.9	.....	0.7
Virginia pine	177.0	174.8	96.6	78.2	.....	2.2
Other softwoods	120.9	117.7	77.8	39.9	.....	3.2
White oak	1,018.2	744.8	360.5	384.3	202.0	71.4
Chestnut oak	881.0	511.1	344.1	167.0	192.8	177.1
Other white oaks	311.8	214.2	98.3	115.9	55.1	42.5
Black and scarlet oaks	1,513.6	993.4	652.1	341.3	365.3	154.9
Northern red and cherrybark oaks	479.4	311.8	237.0	74.8	132.6	35.0
Other red oaks	275.2	185.9	127.5	58.4	71.5	17.8
Hickory	1,133.9	809.7	411.4	398.3	230.4	93.8
Ash	228.3	157.9	67.4	90.5	37.7	32.7
Elm	241.5	160.8	56.7	104.1	31.7	49.0
Cottonwood	34.9	22.2	19.5	2.7	10.9	1.8
Yellow-poplar	606.1	406.8	283.2	123.6	158.7	40.6
Basswood	172.3	101.6	77.5	24.1	43.4	27.3
Sweetgum	184.8	131.9	73.1	58.8	40.8	12.1
Blackgum and tupelo	263.3	146.2	94.4	51.8	52.8	64.3
Sugar maple	274.1	161.0	80.0	81.0	44.9	68.2
Soft maple	248.2	126.9	51.5	75.4	28.8	92.5
Sycamore	117.6	79.1	53.2	25.9	29.8	8.7
Beech	1,008.5	353.9	290.0	63.9	162.4	492.2
Black walnut	128.3	91.0	43.0	48.0	23.9	13.4
Other hardwoods	531.1	345.0	114.4	230.6	64.1	122.0
Noncommercial species	62.6	.....	.....	.....	.....	62.6
Total [3]	10,235.4	6,569.8	3,884.4	2,685.4	1,979.6	1,686.0
Percent	100	64	38	26	19	17

[1] Includes upper stems of softwood sawtimber.
[2] Includes upper stems and limbs of cull trees and trees of noncommercial species.
[3] Does not include volume of standing dead chestnut estimated to be 134.0 million cubic feet.

TABLE 15.—*Net volume of growing stock on commercial forest area by stand-size class and physiographic region, Kentucky, 1949*

Stand-size class	BOARD-FOOT VOLUME					Stand-size class	CUBIC-FOOT VOLUME				
	State total		Western Plateau	Bluegrass	Eastern Highlands		State total		Western Plateau	Bluegrass	Eastern Highlands
	Million bd. ft.	*Percent*	*Million bd. ft.*	*Million bd. ft.*	*Million bd. ft.*		*Million cu. ft.*	*Percent*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*
Large sawtimber stands	14,559	59.0	5,285	387	8,887	Large sawtimber stands	2,812.9	42.8	1,056.4	80.7	1,675.8
Small sawtimber stands	6,749	27.4	2,994	497	3,258	Small sawtimber stands	1,859.7	28.3	859.6	128.1	872.0
Poletimber stands	2,932	11.9	1,324	348	1,260	Poletimber stands	1,744.1	26.5	822.7	237.2	684.2
Seedling and sapling stands	352	1.4	140	21	191	Seedling and sapling stands	121.5	1.9	46.0	14.3	61.2
Nonstocked and other areas	63	.3	35	15	13	Nonstocked and other areas	31.6	.5	15.9	12.4	3.3
Total	24,655	100.0	9,778	1,268	13,609	Total	6,569.8	100.0	2,800.6	472.7	3,296.5
Percent	100	.....	40	5	55	Percent	100	.....	43	7	50

TABLE 16.—*Net cubic-foot volume of growing stock on commercial forest area by species and physiographic region, Kentucky, 1949*

Species	State total	Western Plateau		Bluegrass		Eastern Highlands	
	Million cu. ft.	*Million cu. ft.*	*Percent*	*Million cu. ft.*	*Percent*	*Million cu. ft.*	*Percent*
Shortleaf, pitch, and white pines	222.1	12.8	5.7	8.8	4.0	200.5	90.3
Virginia pine	174.8	40.7	23.3	24.0	13.7	110.1	63.0
Other softwoods	117.7	52.4	44.5	14.0	11.9	51.3	43.6
White oak	744.8	367.5	49.3	47.0	6.3	330.3	44.4
Chestnut oak	511.1	70.2	13.7	16.4	3.2	424.5	83.1
Other white oaks	214.2	160.4	74.9	20.6	9.6	33.2	15.5
Black and scarlet oaks	993.4	366.3	36.9	20.2	2.0	606.9	61.1
Northern red and cherrybark oaks	311.8	129.8	41.6	20.8	6.7	161.2	51.7
Other red oaks	185.9	159.8	86.0	10.3	5.5	15.8	8.5
Hickory	809.7	346.0	42.7	48.0	5.9	415.7	51.4
Ash	157.9	87.7	55.6	32.4	20.5	37.8	23.9
Elm	160.8	105.5	65.6	37.9	23.6	17.4	10.8
Cottonwood	22.2	22.2	100.0				
Yellow-poplar	406.8	116.7	28.7	11.6	2.8	278.5	68.5
Basswood	101.6	4.1	4.0	6.3	6.2	91.2	89.8
Sweetgum	131.9	117.5	89.1	1.1	.8	13.3	10.1
Blackgum and tupelo	146.2	56.0	38.3	3.3	2.3	86.9	59.4
Sugar maple	161.0	97.2	60.4	11.4	7.1	52.4	32.5
Soft maple	126.9	67.1	52.9	4.0	3.1	55.8	44.0
Sycamore	79.1	46.2	58.4	18.0	22.8	14.9	18.8
Beech	353.9	185.0	52.3	4.9	1.4	164.0	46.3
Black walnut	91.0	40.0	44.0	24.3	26.7	26.7	29.3
Other hardwoods	345.0	149.5	43.4	87.4	25.3	108.1	31.3
Total	6,569.8	2,800.6		472.7		3,296.5	
Percent	100	43		7		50	

TABLE 17.—*Net cubic-foot volume of growing stock on commercial forest area by species and tree-diameter class, Kentucky, 1949*

Species	Total		Tree-diameter class (inches)						
			6–8	10	12–14	16–18	20–22	24–26	28+
	Million cu. ft.	*Percent*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*
Shortleaf, pitch, and white pines	222.1	3.4	46.9	34.6	90.2	33.3	13.2		3.9
Virginia pine	174.8	2.7	78.2	38.1	51.2	7.3			
Other softwoods	117.7	1.8	39.9	15.6	22.1	18.8	11.6	7.6	2.1
White oak	744.8	11.3	223.2	161.1	191.5	91.2	37.2	21.2	19.4
Chestnut oak	511.1	7.8	84.2	82.8	92.6	79.3	61.2	49.0	62.0
Other white oaks	214.2	3.3	60.6	55.3	51.6	29.3	13.2	3.3	.9
Black and scarlet oaks	993.4	15.1	174.3	167.0	269.0	236.2	98.5	42.3	6.1
Northern red and cherrybark oaks	311.8	4.7	34.9	39.9	68.7	79.9	41.2	26.5	20.7
Other red oaks	185.9	2.8	29.0	29.4	44.1	41.6	22.7	12.6	6.5
Hickory	809.7	12.3	241.5	156.8	201.3	109.9	55.6	28.4	16.2
Ash	157.9	2.4	56.6	33.9	26.5	20.4	12.0	4.0	4.5
Elm	160.8	2.5	62.7	41.4	27.9	11.9	9.0	3.8	4.1
Cottonwood	22.2	.3	1.3	1.4	4.6	7.0	4.7	2.7	.5
Yellow-poplar	406.8	6.2	65.1	58.5	104.7	104.3	45.9	24.8	3.5
Basswood	101.6	1.5	13.1	11.0	20.2	34.4	18.6	4.3	
Sweetgum	131.9	2.0	35.0	23.8	31.0	26.0	9.7	4.5	1.9
Blackgum and tupelo	146.2	2.2	29.9	21.9	38.3	28.1	16.7	9.3	2.0
Sugar maple	161.0	2.5	52.8	28.2	26.6	18.3	17.9	8.2	9.0
Soft maple	126.9	1.9	49.7	25.7	23.9	18.1	7.1	.8	1.6
Sycamore	79.1	1.2	13.5	12.4	14.4	11.8	11.6	8.0	7.4
Beech	353.9	5.4	32.4	31.5	64.6	74.6	68.7	49.2	32.9
Black walnut	91.0	1.4	27.9	20.1	24.0	12.2	6.8		
Other hardwoods	345.0	5.3	159.1	71.5	51.8	27.0	21.2	5.8	8.6
Total	6,569.8	100.0	1,611.8	1,161.9	1,540.8	1,120.9	604.3	316.3	213.8
Percent	100		25	18	23	17	9	5	3

TABLE 18.—*Average volume of growing stock per acre by stand-size class and region, Kentucky, 1949*

Stand-size class	BOARD-FOOT VOLUME			
	State total	Western Plateau	Bluegrass	Eastern Highlands
Large sawtimber stands	5,288	5,540	5,230	5,152
Small sawtimber stands	3,052	2,921	3,601	3,109
Poletimber stands	726	753	607	738
Seedling and sapling stands	192	225	86	198
Nonstocked and other areas	103	154	78	67
Average	2,154	2,132	1,038	2,413

Stand-size class	CUBIC-FOOT VOLUME			
	State total	Western Plateau	Bluegrass	Eastern Highlands
Large sawtimber stands	1,021.8	1,107.3	1,090.5	971.5
Small sawtimber stands	841.1	838.6	928.3	832.1
Poletimber stands	431.7	467.7	414.0	400.6
Seedling and sapling stands	66.4	74.1	58.6	63.4
Nonstocked and other areas	51.6	70.0	64.6	17.1
Average	574.0	610.7	387.1	584.6

TABLE 19.—*Average 10-year diameter growth by species and tree-size class, Kentucky, 1949*

Species	Sawtimber	Poletimber	Seedlings and saplings
	Inches	*Inches*	*Inches*
Shortleaf, pitch, and white pines	1.66	1.78	1.92
Virginia pine	1.56	2.00	1.98
Other softwoods	1.84	1.46	1.16
White oak	1.94	1.44	1.24
Chestnut oak	1.68	1.60	1.30
Other white oaks	1.70	1.20	1.14
Black and scarlet oaks	2.12	1.70	1.42
Northern red and cherrybark oaks	2.92	1.78	1.90
Other red oaks	3.12	2.24	1.78
Hickory	1.44	1.22	.70
Ash	2.30	1.82	1.52
Elm	2.24	1.96	1.48
Cottonwood	5.06	5.06	5.06
Yellow-poplar	2.32	2.40	2.66
Basswood	1.78	2.36	1.80
Sweetgum	2.56	2.16	1.92
Blackgum and tupelo	1.52	1.46	1.28
Sugar maple	1.92	1.48	1.32
Soft maple	2.72	2.14	1.76
Sycamore	3.20	2.72	2.36
Beech	1.58	1.50	1.28
Black walnut	1.78	1.82	1.90
Other hardwoods	2.24	1.72	1.52
Average, all species	2.12	1.66	1.44

TABLE 20.—*Average annual net board-foot growth by species expressed as a percentage of sawtimber inventory volume, Kentucky, 1949*

Species	Growth on original stand less mortality	Ingrowth	Net growth
	Percent	*Percent*	*Percent*
Shortleaf, pitch, and white pines	3.12	2.22	5.34
Virginia pine	2.97	8.21	11.18
Other softwoods	2.01	2.79	4.80
White oak	2.69	2.33	5.02
Chestnut oak	2.17	2.31	4.48
Other white oaks	2.13	2.22	4.35
Black and scarlet oaks	2.61	1.35	3.96
Northern red and cherrybark oaks	3.59	1.09	4.68
Other red oaks	3.73	3.37	7.10
Hickory	2.05	2.41	4.46
Ash	3.10	1.60	4.70
Elm	3.16	4.80	7.96
Cottonwood	5.98	.....	5.98
Yellow-poplar	3.10	1.92	5.02
Basswood	2.44	.91	3.35
Sweetgum	3.19	2.85	6.04
Blackgum and tupelo	1.98	1.77	3.75
Sugar maple	2.31	2.86	5.17
Soft maple	4.07	5.23	9.30
Sycamore	3.29	1.36	4.65
Beech	1.63	.86	2.49
Black walnut	2.20	3.75	5.95
Other hardwoods	3.02	3.81	6.83
Average, all species	2.64	2.18	4.82

TABLE 21.—*Average growth per acre of sawtimber and growing stock by physiographic region, Kentucky, 1949*

Region	SAWTIMBER			
	Growth on present inventory volume	Ingrowth [1]	Mortality	Net growth
	Bd. ft.	*Bd. ft.*	*Bd. ft.*	*Bd. ft.*
Western Plateau	66.6	44.9	7.5	104.0
Bluegrass	34.4	30.9	3.6	61.7
Eastern Highlands	68.5	52.2	7.9	112.8
State	64.1	47.0	7.3	103.8

Region	GROWING STOCK			
	Growth on present inventory volume	Ingrowth [1]	Mortality	Net growth
	Cu. ft.	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*
Western Plateau	24.4	3.9	2.4	25.9
Bluegrass	17.6	3.9	1.5	20.0
Eastern Highlands	21.1	3.2	2.3	22.0
State	22.0	3.6	2.3	23.3

[1] The growth and the merchantable stem volume of trees that grow into a larger size class during the year.

TABLE 22.—*Current annual change in sawtimber volume and growing stock volume by species group, Kentucky, 1949* [1]

Item	SAWTIMBER			Item	GROWING STOCK		
	Total	Softwood	Hardwood		Total	Softwood	Hardwood
	Million bd. ft.	*Million bd. ft.*	*Million bd. ft.*		*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*
Growth on present inventory volume	734	63	671	Growth on present inventory volume	252.2	19 4	232.8
Ingrowth [2]	538	77	461	Ingrowth [2]	41.0	3 5	37.5
Total growth	1,272	140	1,132	Total growth	293.2	22 9	270.3
Mortality	83	7	76	Mortality	25.9	2 0	23.9
Net growth	1,189	133	1,056	Net growth	267.3	20 9	246 4
Commodity drain	734	52	682	Commodity drain	160.7	10 2	150.5
Current annual change	+455	+81	+374	Current annual change	+106.6	+10 7	+95.9

[1] Though commodity drain was determined for the year 1948, the total drain figure can be considered representative of the total drain in 1949.
[2] The growth and merchantable stem volume of trees that grow into a larger size class during the year.

TABLE 23.—*Number of sound trees on commercial forest land by species and tree-diameter class, Kentucky, 1949*

Species	Total	D. b. h. class in inches							
		2	4	6–8	10	12–14	16–18	20–22	24+
	Million trees	*Million trees*	*Million trees*	*Million trees*	*Million trees*	*Million trees*	*Million trees*	*Million trees*	*Million trees*
Shortleaf, pitch, and white pines	73.1	39.0	9.8	14.4	4.0	5.0	0 7	0 2	(1)
Virginia pine	121.1	66.8	20.2	25.7	4.7	3.5	.2	.....	(1)
Other softwoods	122 4	68.3	30.7	18.9	2.2	1.4	6	.2	0.1
White oak	314.0	143.0	59.9	73.5	17.1	15.7	3.4	.8	.6
Chestnut oak	165.9	83.0	33.3	27.0	8.8	8 0	2.9	1.5	1.4
Other white oaks	92.7	30 8	26.0	22.2	6.6	5.2	1.4	.5	(1)
Black and scarlet oaks	295.3	141.5	50.0	54.0	16.8	21.2	8 6	2.4	.8
Northern red and cherrybark oaks	60.2	24.8	10.9	10.6	4.2	5.1	2.9	1 1	.6
Other red oaks	56.9	27.8	11.5	8.8	2.9	3.4	1.5	5	.5
Hickory	570.8	358.6	94.9	81.4	16.7	14.5	3.7	7	.3
Ash	159.9	107.3	25.4	19.9	3.6	2.6	.6	4	.1
Elm	163.8	106.1	27.7	21.6	4.4	3.0	.6	3	.1
Cottonwood	3.4	2.1	.....	.5	.2	.4	.2	(1)	(1)
Yellow-poplar	170.4	105.1	26.6	21.3	6.4	7.1	3.1	6	.2
Basswood	29.0	14.7	5.7	4.9	1.2	1.3	.9	.3	(1)
Sweetgum	54.7	29.7	9.4	9.6	2.6	2 3	.9	2	(1)
Blackgum and tupelo	120.2	87.8	15.6	9.9	2.2	3.4	1 0	2	.1
Sugar maple	168.6	117.9	26.5	17.6	3.0	2.2	.7	6	.1
Soft maple	241.2	186.1	31.8	17.4	2.7	2.1	.9	2	(1)
Sycamore	20.3	8.4	4.6	3.9	1.3	1.2	.5	2	.2
Beech	72.2	37.1	10.1	11.0	3.4	5.2	2.8	1 5	1 1
Black walnut	38.9	19.9	5.8	8.4	1.9	2.2	6	1	(1)
Other hardwoods	1,046.7	816.2	157.6	58.7	7.5	4.7	1 4	.5	.1
Total	4,161.7	2,622.0	694.0	541.2	124.4	120.7	40 1	13.0	6.3
Trees per forest acre	363.6	229.1	60.6	47.3	10.9	10.5	3.5	1.1	0.6

[1] Figure too small to be represented in this table.

TABLE 24.—*Number of sound trees on commercial forest area (2 inches d.b.h. and larger) by region and by species, Kentucky, 1949*

Species	Total number of trees	Western Plateau	Bluegrass	Eastern Highlands
	Million trees	*Million trees*	*Million trees*	*Million trees*
Shortleaf, pitch, and white pines	[1] 73.1	6.9	1.1	65.1
Virginia pine	121.1	31.5	5.5	84.1
Other softwoods	122.4	76.8	36.8	8.8
White oak	314.0	108.1	20.3	185.6
Chestnut oak	165.9	31.7	13.6	120.6
Other white oaks	92.7	67.6	9.9	15.2
Black and scarlet oaks	295.3	108.5	9.9	176.9
Northern red and cherrybark oaks	60.2	22.2	3.2	34.8
Other red oaks	56.9	50.6	1.8	4.5
Hickory	570.8	250.8	38.2	281.8
Ash	159.9	104.5	22.6	32.8
Elm	163.8	103.3	50.9	9.6
Cottonwood	3.4	3.4		
Yellow-poplar	170.4	46.1	2.1	122.2
Basswood	29.0	1.1	4.3	23.6
Sweetgum	54.7	49.7	.1	4.9
Blackgum and tupelo	120.2	55.6	1.6	63.0
Sugar maple	168.6	111.6	6.8	50.2
Soft maple	241.2	63.9	8.0	169.3
Sycamore	20.3	11.6	4.1	4.6
Beech	72.2	32.7	.4	39.1
Black walnut	38.9	9.8	19.9	9.2
Other hardwoods	1,046.7	441.4	150.0	455.3
Total	4,161.7	1,789.4	411.1	1,961.2

[1] Includes only a small amount of white pine.

TABLE 25.—*Number of sawtimber-size cull and dead trees by region, Kentucky, 1949*

Class	State total	Western Plateau	Bluegrass	Eastern Highlands
	Million trees	*Million trees*	*Million trees*	*Million trees*
Sound cull	3.6	1.5	0.8	1.3
Rotten cull	38.0	12.0	1.5	24.5
Dead chestnut	3.3	.2	.....	3.1
Other dead trees	2.6	.7	.4	1.5
Total	47.5	14.4	2.7	30.4
Average cull and dead trees per forest acre	4.1	3.1	2.2	5.4

TABLE 26.—*Volume and value*[1] *of primary forest products, Kentucky, 1948*

Commodity	Standard unit	Number of units produced	Cubic volume produced	Total value of products	Value per cubic foot of wood
			Thousand cu. ft.	*Thousand dollars*	*Cents*
Sawlogs	M board feet [2]	508,240	70,589	13,722	19
Veneer bolts	....do	9,614	1,335	721	54
Cooperage bolts	....do	44,042	6,117	3,523	58
Handle bolts	....do	5,468	760	273	36
Fuelwood	Standard cords	1,506,232	95,907	15,062	16
Pulpwood	....do	47,225	3,366	534	16
Fence posts	Pieces	13,544,000	10,305	3,386	33
Hewn crossties	....do	75,000	434	113	26
Mine timbers	M cubic feet	16,497	16,497	4,125	25
Miscellaneous farm timbers	....do	2,812	2,812	281	10
Total			208,122	41,740	20

[1] Volume figures based on Forest Survey studies; value on authors' estimates guided by local information.
[2] International ¼-inch log rule.

TABLE 27.—*Employment in the primary forest-products industries, Kentucky, 1948*

Commodity	Number of plants	Employment[1]		
		Plant	Woods	Total
		Man-years[2]	*Man-years*[2]	*Man-years*[2]
Lumber	[3] 2,168	3,736	2,908	6,644
Veneer	6	240	76	316
Cooperage stock	87	528	616	1,144
Handle stock	3	64	52	116
Pulpwood	0	0	188	188
Fuelwood	0	0	7,832	7,832
Fence posts	0	0	676	676
Round mine timbers	0	0	824	824
Miscellaneous	0	0	160	160
Total	2,264	4,568	13,332	17,900

[1] Employment based upon estimate of amount of labor required per unit of production.
[2] A man-year is 250 8-hour man-days.
[3] Active in 1947 according to the Census Bureau.

TABLE 28.—*Number of sawmills and lumber production by class of mill, Kentucky, 1947* [1]

Class of mill (production in M bd. ft.)	Mills		Production	
	Number	*Percent*	*Thousand bd. ft.*	*Percent*
Idle	306	12.4	0	0
1–49	731	29.5	16,451	3.8
50–199	1,033	41.7	112,418	25.6
200–499	200	8.1	64,950	14.8
500–999	145	5.9	99,308	22.6
1,000–2,999	44	1.8	68,423	15.6
3,000–4,999	8	.3	28,998	6.6
5,000–9,999 [2]	7	.3	48,174	11.0
Total	2,474	100.0	438,722	100.0

[1] Source: Bureau of the Census, U. S. Dept. of Com.
[2] Includes 1 mill in the 10,000–14,999 class, to avoid disclosure of individual plant production.

TABLE 29.—*Secondary wood-remanufacturing plants, Kentucky, 1947* [1]

Industry group [2]	Number of plants	Average number employees for year	Total salaries and wages	Value added by manufacture
			Thousand dollars	*Thousand dollars*
Millwork and related products	24	1,046	2,670	6,009
Wooden containers	19	2,291	4,909	7,914
Miscellaneous	21	1,156	2,391	4,843
Wood house furniture	35	4,948	12,794	16,510
Partitions and fixtures	10	219	525	859
Window and door screens	5	207	507	905
Total	114	9,867	23,796	37,040

[1] Source: Census of Manufactures–1947, Bureau of the Census, U. S. Dept., of Com.
[2] The industry groups listed include those plants that rely most heavily on wood in the manufacture of a product. This list does not include all secondary wood-remanufacturing plants.

TABLE 30.—*Local and imported lumber, veneer, and bolts used in manufacture, by product, Kentucky, 1948* [1]

Product	Lumber	Veneer [2]	Bolts [3]
	Thousand bd. ft.	*Thousand bd. ft.*	*Thousand bd. ft.*
Agricultural implements	219	4	
Car construction and repair	9,572	3	
Caskets and burial boxes	1,274		
Containers (except cooperage)	17,744	9,450	
Dairy, poultry, etc., supplies	500		
Fixtures	307	406	
Flasks	388		
Flooring	5,854		
Furniture	40,915	2,698	
Handles	139		654
Housetrailers	822	332	
Machinery	57		
Millwork	17,862	13,429	
Pallets	4,376		
Patterns	516	9	
Prefabricated houses and house panels	226	81	
Other prefabricated structures	254		
Printing material	12		
Radios, phonographs, sewing machines	4,801	1,129	
Rollers, shade and map	192		
Ship and boat building	4	1	
Shuttles, spools, and bobbins	12		350
Signs, scenery, displays	393		
Sporting, athletic, playground equipment	5,838		
Surgical supplies	13		
Toys	93	3	
Trunks and valises		14	
Vehicles, motor	105	9	
Vehicles, nonmotor	754	72	74
Venetian blinds	16		
Woodenware, novelties and miscellaneous	426	24	
Total	113,684	27,664	1,078

[1] Source: Gordon D. Merrick, Wood Used in Manufacture–1948, Forest Resource Report No. 2, Forest Service, U. S. Dept. Agr.
[2] Quantities reported were converted to square feet, one inch thick.
[3] Quantities reported were converted to board feet, lumber equivalent.

Standard Summary Tables

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

TABLE 31.—*Land area by major classes of land, Kentucky, 1949*

Class of land	Thousand acres
Forest:	
Commercial	11,446
Noncommercial:	
Reserved from commercial timber use	51
Unproductive for timber use	0
Total forest land	11,497
Nonforest	14,016
Total, all classes	25,513

TABLE 32.—*Commercial forest land area by ownership and stand-size classes, Kentucky, 1949*

[Thousand acres, i.e. 000 omitted]

Ownership class	Total	Sawtimber stands	Poletimber stands	Seedling and sapling stands	Nonstocked [1]
Federal:					
National forest	406	227	148	31	0
Indian	0	0	0	0	0
Other	217	101	80	31	5
Total	623	328	228	62	5
State	53	28	18	5	2
County and municipal	[2]				
Private	10,770	4,608	3,794	1,763	605
All ownerships	11,446	4,964	4,040	1,830	612

[1] Includes areas not classified elsewhere.
[2] Included in private ownership (590 acres).

TABLE 33.—*Area of commercial forest land by major forest types, Kentucky, 1949*

Forest type	Thousand acres
Pine	234
Redcedar-hardwoods	490
Oak-pine	726
Oak-hickory	5,186
White oak	311
Beech-maple	393
Mixed hardwoods	3,603
Bottom-land hardwoods	503
Total	11,446

TABLE 34.—*Net volume of live sawtimber and growing stock on commercial forest land by stand-size class, Kentucky, 1949*

Stand-size class	Sawtimber	Growing stock
	Million bd. ft.	*Million cu. ft.*
Sawtimber stands	21,308	4,672.6
Poletimber stands	2,932	1,744.1
Seedling and sapling stands	352	121.5
Nonstocked and other areas not classified elsewhere	63	31.6
Total	24,655	6,569.8

TABLE 35.—*Net volume of live sawtimber and growing stock on commercial forest land by ownership class, Kentucky, 1949*

Ownership class	Sawtimber	Growing stock
Federal:	*Million bd. ft.*	*Million cu. ft.*
National forest	1,109	288.9
Indian	0	0.0
Other	476	132.9
Total	1,585	421.8
State	141	36.2
County and municipal	[1]	[2]
Private:		
Farm	11,671	3,110.9
Industrial and other	11,258	3,000.9
Total	22,929	6,111.8
Total, all ownerships	24,655	6,569.8

[1] Less than 0.5 million board feet.
[2] Less than 0.05 million cubic feet.

TABLE 36.—*Net volume of live sawtimber and growing stock on commercial forest land by species, Kentucky, 1949*

Species	Sawtimber	Growing stock
	Million bd. ft.	*Million cu. ft.*
Softwoods:		
Shortleaf and loblolly pines	978	213.0
Other southern yellow pines	523	174.8
White and red pines	61	9.1
Hemlock	289	56.1
Cypress	38	8.6
Other eastern softwoods	65	53.0
Total softwoods	1,954	514.6
Hardwoods:		
White oaks	2,315	744.8
Red oaks	1,526	311.8
Other white oaks	2,867	725.3
Other red oaks	4,931	1,179.3
Sugar maple	526	161.0
Soft maples	326	126.9
Beech	1,959	353.9
Sweetgum	462	131.9
Tupelo and blackgum	584	146.2
Ash	418	157.9
Hickory	2,631	809.7
Cottonwood and aspen	124	22.2
Basswood	509	101.6
Yellow-poplar	1,830	406.8
Black walnut	266	91.0
Other eastern hardwoods	1,427	584.9
Total hardwoods	22,701	6,055.2
Total, all species	24,655	6,569.8

TABLE 37.—*Net volume of all timber on commercial forest land by class of material and species group, Kentucky, 1949*

Class of material	Total	Softwoods	Hardwoods
	Million cu. ft.	*Million cu. ft.*	*Million cu. ft.*
Growing stock:			
Sawtimber trees:			
Sawlog portion	3,858.0	323.2	3,534.8
Upper stem portion	26.4	26.4	(1)
Total sawtimber	3,884.4	349.6	3,534.8
Poletimber trees	2,685.4	165.0	2,520.4
Total growing stock	6,569.8	514.6	6,055.2
Other material:			
Sound cull trees	203.3	3.2	200.1
Rotten cull trees	1,482.7	2.9	1,479.8
Hardwood limbs	1,880.6	.....	1,880.6
Salvable dead trees	134.0	.....	134.0
Total other material	3,700.6	6.1	3,694.5
Total, all timber	10,270.4	520.7	9,749.7

[1] The volume of upper stem portion of hardwoods is estimated to be 99.0 million cubic feet. The figure is not included with growing stock in this or any of the other tables because the volume cannot be distributed by the classes called for in some of the tables.

TABLE 38.—*Net volume of live sawtimber on commercial forest land by diameter class groups and species, Kentucky, 1949*

[Million board feet, i.e. 000,000 omitted]

Species	Diameter class groups (inches)						
	10	12	14	16	18	20+	Total
Softwoods:							
Southern yellow pines	355	437	380	151	99	79	1,501
White and red pines	.....	.....	2	7	10	42	61
Other eastern softwoods	51	53	47	50	54	137	392
Total softwoods	406	490	429	208	163	258	1,954
Hardwoods:							
White oak	.....	615	556	275	329	540	2,315
Other white oaks	.....	423	450	345	356	1,293	2,867
Red okas	.....	181	232	297	219	597	1,526
Other red oaks	.....	901	994	996	780	1,260	4,931
Sugar maple	.....	83	80	57	61	245	526
Beech	.....	188	223	246	257	1,045	1,959
Sweetgum	.....	84	102	97	70	109	462
Tupelo and blackgum	.....	105	122	109	67	181	584
Yellow-poplar	.....	302	334	336	345	513	1,830
Other eastern hardwoods	.....	1,177	1,209	1,005	633	1,677	5,701
Total hardwoods	.....	4,059	4,302	3,763	3,117	7,460	22,701
Total, all species	406	4,549	4,731	3,971	3,280	7,718	24,655

TABLE 39.—*Net annual growth, annual mortality, and commodity drain on live sawtimber and growing stock on commercial forest land by species group, Kentucky, 1949* [1]

Item	Saw timber			Growing stock		
	Total	Softwoods	Hardwoods	Total	Softwoods	Hardwoods
	Million bd. ft.	*Million bd. ft.*	*Million bd. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*
Net annual growth	1,189	133	1,056	267.3	20.9	246.4
Annual mortality	83	7	76	25.9	2.0	23.9
Commodity drain:						
Timber products	692.2	52.2	640.0	154.7	10.2	144.5
Logging waste	41.6	.....	41.6	6.0	.....	6.0
Total	733.8	52.2	681.6	160.7	10.2	150.5

[1] Though commodity drain was determined for the year 1948 (table 40), the total drain figure can be considered representative of the total drain in 1949.

TABLE 40.—*Total output of timber products and commodity drain on live sawtimber and growing stock, Kentucky, 1948*

Product	Volume of products cut [1]			Commodity drain on sawtimber			Commodity drain on growing stock		
	Standard unit	Number	M cu. ft.	Total	Softwoods	Hardwoods	Total	Softwoods	Hardwoods
				Million bd. ft.	*Million bd. ft.*	*Million bd. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*
Sawlogs	M bd. ft.[2]	508,240	70,589	551	50	501	78	7	71
Veneer logs and bolts	do.	9,614	1,335	11	(3)	11	2	.....	2
Cooperage logs and bolts	do.	44,042	6,117	49	.....	49	7	.....	7
Pulpwood bolts	Cords [4]	47,225	3,366	1	.....	1	1	.....	1
Fuelwood	do.	1,506,232	95,907	105	.....	105	45	.....	45
Fence posts	M pieces	13,544	10,305	7	2	5	8	3	5
Hewn ties	do.	75	434	3	.....	3	1	.....	1
Mine timbers	M cu. ft.	16,497	16,497	.....	.....	.....	16	.....	16
Miscellaneous [5]	do.	3,572	3,572	7	.....	7	3	.....	3
Total	.....	.....	208,122	734	52	682	161	10	151

[1] Includes material from both growing stock and other miscellaneous sources.
[2] International ¼-inch log rule.
[3] Less than 500,000 board feet.
[4] Standard cords, rough wood basis.
[5] Includes chemical wood, excelsior, handle stock, shingle bolts, etc.

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