Abstract.—Recent surveys show a slight decline in hardwood inventory in the Midsouth. Volume is primarily in oak-hickory forest types, with less than one-third in oak-gum-cypress types. One-fifth of the hardwood volume occurs in association with pines.

Additional keywords: Land clearing, hardwood quality assessment, removals, ownership.

There has been a resurgence of interest in the hardwood resource situation. Concerns are voiced over the disappearance of quality stands of bottomland hardwoods, the scarcity of premium hardwood logs, and declining game habitat. Other concerns focus on the problem of too many hardwoods, so prevalent that they interfere with pine regeneration, and that there are too few markets for low-quality hardwoods. Analysis of Forest Survey data published in the 1977 National Assessment, in locally issued periodic Resource Bulletins, and interrogation of the Southern Forest Survey data base provide some insight into the current hardwood situation in the Midsouth—Alabama, Arkansas, Louisiana, Mississippi, Oklahoma, Tennessee, and Texas.

FOREST LAND

The area of Midsouth forests available and suitable for growing crops of industrial wood comprises roughly 100 million acres. Forest Survey findings subsequent to the 1977 assessment indicate a total commercial forest area of 98.4 million acres. Hardwood types, including oak-pine, comprise roughly 70 percent of the total forest area. While the total commercial forest area has been declining slowly and steadily, there have been dynamic changes in the hardwood resources. Thousands of acres of upland forests have been converted to pasture for raising beef cattle. Clearing for agricultural crops, mainly soybeans, has removed over 4 million acres of prime hardwoods in the bottomlands of the Midsouth (in Arkansas, Louisiana, Mississippi, and Tennessee). Although some areas are reverting to hardwood forests, clearing has more than offset the gain over the last 20 years. The rate of clearing has dropped substantially during the past 5 years (before 1984), partially because of less forest land being suitable for farming. Also, a growing part of the land clearing is for urban and other development. There are also changes in owner objectives. For example, wildlife interests in hardwood forests are becoming increasingly important. In addition to the many thousands of acres purchased for wildlife habitat by State and Federal agencies, numerous hardwood tracts have been acquired by individuals or groups for private hunting, fishing, and recreation. Fortunately, some degree of timber harvest is still part of most wildlife management programs.

Other land use changes adversely affecting hardwood timber production include areas where reservoirs have flooded choice lands capable of producing preferred hardwood species. Water impoundments may be a boon to sport fishing and other water-based recreation, but they totally eliminate fine hardwood forests.
TIMBER VOLUME

At last assessment, Midsouth forests contained 100+ billion cubic feet of growing stock volume. The volume is about even between hardwood and softwood, with hardwood volume being slightly larger. Hardwood volume has been increasing in each successive assessment between 1952 and 1977. Softwoods have been gaining faster and are about even in volume, according to the latest Forest Survey findings. This is due in part to a slight decline in hardwood volume since 1977.

The hardwood volume is primarily in widely scattered oak-hickory forest types. Bottomland sites with oak-gum-cypress types comprise less than one-third of the volume. About one-fifth of the hardwood volume is on sites occupied by mixed (pine-hardwood) forests. By contrast, about one-third of the softwood volume occurs in association with hardwoods.

When using forest type to make inferences about the timber resource, we often assume that pine type represents pines and hardwood type represents hardwood trees. Though this is generally true, departures from this assumption can be significant and surprising. By definition, oak-pine forests are those in which hardwoods comprise a plurality of the stocking but in which pines comprise 25 to 49 percent of the stocking. Though hardwoods comprise most of the stocking, pines account for three-fifths of the growing stock volume. The difference is in the generally poorer form of hardwoods as influenced, in part, by sites and occupancy in the type association. The oak-pine type includes 11 percent of the hardwood volume, and oak-hickory contains 47 percent of the hardwood volume. In oak-hickory types, pine volume is roughly 10 percent of the growing stock volume.

Within the Midsouth, hardwood volume exceeds softwood volume only in Tennessee and Arkansas. Though Tennessee forests are predominately hardwoods, Arkansas forests lean only slightly to hardwoods.

With the resurgence of softwood forests in the last 3 decades, hardwood removals have fallen behind those for softwood. According to the 1970 assessment, softwood removals exceeded hardwood removals by 18 percent. By 1976, softwood removals were more than twice those for hardwoods. Non-industrial private holdings supply about three-fourths of the hardwood removals and roughly half of the softwood removals.

QUALITY

Assessment of the hardwood resource must include tree or log quality because it is so important to timber values. But hardwood quality assessment is far more complex than for softwoods. The ultimate use of hardwood material is influenced by factors ranging from forest sites and type associations to tree size and physical attributes such as knots, holes, and even bird pecks. Species diversity within southern hardwoods is much greater than in southern softwoods and serves to further cloud the quality issue.

When conducting statewide forest assessments, the butt log of each sawtimber size tally tree (≥11.0 inches d.b.h.) is assigned a log grade by forest survey crews. Upper stem log grades are estimated by equations
developed during felled tree studies. In the Midsouth, the distribution of hardwood board foot volume by grade is fairly consistent. About 47 percent of the sawtimber is log grade 3, 27 percent is grade 4, 16 percent is grade 2, and 10 percent is grade 1. Within the Region, 27 percent of the grade 1 volume is in Tennessee, which has the highest share of its hardwood volume in grade 1 (12 percent). We cannot offer a rule-of-thumb for estimating relative values of grades 1, 2, and 3 logs because of differences among species, and Midsouth forests contain 60 to 70 species that are considered commercial. But for one group, red oaks, grade 1 logs currently are about 1.5 times more valuable than grade 2 logs, which in turn are nearly twice the value of grade 3 logs.

Tree size (log size) is an important determinant of hardwood log quality. Minimum scaling diameter (inside bark at small end) for grade 1 butt logs is 13 inches if all other criteria are met. Diameters at breast height must be 16 to 18 inches to qualify for grade 1. Volume by diameter class distribution indicates that only one-third of the trees qualify on the basis of size alone. For log grade 1, half of the volume is in trees 22 inches d.b.h. and larger.

Species and hardwood tree quality are loosely related. Good sites tend to produce better quality logs; poor sites produce poorer quality logs. Thus, favoring desirable species on good sites offers an opportunity to improve quality in the long run. Trees graded number 1 were tabulated by individual species in the latest surveys of Midsouth States along the Mississippi River (Louisiana, Mississippi, Arkansas, and Tennessee). In three of the States, the single species with the largest grade 1 volume was sweetgum. The exception was Tennessee, where white oak was number 1, but sweetgum was still in the top 10. Also prominent in the grade 1 top 10 were cherrybark oak, yellow-poplar, northern red oak, and other species generally regarded as quality hardwoods. There were a few surprises in the top 10. Hickory, like sweetgum, was in the top 10 for each of the States. Another surprise, water tupelo, was number 2 in Louisiana; willow was number 3! Cottonwood was prominent in all but Tennessee. Overcup oak comprised 10 percent of the grade 1 material in Arkansas.

Restricted markets are an indirect cause of the gradual reduction in hardwood tree quality and, on better sites, of the gradual stand conversion toward more shade-tolerant, less desirable species. There are markets for the largest and best trees, but if such are the only ones cut, stand deterioration in terms of species and quality is inevitable. Another effect of frequent harvests of only higher quality sawtimber trees is the gradual reduction in annual value production brought about by lowering the volume base. Low board-foot volumes per acre can be compared to a low balance savings account. Even at relatively high rates of interest, returns are modest. Stands should be allowed to develop a base volume of at least 4,000 board feet per acre, a level found on only about 20 percent of our current stands. An annual growth of 7 to 8 percent, which is attainable in well-stocked, managed stands, amounts to perhaps $30.00 per acre or more annually at today's price (1984). Compare this with the 2 to 3 percent return from stands that have a high proportion of cull trees and a base growing stock volume of less than 1,500 board feet per acre.
OUTLOOK

Acreage capable of producing quality hardwoods is expected to continue declining because of the economic advantages of growing alternative crops such as soybeans and raising beef cattle. One important impetus that could slow the decline of hardwood forests, and at the same time lead to treatments that would vastly improve run down stands, may come from finding uses for and giving added value to inferior growing stock. Industries that use hardwoods for reconstituted board products offer an important expanding market. Fuelwood is another, but still cloudy, market for low quality trees.

Research has already demonstrated silvicultural techniques that could improve production of both bottomland and upland forests. One measure is to release desirable stems by removing overtopping trees, either through cutting or deadening. Where necessary, good species can be established either by converting existing stands or by establishing new stands in open areas. Two options are available—planting or seeding.

Hardwood plantations are relatively new to the South, but the acreage planted still exceeds that in all other sections of the country. Cottonwood plantings cover more than 50,000 acres, mostly on extremely productive sites in the Mississippi River bottom. Generally, they have replaced stands of relatively low-value species, primarily boxelder, that were growing at about one-fifth the rate of the planted cottonwood. Research at Stoneville shows that, on a good site, annual production of a 10-year-old cottonwood planting would average about 300 cubic feet per acre. Up to 10,000 board feet per acre of sawtimber cottonwood is attainable in 20 years, depending on the spacing between trees.

Plantations of sycamore, sweetgum, and green ash cover perhaps 15,000 acres of productive bottomland sites. Early indications are that sycamore may average about two-thirds and green ash and sweetgum about one-half the annual volume production of cottonwood.

Oaks will continue to be among the most important tree species in the Midsouth. On poor sites, oaks will likely persist as a major component of post-harvest stands. But competition from trees of faster-growing species clouds the future for establishment and development of oaks on good sites. For those willing to invest, oaks can be successfully planted. A less expensive method to establish oaks in forest openings or in abandoned fields is direct seeding of acorns. At Stoneville, there are excellent 10-to 15-year-old test stands of oak that originated from field-sown acorns. Commercial seedings have recently been tried on open fields of two wildlife refuges in the Midsouth with promising results.

There is an obvious trend toward multiple resource management in hardwood forests. Timber management will likely be slightly altered in consideration of other resources, particularly wildlife. The most obvious change may be longer rotations for mast-bearing species. It is conceivable that very soon income from wildlife could match or exceed the landowner's income from timber harvest.
The landowner with quality hardwoods or with sites that have the potential to grow good hardwoods is in a position to capitalize on the future. Based on today's stands, good hardwoods are going to become scarce and, consequently, valuable for products, for habitat, and for the peace of mind that hardwood forests can bring.