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Virginia's Forests, 1992

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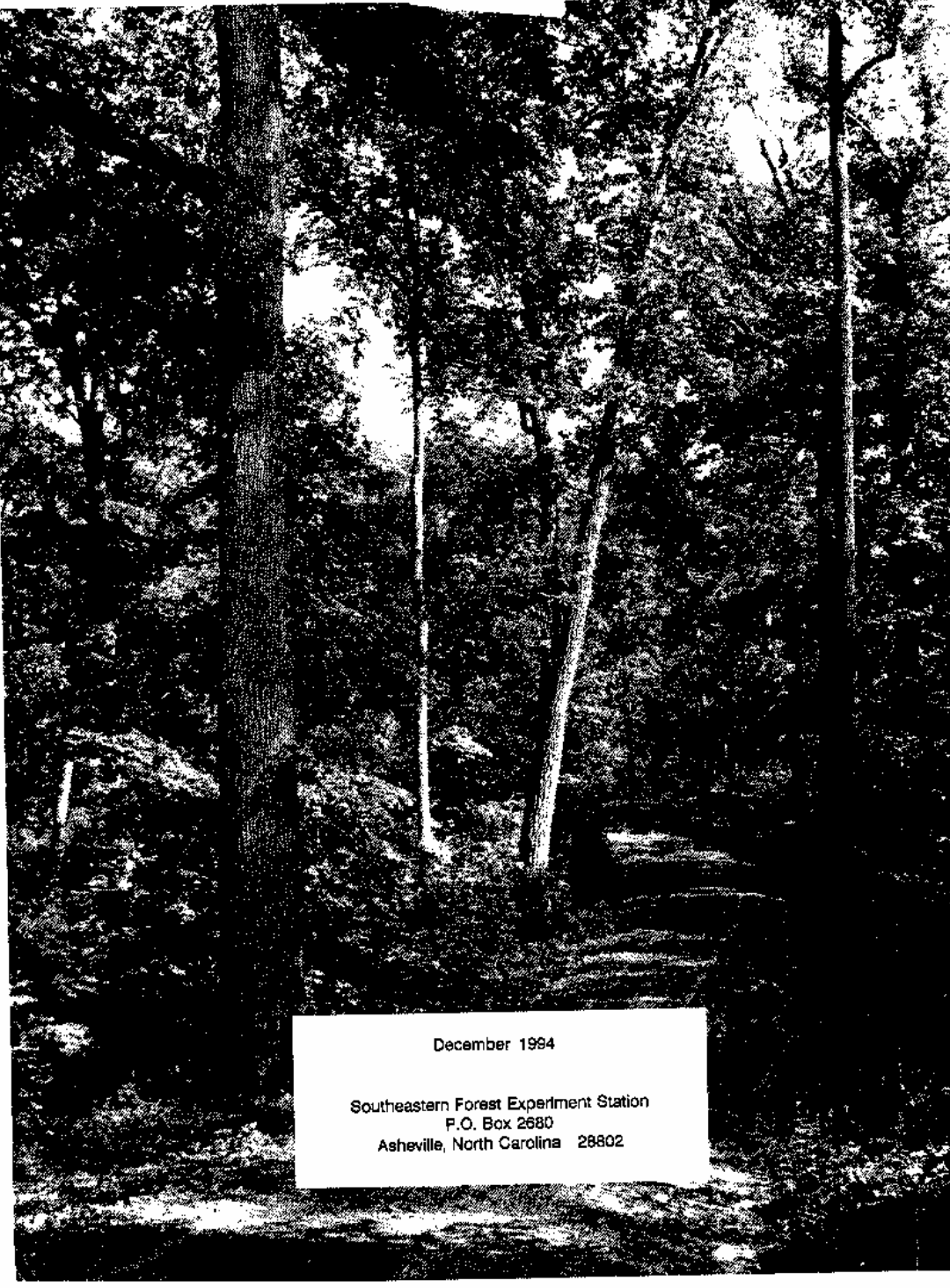

December 1994

Southeastern Forest Experiment Station
P.O. Box 2680
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Virginia's Forests, 1992

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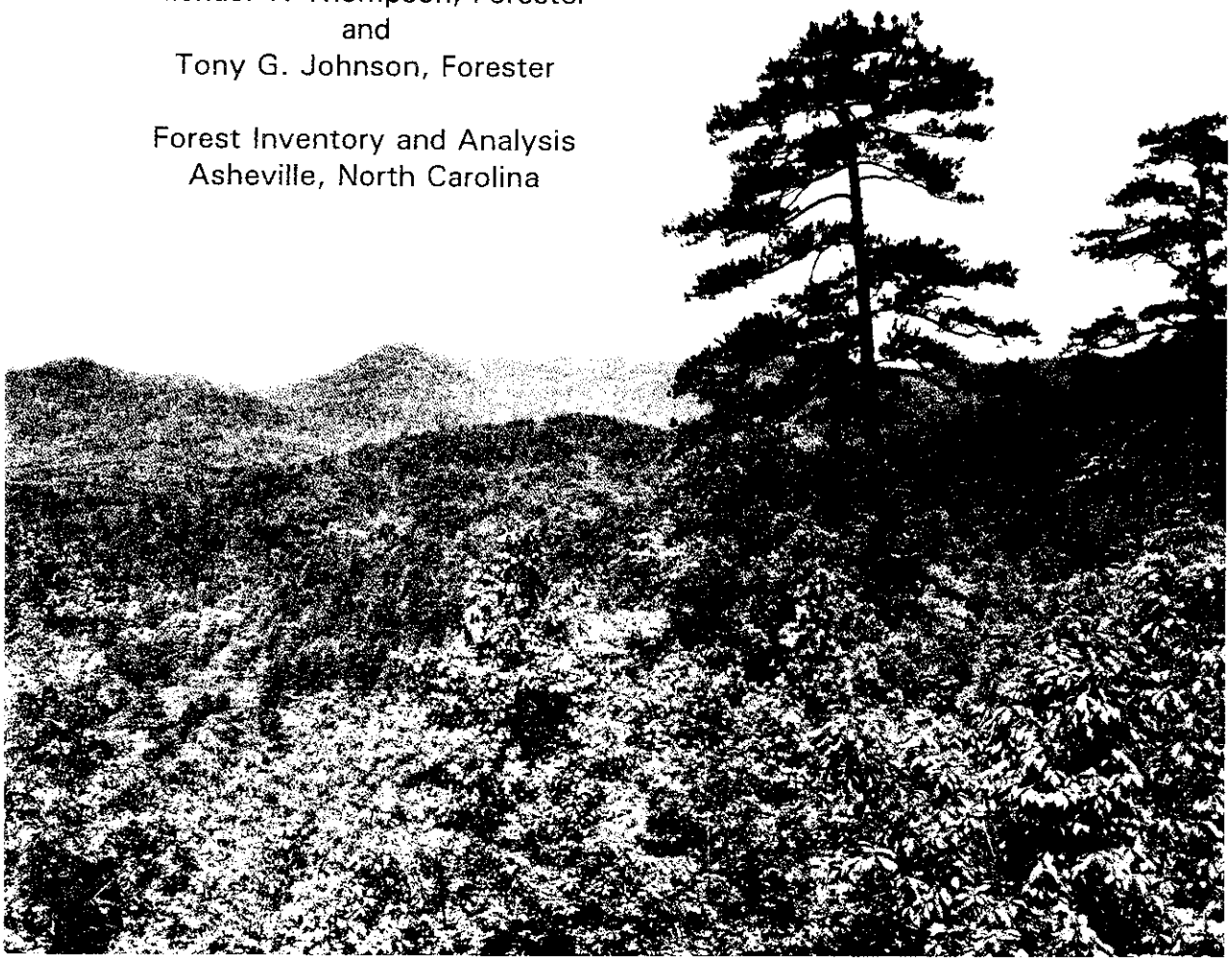

Cover photo—Virginia Division of Forestry

Foreword

This Resource Bulletin describes the principal findings of the sixth inventory of Virginia's forest resources. Data on the extent, condition, and classification of forest land and associated timber volumes, growth, removals, and mortality are described and interpreted. Data on nontimber commodities associated with forests were also collected; evaluations of these data are not included in this report.

The inventory of Virginia's forests, authorized by the Forest and Rangeland Renewable Resources Research Act of 1978, is part of a continuing nationwide undertaking by the USDA Forest Service. In the five Southeastern States (Florida, Georgia, North Carolina, South Carolina, and Virginia), these surveys are conducted by the Forest Inventory and Analysis (FIA) Work Unit of the Southeastern Forest Experiment Station, one of six FIA research units in the United States. The primary objective of these periodic appraisals is to develop and maintain the resource information needed to formulate sound forest policies and programs. More information is available about Forest Service resource inventories (U.S. Department of Agriculture, Forest Service 1992).

The field inventory of Virginia began in October 1990 and was completed in January 1992. Five previous surveys, completed in 1938, 1957, 1966, 1977, and 1986, provide statistics for measuring changes and trends over a 52-year span. This analysis focuses mainly on changes and trends in recent years and their implications for the future.

Previously reported figures have been adjusted in some cases to provide the best estimates of change. Normally, such adjustments are necessary to compensate for improvements in volume equations. However, trends in timberland area since 1986, as shown in this report, reflect a 0.9 percent upward adjustment in the acreage of timberland for 1986. The adjustments were confined to the Northern Piedmont and Mountain Survey Units. Revisions were necessary due to the incomplete and poor quality aerial photography available for the 1986 survey and to the associated difficulties in photo interpretation of land use.

The combined efforts of many people have gone into this evaluation of Virginia's forest resources. Appreciation is expressed to all Work Unit and Station personnel who participated in the field and office work. The Southeastern Station gratefully acknowledges the cooperation and assistance provided by the Virginia Division of Forestry. Appreciation is also expressed for the excellent cooperation of other public agencies, forest industries, and private landowners in providing information and allowing access to the sample locations.

Tabular data included in FIA reports are designed to provide a comprehensive array of forest resource statistics, but additional data can be obtained for those who require more specialized information. A Forest Information Retrieval service is available for custom compilation of forest resource data for any area within the Southeastern States. Data in a format common to the four FIA units in the Eastern United States (Eastwide Data Base) are also available (Hansen and others 1992). Custom compilations of tabular data and datasets require processing fees; costs may range from less than $100 for a relatively simple retrieval to several thousand dollars for a complex request that involves special programming. Although such requests are usually serviced promptly, attention to special requests is sometimes delayed by our regular duties.

Information concerning any aspect of this survey may be obtained from:

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Highlights

Since the fifth inventory of Virginia's forest resources was completed in 1986—

• *timberland area has been relatively stable, dropping by only 1 percent, or 122,000 acres.* Timberland area now totals 15.4 million acres. The reduction in timberland area is smaller than the 0.4 million acre decline recorded between 1977 and 1986. The diversion of 366,000 acres to nontimber land uses was offset by the addition of 244,000 acres of new timberland.

• *ownership of timberland by farmers continued to drop, with an 8 percent reduction to 3.9 million acres since 1986.* This reduction was considerably smaller than that recorded in previous decades. In contrast, timberland owned by other individuals increased 4 percent to 6.5 million acres and that owned by other corporate owners rose 20 percent to over 1.5 million acres. Timberland owned by forest industries declined 16 percent and now totals 1.6 million acres. The drop in land controlled by forest industry represents the first recorded decline in the State for this owner category. Public agencies manage 2.0 million acres of timberland.

• *timberland classified as a pine plantation increased by 25 percent to 1.5 million acres, a result of increased tree planting on cutover forest land and on agricultural land.* In contrast, area in natural pine fell 15 percent to 1.9 million acres. Timberland classified as oak-pine and hardwood forest types remained stable at nearly 12.1 million acres.

• *volume of softwood growing stock increased from 6.3 to 6.6 billion cubic feet, or by 6 percent.* Most of the increase occurred in planted pine stands where softwood volume rose 63 percent. Softwood growing-stock volume was up 8 percent to 4.8 billion cubic feet on nonindustrial private forest (NIPF) land. Softwood volume remained stationary on forest industry land and increased by 5 percent on public forests. Volume of softwood growing stock increased in all survey units with the exception of the Southern Mountains. Statewide, softwood volume increases occurred across all diameter classes, with the largest increases recorded in the 22-inch and larger size class. The inventory of softwood growing stock includes 19.9 billion board feet of sawtimber.

• *volume of hardwood growing stock increased from 18.7 to 19.8 billion cubic feet, or by 6 percent.* This rate of increase is well below those recorded in previous decades. Hardwood inventory increased on public and NIPF properties by 14 and 6 percent, respectively, while a drop of 13 percent was measured on forest industry land. Small reductions continued in the 6- and 8-inch diameter classes, while moderate increases were recorded in the 10-inch and larger classes. Hardwood growing-stock volume increased in each region, ranging from a low of 1 percent in the Coastal Plain to a high of 10 percent in the Northern Piedmont. The inventory of hardwood growing stock includes 60.4 billion board feet of hardwood sawtimber.

• *average net annual growth of softwood growing stock increased by 38 percent to 317 million cubic feet per year.* Softwood net growth now exceeds removals by 25 percent. Softwood growth increased in all ownership categories. The principal reason for the recent escalation in softwood growth is the increasing number of pine plantations reaching merchantable size.

• *average net annual growth of hardwoods declined 7 percent to 531 million cubic feet.* Hardwood growth still exceeds removals by 53 percent, but this margin of growth over removals has narrowed considerably. Declines in hardwood growth occurred in all regions and across all ownership categories. Declines in hardwood growth are primarily attributed to rising removal rates and increasing levels of hardwood mortality.

• *annual removals of softwood growing stock increased 23 percent from 206 to 253 million cubic feet.* On NIPF land, softwood removals rose 20 percent to 168 million cubic feet and on forest industry land increased 16 percent to 70 million cubic feet. Softwood growing-stock removals more than doubled on public land. Pine plantations supplied over 18 percent of total softwood removals. Hardwood growing-stock removals were up 27 percent from 274 to 346 million cubic feet annually. On NIPF land, hardwood removals increased 36 percent to 287 million cubic feet and accounted for 83 percent of the total hardwood removals. Hardwood removals were up 41 percent on public land but fell nearly 18 percent on forest industry land.

• *total annual output of timber products increased 13 percent, averaging 666 million cubic feet annually.* About 85 percent of the output was roundwood, with the remaining 15 percent from plant byproducts. Pulpwood and sawlog production each accounted for 37 percent of total production. Veneer logs made up 2 percent, other miscellaneous products 8 percent, and domestic fuelwood the remaining 16 percent of total output.

• *successful regeneration averaged about 201,000 acres annually, exceeding the area harvested by 8 percent.* Acreage of new pine establishment surpassed the 63,000 acres of pine stands harvested and retained in timberland by 9 percent. However, diversions of pine land to nonforest and resulted in a small net decline in the total amount of pine acreage. The increase in total pine regeneration is solely attributable to new pine stands originating from planting efforts. The annual rate of oak–pine regeneration exceeded the 25,000 acres of harvested oak–pine stands by 88 percent. Statewide, nearly 98,000 acres of hardwood stands were harvested, whereas some 86,000 acres of new hardwood stands were regenerated.

• *better management of the hardwood resource is viewed as the most significant opportunity to enhance future timber supplies.* Continuing increases in overmature and substantial acreage in poorly stocked hardwood stands will eventually detract from prospective supplies. The current age structure of Virginia's softwood resource suggests ample supply for the immediate future because intensive regeneration efforts have been undertaken over the past three decades. Pine sawtimber supplies for the future are somewhat questionable because a number of older, natural pine stands are being replaced by younger, planted pine stands. However, recent increases in commercial thinning of plantations coupled with changes in wood-processing technology may alleviate this situation.

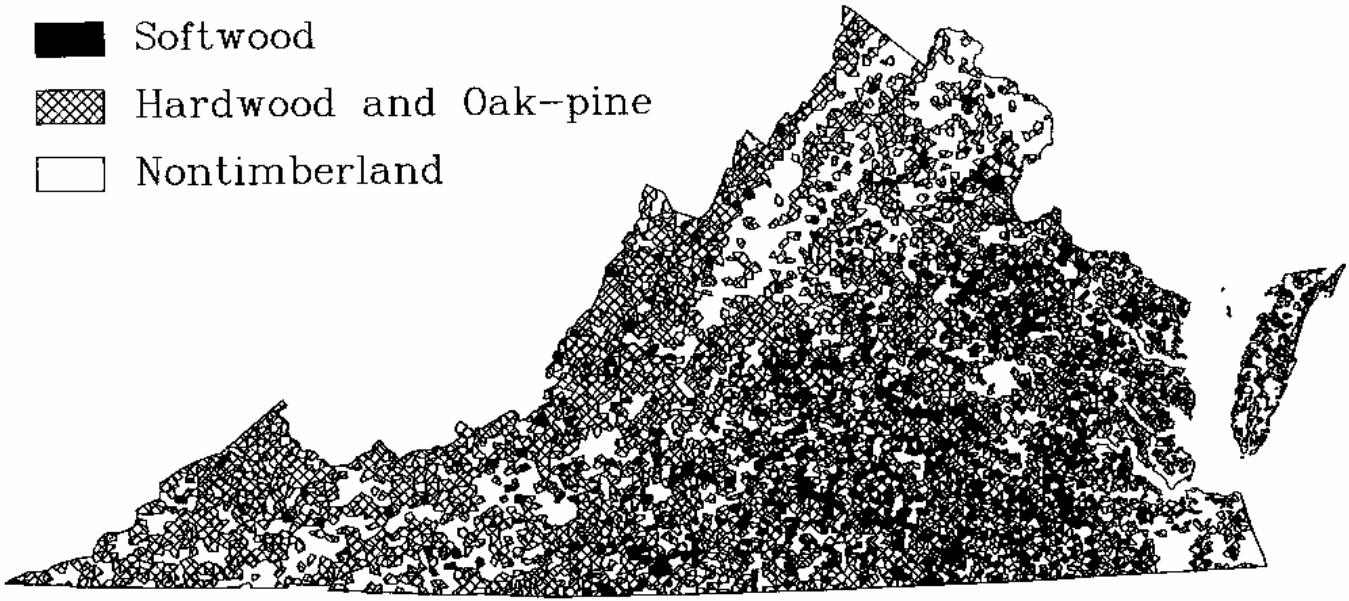


Figure 1— Forest Survey Units in Virginia with a generalized distribution of timberland, 1992.

Forest Trends

Background and Geography

Virginia's boundaries encompass 25.4 million acres of land and nearly 0.7 million acres of inland water (large lakes, rivers, and reservoirs). About 16.0 million acres, or 63 percent, of the land area is covered by forests. More than 15.4 million acres of this forested area is classified as timberland. Nearly all the remaining half million acres are categorized as reserved timberland, such as wilderness, parks, and historic sites, where commercial timber harvesting is prohibited by statutes or administrative regulations. Only 47,000 acres of Virginia's timberland area is classified as woodland. This woodland acreage generally consists of forest areas incapable of commercial timber production because of adverse site conditions. Examples of woodland are rock outcrops, poorly drained pocosins, and harsh coastal environments.

Virginia's forests occupy a diversity of physiographic conditions, ranging from deep swamps in the east to rolling hills in the central region to rugged mountains in the west. Because of these basic geographic differences, the State is divided into Survey Units to facilitate the inventory and reporting process. Five Survey Units are recognized: Coastal Plain, Southern Piedmont, Northern Piedmont, Northern Mountains, and Southern Mountains (fig. 1). (Any reference to the Piedmont region includes the Southern and Northern Piedmont Survey Units, and any reference to the mountain region includes the Southern and Northern Mountain Survey Units.) The Southern Piedmont is the most heavily forested region, with more than two-thirds of the total land area in timberland. The Northern Piedmont has the smallest proportion (55 percent) of land area in timberland, primarily because large areas are dominated by urban development in the northern half of the Survey Unit.

Land Use Trends

Since the 1986 inventory of Virginia, the area of timberland declined by less than 1 percent, or 122,000 acres, to 15.4 million acres (table 1). This reduction has moderated considerably compared to the 0.4 million-acre decline that occurred between 1977 and 1986 (Bechtold and others 1987). The net loss of timberland reported in 1986 was the first documented decline in the State. Increases in previous decades resulted when high rates of natural seeding and tree planting on abandoned agricultural land outpaced rates of timberland lost to urban development. Small declines occurred in all Survey Units, except the Southern Mountains, where the area of timberland remained stable. Almost 83 percent of the decline was recorded in the Coastal Plain and Northern Piedmont regions. The net reduction in 1992 was the result of land use changes on more than 610,000 acres. The diversion of 366,000 acres to nontimber land uses was offset by the addition of 244,000 acres of new timberland.

Losses to urban development and other uses totaled 222,000 acres, or 61 percent of all diversions. This category includes residential and industrial development, roads and highways, utility rights-of-ways, and many other uses where the land generally never reverts back to timberland. The Coastal Plain and the heavily populated Northern Piedmont accounted for the majority of timberland clearing for urban land uses. Residential development accounted for over one-half of the diversions to urban use. Whether the rate of urban development at the expense of timberland area will decrease or increase depends on many complex factors, such as population growth, housing starts, and economic conditions on local and national levels.

Table 1—Changes in area of timberland, by Survey Unit, Virginia, 1986-1992

Survey Unit	Area of timberland in—		Net change	Changes							
				Total gain	Additions from—		Total loss	Diversions to—			
					Nonforest	Other forest land		Other forest land	Agriculture	Urban and other	Water
	1986	1992			*Thousand acres*						
Coastal Plain	3,773.9	3,702.3	-71.6	51.5	49.7	1.8	123.1	3.2	16.2	100.5	3.2
Southern Piedmont	3,783.6	3,778.3	-5.3	69.4	69.4	--	74.7	12.5	38.9	23.3	--
Northern Piedmont	2,465.0	2,426.6	-38.4	34.2	34.1	0.1	72.6	5.7	6.1	60.8	--
Northern Mountains	2,554.7	2,536.8	-17.9	27.5	12.8	14.7	45.4	43.3	0.7	1.4	--
Southern Mountains	2,992.5	3,003.6	+11.1	61.8	59.3	2.3	50.5	1.0	13.5	36.0	--
State	15,569.7	15,447.6	-122.1	244.2	225.3	18.9	366.3	65.7	75.4	222.0	3.2

Over 75,000 acres of timberland were converted to agricultural uses. The annual average of agricultural clearing apparently peaked during the period between 1977 and 1986 at over 32,000 acres. Since 1986, timberland clearing for agricultural purposes averaged over 12,000 acres per year. Agriculture accounted for one-fifth of all timberland clearing. Cropland expansion at the expense of timberland acreage was most prevalent in the Southern Piedmont—this region was responsible for over 50 percent of timberland lost to agricultural uses. Forest classification changes were responsible for nearly all remaining diversions. Most reclassification occurred in the Northern Mountains, where reassignment of timberland to a reserved status on the George Washington and Jefferson National Forests was the primary reason for this region's reduction in timberland area.

The addition of new timberland resulting from natural reversion and tree planting on former nonforest land accounted for 92 percent of the total area added to the timberland base and presently totals 225,000 acres. In 1986, the area of new timberland originating from planted and natural reversions totaled 649,000 acres, and has been steadily declining from one survey period to the next. The continuing decline of this new timberland source may indicate an increase in the amount of agricultural land being converted to an urban land use.

Timberland Area by Ownership

The area of timberland in NIPF ownership increased 2 percent to 11.9 million acres since 1986 (fig. 2). Virtually all the net gain of timberland in the State was confined to this owner group. The farmers, private corporations, and other private individuals who make up this ownership category collectively control 77 percent of the timberland area in Virginia. The relatively small net increase of NIPF acreage masks substantial changes occurring within the NIPF category. Farmer-owned timberland declined by 341,000 acres, or 8 percent, to 3.9 million acres. Even though this decline is considerably less severe than the 32-percent decline observed in 1986, it continues a trend observed throughout the Southeast for over three decades. Since 1959, the area of timberland held by farmers has dwindled from the State's highest recorded total of 10.1 million acres to the current level of 3.9 million acres. A large share of this loss is associated with farm incorporation and changes in occupation that result in reclassification to other ownerships. The clearing of forest land for agricultural purposes also reduced farmer-owned timberland. Over 55 percent of all timberland held by farmers is located in the Coastal Plain and Southern Piedmont, where it dropped 6 and 7 percent, respectively. Elsewhere in the State, farmer-owned timberland dropped by

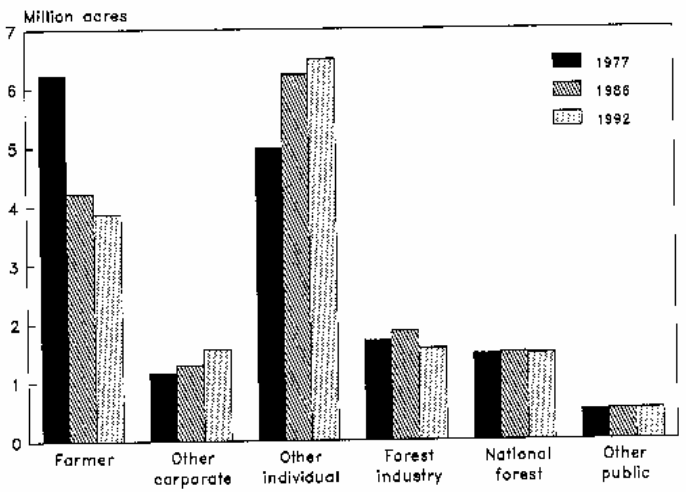


Figure 2—Area of timberland by ownership class, 1977, 1986, and 1992.

12, 8, and 10 percent in the Northern Piedmont, Southern Mountain, and Northern Mountain Survey Units, respectively.

Timberland held by other individuals increased 4 percent from 6.2 to almost 6.6 million acres. The other individual group remains the largest single owner category in Virginia with 42 percent of the timberland area. This diverse owner group consists of individual owners, such as retired persons, professional people, and a variety of blue- and white-collar workers. The highly urbanized Northern Piedmont region contains the highest proportion of other individual owners. Other corporate owners registered the largest increase of any single owner group, rising 20 percent to over 1.5 million acres of timberland. Corporate owners now control 10 percent of timberland in Virginia.

Companies that manufacture forest products (forest industry) currently own or lease some 1.6 million acres, or slightly more than 10 percent of the timberland in Virginia. Industry holdings have declined by 298,000 acres, or 16 percent since 1986. The drop in land controlled by forest industry represents the first recorded decline by this owner group in Virginia after steadily increasing since 1959. Timber company disposal of extensive tracts of timberland to private corporations and other individual landowners appears to be the primary reason for this reduction. Nearly 83 percent of the land controlled by forest industry is concentrated in the Coastal Plain and Southern Piedmont, the regions most intensively managed for timber production in the State.

Since 1986, timberland held by public agencies has remained relatively stable, and now accounts for 13 percent of the timberland area in Virginia. This proportion varies from a low of 4 percent in the Coastal Plain to 41 percent in the Northern Mountains where the George Washington and Jefferson National Forests are located. Other large Federal holdings include the Quantico, A.P. Hill, and Camp Pickett military reservations. Collectively the State, counties, and municipalities control one-fifth of the publicly owned timberland. The State forests of Pocahontas, Prince Edward Gallion, Cumberland, and Buckingham-Appomattox account for most of the State-owned timberland.

Timberland Area by Broad Management Class

Since 1986, the area of timberland classified as planted pine increased by 26 percent, from 1.2 to 1.5 million acres (fig. 3). Over 95 percent, or 285,000 acres, of this increase occurred in the Coastal Plain and Southern Piedmont regions. Gains in pine plantation acreage were evident in all ownerships. On NIPF land, plantation acreage jumped 49 percent from 0.5 to 0.8 million acres. A large share of this increase is the consequence of land exchanges from forest industry to the NIPF category. However, enhanced regeneration efforts following harvest and continued planting of abandoned agricultural land contributed to the increase in artificially regenerated acreage on NIPF land. Currently, planted pine acreage now accounts for 44 percent of all pine stands in the State.

The establishment of planted pine stands over extensive areas of Virginia has been one of the most significant developments to impact the State's forest resource. Pine reforestation efforts have greatly intensified over the last 15 years in Virginia—the current level of planted acreage is more than twice the total recorded in 1977 (Knight and McClure 1977). The recent increase follows a 77-percent jump in planted acreage that occurred in the 1977-86 period. The rapid upturn in pine plantation establishment reflects the efforts of the Virginia Division of Forestry, forest industry, and the success of a variety of incentive programs to enhance the quality and productivity of Virginia's forests.

In contrast to the large buildup in planted pine acreage, area in natural pine stands fell 15 percent to 1.9 million acres since 1986. This decrease, coupled with the increase in pine plantations, stabilized total pine-type acreage, in contrast to the steady declines registered since the first survey of Virginia in 1940. Pine stands now occupy 3.4 million acres, or 22 percent, of Virginia's timberland. Over two-thirds of all pine stands are controlled by NIPF owners; 25 percent are on forest industry land; and the remaining 7 percent are managed by public agencies.

Loblolly pine, at 2.0 million acres, is the dominant pine type in the State, accounting for 60 percent of the total pine-type acreage. The 27-percent jump in loblolly pine plantations is responsible for nearly all the increase in planted pine acreage, clearly indicating the preference for this species for artificial regeneration. As loblolly pine continues to assume dominance in the Piedmont and Coastal Plain, Virginia and shortleaf pine, the other major pine types in these regions, declined. In 1940, Virginia pine covered some 2.0 million acres, an area roughly equivalent to that presently occupied by loblolly pine.

Currently, acreage in Virginia pine totals only 803,000 acres, down 23 percent from 1986. Shortleaf pine has also experienced a similar fall over the same time span. The present total of 118,000 acres of shortleaf pine type is down 19 percent from the previous survey, and covers only 8 percent of its former range in 1940. In

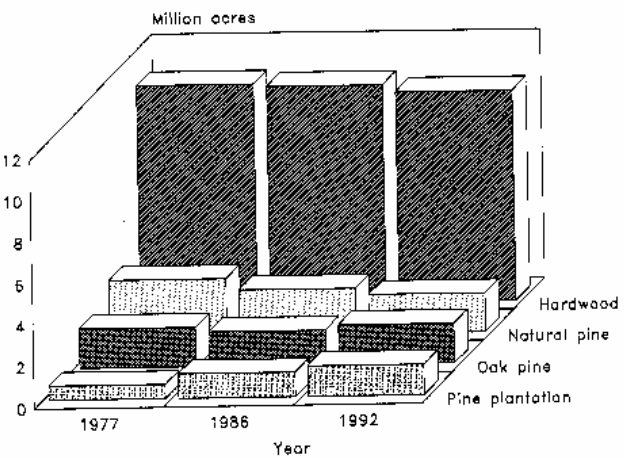


Figure 3—Area of timberland in pine plantation, oak-pine, natural pine, and hardwood stand types, 1977, 1986, and 1992.

contrast, the white pine–hemlock type—the dominant pine type in the Mountain region—increased by 15 percent to 217,000 acres.

Oak–pine stands have increased by 241,000 acres to 1.9 million acres, reversing the decline that occurred between 1977 and 1986 (fig. 3). These mixed stands, where pine constitute 25 to 50 percent of all live tree stocking, make up 13 percent of all timberland in the State. Almost 286,000 acres of the total oak–pine acreage show some evidence of planting or seeding. If the hardwood component is controlled, many of these acres should reenter the pine type classification, and subsequently contribute to the overall increase in planted pine area.

Hardwood forest types remain the predominant cover type in the State. The upland and bottomland hardwood types combined constitute almost two-thirds of the timberland area in Virginia. This proportion of forest cover in hardwoods surpasses that of any other state in the Southeast. Upland hardwood forest types have dropped 4 percent to 9.5 million acres and are by far, the most dominant forest type (fig. 3). Red and white oaks and yellow-poplar are the principal species that comprise the diverse upland hardwood type.

Many complex factors affect the net gains and losses by forest cover types and management classes. Transitory shifts in and out of the oak–pine forest type in the absence of man-caused and natural disturbance was a significant factor for acreage exchange among the types. Transfers to and from the oak–pine type are more common than for the pine and hardwood types because the range of pine stocking to hardwood is narrow. Clearing of timberland to nonforest land uses was another reason for the net reduction of natural pine and hardwood stands. Harvesting and the subsequent establishment of new pine plantations resulted in loss of natural pine area and some reduction in hardwood stands. However, the encroachment of hardwoods on harvested natural pine stands contributed to additional acreage in young oak–pine stands and some of the hardwood types. In Virginia and much of the Southeast, hardwoods typically assume dominance rapidly on harvested pine stands unless measures are taken to control the hardwood component.

Nearly 91,000 acres of new pine stands were added as the result of tree planting and natural reversion on former agriculture land. Pine and oak–pine stands accounted for 90 percent of planted reversions, while hardwood forest types accounted for the highest proportion of naturally regenerated acreage.

Softwood Inventory

Volume of softwood growing stock on timberland in Virginia increased by 6 percent from 6.3 to 6.6 billion cubic feet during the 1986-92 period. The recent expansion of softwood inventory follows a 5-percent increase measured during the 1977-86 period (Bechtold and others 1987). Softwoods currently account for 25 percent of the aggregate growing-stock inventory in Virginia. With the exception of a 4-percent decline in the Southern Mountains, softwood volume increased in each of the other four Survey Units (fig. 4). The Coastal Plain and Southern Piedmont combined contain two-thirds of the softwood volume and accounted for 75 percent of the increase. Volume of softwoods was up 8 percent in the Northern Piedmont and 8 percent in the Northern Mountains.

The buildup of the softwood growing-stock inventory has occurred because accelerated rates of planted pine growth have outpaced the level of softwood removals. Softwood volume in pine plantations increased by 567 million cubic feet, or by 63 percent, more than offsetting a reduction of 300 million cubic feet in natural pine stands. Oak–pine stands showed a 13-percent increase in softwood growing stock, while hardwood stands showed no change. These changes in volume of volume of softwood growing stock have changed the distribution of softwood inventory by broad management class since 1986, when 14 percent of the softwood growing-stock inventory was contained in pine plantations. Currently, planted pine stands account for about 22 percent of the softwood inventory. This figure will probably continue to rise as the number of pine stems on extensive areas of recently established pine plantations approach merchantable size.

By ownership, 89 percent of the increase in softwood growing-stock volume occurred on NIPF land, where softwood volume was up 5 percent to 4.8 billion cubic feet. The acquisition of forest industry timberland by the

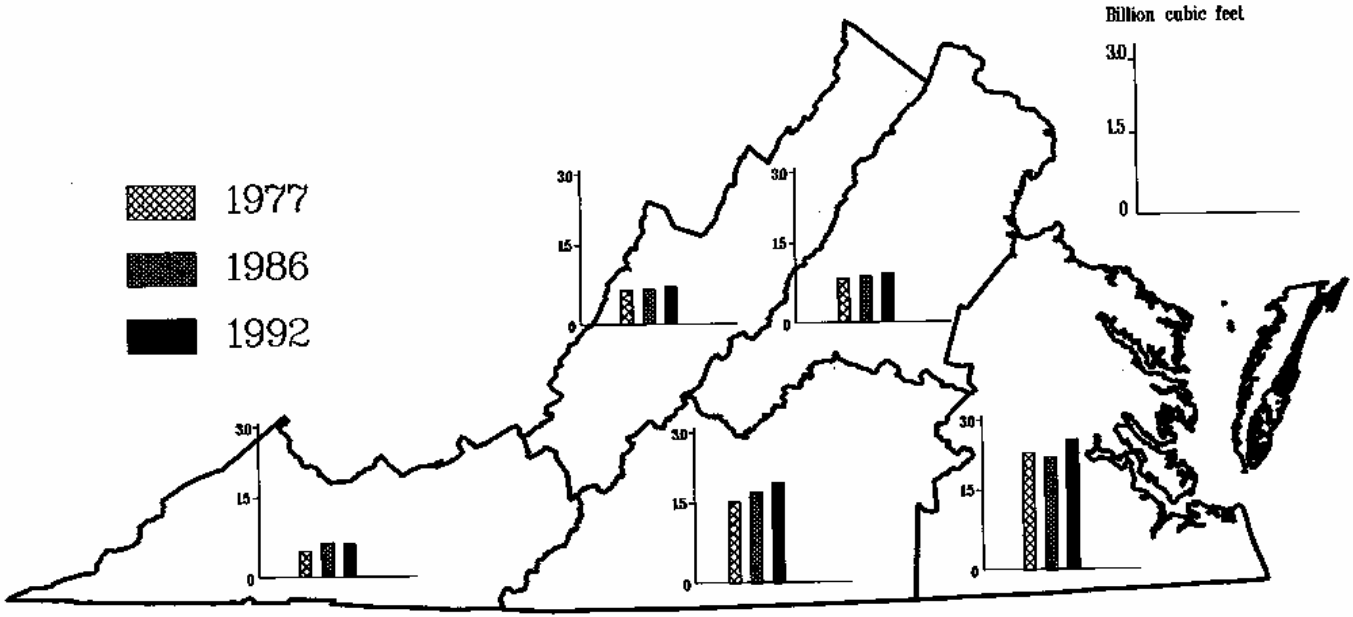


Figure 4—Volume of softwood growing stock by Survey Unit, 1977, 1986, and 1992.

corporate owner group was primarily responsible for the increase of softwood inventory in this ownership category. Meanwhile, softwood volume remained stable on and controlled by forest industry. A drop of 75 million cubic feet on industry land in the Coastal Plain was offset by an increase of 77 million cubic feet in the Piedmont. The remaining increase in softwood growing stock occurred on public land, where a 5-percent jump in softwood volume pushed the inventory to 721 million cubic feet.

The 8- and 10-inch diameter classes continue to contain the most softwood volume in Virginia, accounting for 41 percent of the softwood inventory (fig. 5). Increases were measured in all diameter classes, ranging from under 1 percent in the 14-inch class to 30 percent in the 22-inch and larger class. The most pronounced change in softwood volume occurred in the 12-inch class, where the current increase of 10 percent reversed a 4-percent decline in 1986. The rate of volume increase in the 16- and 18-inch class has moderated compared to the magnitude recorded in the previous inventory. A 36-percent increase in annual softwood removals in these size classes reflected the continuing liquidation of older natural pine stands and influenced the slowdown. Nevertheless, softwood growing-stock volume continues to increase in the largest size classes—the volume of softwoods in trees 20 inches and larger increased by 29 percent. Reasons for the continuing expansion of volume in these size classes are uncertain. Perhaps aging stands of large-diameter pines remain on small ownership tracts that, because of their size, are uneconomical to harvest. Or possibly, a substantial quantity of softwood volume in large trees in older, predominantly hardwood stands occur on sites with conditions too adverse for harvesting purposes. As the softwood resource continues to build-up in these larger trees, the need to monitor this trend will intensify.

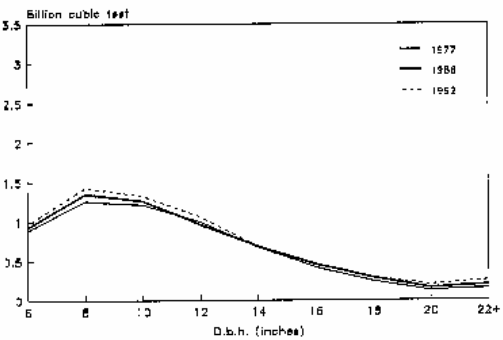


Figure 5—Volume of softwood growing stock by tree d.b.h. class, 1977, 1986, and 1992.

Loblolly pine remains by far the most dominant species in the State in terms of softwood growing-stock volume. It is almost exclusively the species used in pine plantations and also accounts for the greatest proportion of softwood volume in natural pine stands. Volume of loblolly pine has increased by 18 percent since 1986 (fig. 6) and currently totals 3.0 billion cubic feet. Nearly 71 percent of the loblolly volume is concentrated in the Coastal Plain, but most of the volume increase was attributable to a 46-percent jump in the Southern Piedmont. Loblolly pine grows well on a variety of sites and is the most favored southern yellow pine species for planting. It is rapidly assuming dominance on many sites formally occupied by natural stands of Virginia and shortleaf pine.

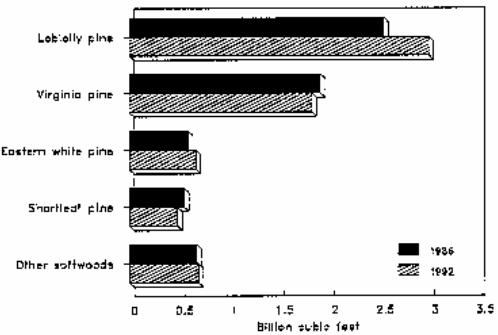


Figure 6—Volume of softwood growing stock by species between 1986 and 1992.

Second to loblolly pine in abundance, Virginia pine fell 5 percent to 1.8 billion cubic feet. Eastern white pine, the predominant softwood species in the Mountain region, rose 13 percent to 663 million cubic feet. Volume of shortleaf pine dropped 12 percent to 479 million cubic feet. Shortleaf pine has been declining steadily throughout the Southeast because efforts to regenerate stands of this species have been limited. Volume of most other yellow pine and other softwood species increased during the latest remeasurement period.

The inventory of softwood growing stock included 19.9 billion board feet of sawtimber—an 8-percent increase since 1986. Nearly 42 percent of softwood sawtimber is located in the Coastal Plain, 23 percent is in the Southern Piedmont, and 35 percent is equally distributed among the other three survey units. Volume of softwood sawtimber was up by 3 percent in the Coastal Plain, while 16-percent increases were recorded in both the Southern Piedmont and Northern Mountains. By ownership, almost 74 percent of softwood sawtimber is on NIPF land, 13 percent is on forest industry land, and 8 percent is on public land.

Hardwood Inventory

The inventory of hardwood growing stock continued to rise during the 1986-92 period, but this rate of increase appears to be slowing when compared to previous decades. Hardwood volume rose from 18.7 billion cubic feet in 1986 to 19.8 billion cubic feet in 1992, an increase of 6 percent. In comparison, hardwood volume rose 25 percent between 1966 and 1977 and 11 percent between 1977 and 1986. Increased rates of hardwood removals and reduced hardwood growth rates during the latest remeasurement period contributed to the smaller overall increase in hardwood inventory.

Hardwood currently constitutes 75 percent of the total inventory of growing stock in Virginia. By ownership, NIPF owners controlled 79 percent of hardwood inventories, public owners managed 16 percent, and forest industries controlled the remaining 5 percent. Volume of hardwood growing stock rose by 14 percent on public land and 8 percent on NIPF land. In contrast, hardwood volume fell by 13 percent on land controlled by forest industry. Hardwood growing stock increased in all survey units, ranging from a low of under 1 percent in the Coastal Plain to a high of 10 percent in the Northern Piedmont (fig. 7). Increases of 16 and 18 percent recorded in the Southern Piedmont and Southern Mountains in 1986 have slowed to increases of 8 and 5 percent, respectively. Although the hardwood inventory is fairly evenly distributed among all survey units, the proportion of hardwood inventory varies from 60 percent in the Coastal Plain region to nearly 89 percent in the Southern Mountain region.

Concurrent with the recent slowdown in the buildup of hardwood inventory, changes in volume by tree size have moderated when compared to figures recorded since the 1977-86 period (Bechtold and others 1987). Small reductions continued in the 6- and 8-inch diameter classes while increases occurred in the 10-inch and larger size classes (fig. 8). The rate of inventory buildup in the upper diameter categories was correlated with tree size. Increases began at less than 1 percent in the 10-inch class and gradually rose to 22 percent for the 20-inch and larger classes.

The slowdown in volume accumulation by hardwood tree size was driven by the recent upturn in the rate of hardwood removals. Increases in the annual removals of hardwood growing stock occurred in all diameter

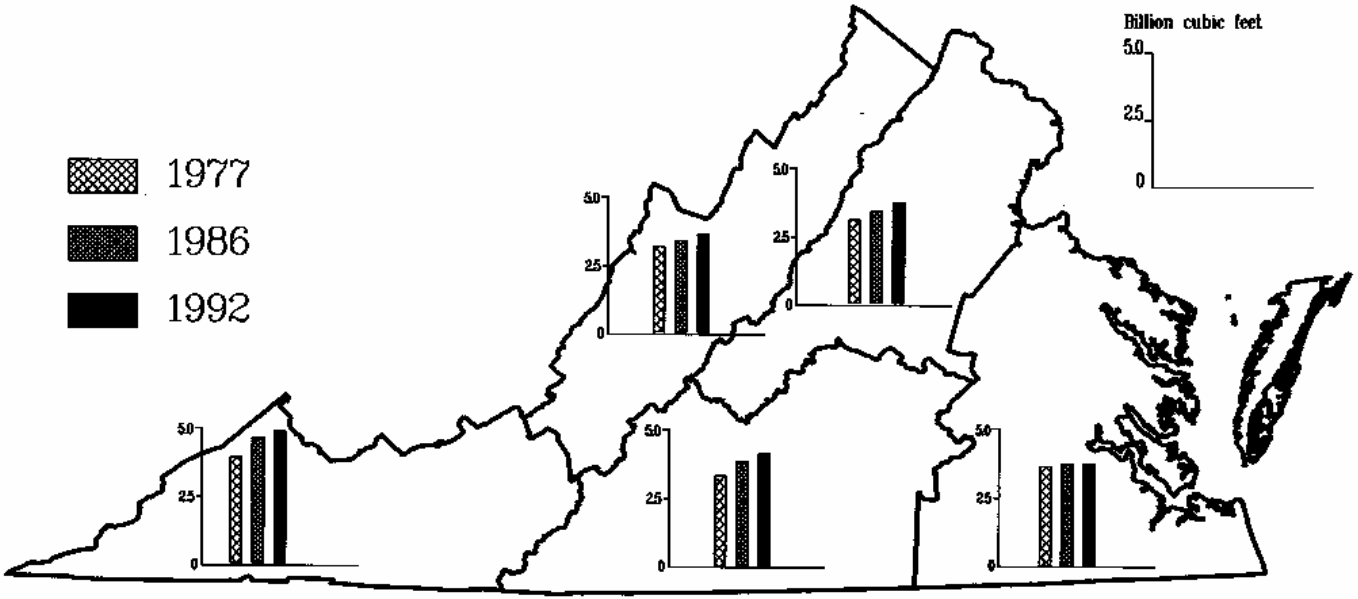


Figure 7—Volume of hardwood growing stock by Survey Unit, 1977, 1986, and 1992.

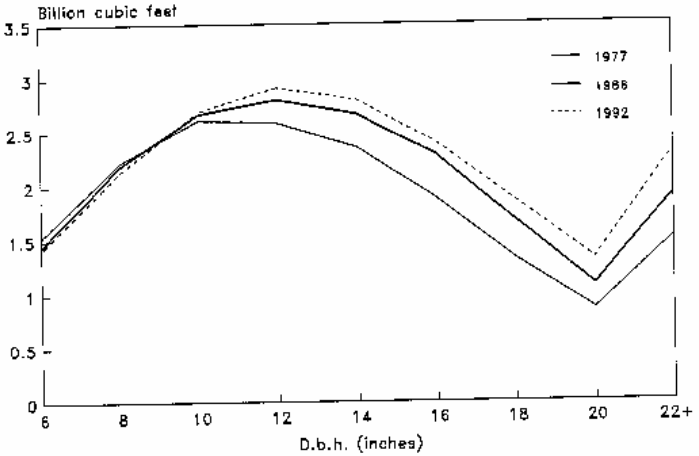


Figure 8—Volume of hardwood growing stock by tree d.b.h. class, 1977, 1986, and 1992.

classes, ranging from 10 percent in the 12-inch class to 56 percent in the 21-29-inch class. The sustained build-up in the larger-sized hardwoods appears to indicate an aging resource that is skewing the volume distribution toward bigger trees. Contributing heavily towards this trend are various limitations affecting the availability of hardwood volume. Factors such as year-round water in stands, limited access, low volume per acre, steep slopes, undesirable species mix, and difficult operability restrict extensive harvesting of hardwoods. In addition to these physical factors, landowner intentions, wetlands legislation, and social attitudes affect the utilization of this resource.

Most of the major hardwood species and species groups have increased in volume since 1986 (fig. 9). Collectively, the various oak species account for 49 percent of the total hardwood volume. The composite volume of the select white and red oaks rose by 191 million cubic feet to 4.4 billion cubic feet, an increase of 5 percent.

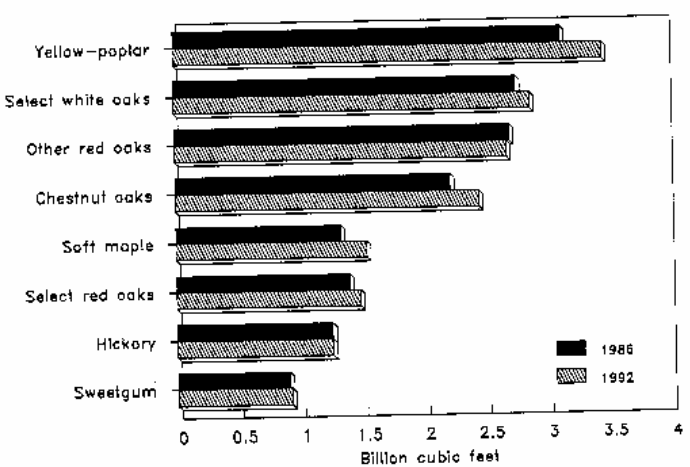


Figure 9—Volume of hardwood growing stock by species between 1986 and 1992.

Yellow-poplar volume increased by 11 percent to 3.5 billion cubic feet and remains the most abundant individual species in Virginia. Yellow-poplar is widely dispersed throughout the State and recorded increases in all survey units. The second most abundant hardwood species in Virginia is chestnut oak, which increased by 10 percent to 2.5 billion cubic feet. The soft maple species group increased by 15 percent to 1.5 billion cubic feet. Of the hardwood species declining in volume, the other white and red oak species group dropped by 1 percent to 2.8 billion cubic feet and accounted for 68 percent of the decline in hardwood volume. Sycamore, magnolias, and cottonwood also declined in volume.

The inventory of hardwood growing stock includes 60.4 billion board feet (International 1/4-inch log rule) of sawtimber, an increase of 11 percent since 1986. Hardwood sawtimber volume was up for each region in the State. The largest increase, 17 percent, occurred in the Northern Piedmont and the smallest increase, 4 percent, occurred in the Coastal Plain. By ownership, 79 percent of the hardwood sawtimber inventory is on NIPF land, 16 percent is on public land, and the remaining 5 percent is on forest industry land.

The hardwood lumber and veneer industry are especially concerned about the quality of the hardwood sawtimber resource. In Virginia, each sawtimber tree was assigned a tree grade according to the procedures described in the appendix. Because tree grade classification of the total board-foot volume of the tree is usually based on the grade of the butt log, which in most cases is better than that of the upper logs, the tree grade classification tends to exaggerate the volume in the better grades. In the 1986 inventory, the distribution of volume by log grade was obtained from a subsample from all inventory plots.

About 13 percent of Virginia's hardwood sawtimber volume is in grade 1 trees, 31 percent is in grade 2 trees, 48 percent is in grade 3 trees, and the remaining 8 percent is in grade 4 (tie and timber grade only). Yellow-poplar has the largest proportion of any individual species in higher-quality volume; nearly 60 percent of its volume is in grade 1 or 2 trees. Tree size apparently affects volume distribution by tree grade. Three-fourths of the hardwood sawtimber in trees 15.0 inches d.b.h. and larger are classed as grade 1 or 2.

Forest Biomass

Estimates of growing-stock and sawtimber volume have been the customary measures of timber inventory. However, as timber utilization continues to improve and the demand for wood chip-related products escalates, the total quantity of wood and bark is gaining recognition as an important source of fiber. Cumulatively, the aboveground volume of all live trees totals 39.4 billion cubic feet—49 percent more volume than growing stock (app. table 23). This biomass, which equates to 1.5 billion tons, includes conventional growing-stock volume, sapling volume, and volume contained in stumps, tops, and limbs.

A number of economically related factors affect the feasibility of utilizing the total inventory. Continuing advances in timber harvesting equipment and practices, such as whole-tree chipping, have greatly facilitated the removal of the total biomass in stands. Over the past remeasurement period in Virginia, harvested stands had a residual standing inventory averaging 18 tons per acre. This average ranged from over 4 tons per acre for harvested pine plantations to 23 tons per acre for harvested upland hardwood stands. These values do not include another potential source of fiber—that volume of trees killed due to logging but not removed for products such as logging residues and logging slash.

Net Annual Growth

Since the previous period (1977-85), net annual growth for all species of growing-stock trees has increased from 802 (Bechtold and others 1987) to 848 million cubic feet, or by 6 percent. Softwood net annual growth was up 38 percent to 317 million cubic feet, while hardwood net annual growth dropped 7 percent to 531 million cubic feet.

Coincident with the upward trend in softwood growth, annual removals of softwood growing stock increased 22 percent to 253 million cubic feet during the latest period (fig. 10). Despite the recent escalation in the removal rate for softwoods, the present growth to removals ratio of over 1.25 to 1 marks the highest recorded softwood growth surplus in Virginia. This present ratio is also higher than that indicated by the most recent inventories of the remaining four southeastern States. In contrast, the gap between hardwood growth to removals has narrowed considerably when compared to previous surveys. While hardwood growth has declined, removals have increased by 27 percent to 346 million cubic feet. The ratio of hardwood growth to removals has gone from 2.09 to 1 in the 1977-85 survey period, to 1.53 to 1 in the 1986-91 survey period.

The rapid development of pine plantations in Virginia has been the primary reason for the recent escalation in annual growth rates for softwoods. Net annual growth of softwoods concentrated in planted stands more than

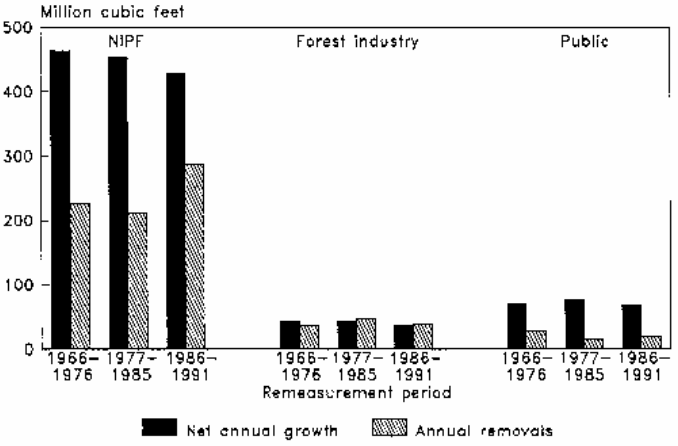


Figure 10—Average net annual growth and annual timber removals of softwood growing stock by ownership class, 1966-1976, 1977-1985, and 1986-1991.

doubled during the latest period, rising from 71 to 145 million cubic feet. The Southern Piedmont and the 12-county area south of the James River in the Coastal Plain, two regions that contain extensive forest industry holdings dominated by pine plantations, accounted for 64 percent of the increase in softwood growth. Many of these stands were established in the late 1970's and early 1980's and have now progressed into those age classes characterized by higher levels of ingrowth and accelerated volume accumulation of survivor trees.

The boost in softwood net growth occurred in all survey units except the Southern Mountains, where growth dropped 9 percent (fig. 11). Softwood growth increases ranged from 15 percent in the Northern Mountains to 59 percent in the Southern Piedmont. Since 1966, softwood growth-to-removal relationships have been positive with the exception of the Coastal Plain where removals slightly exceeded growth during the 1966-76 and 1977-85 periods. Maturing pine plantations on forest industry land contributed to the current growth-to-removal ratio of 1.18 to 1 in this region. The recent surge in plantation growth also improved the ratios in the Northern and Southern Piedmont to 1.39 to 1 and 1.27 to 1, respectively. The only region to experience an overcut of the softwood resource was the Southern Mountains where a substantial jump in softwood removals dropped the ratio of 6.74 to 1 in the previous period to a current ratio of 0.84 to 1.

In addition to intensive plantation management, other factors affect the overall increase in softwood growth. Past declines were attributed to reductions in the area of timberland, high mortality rates, slowdowns in survivor-tree growth, and periods of inadequate regeneration. The current area of timberland has remained stable since 1986, and annual mortality of softwoods dropped significantly since the 1977-85 period. During this same period, significant declines in rates of individual-tree diameter growth were measured in Virginia and other regions of the Southeast (Sheffield and others 1985). The average annual radial increments of softwoods in natural stands have increased in all diameter classes since the 1977-86 period and appear to be approaching the rates recorded in the late 1960's and early 1970's. If young, vigorous pine plantations continue to replace older, slow-growing natural pine stands, future increases in softwood growth are likely when the young stands reach merchantable size and can contribute to growth estimates.

Shifts in timberland acreage from forest industry to NIPF ownership inflated softwood growth rates on NIPF land and lowered growth rates on forest industry land. Much of the former forest industry acreage was in highly productive pine plantations that are now contributing to a favorable growth situation on NIPF land. Softwood growth was up 43 percent to 212 million cubic feet on NIPF land, and exceeded the annual rate of removals by nearly 27 percent. On land controlled by forest industry, softwood growth increased 32 percent to 85 million

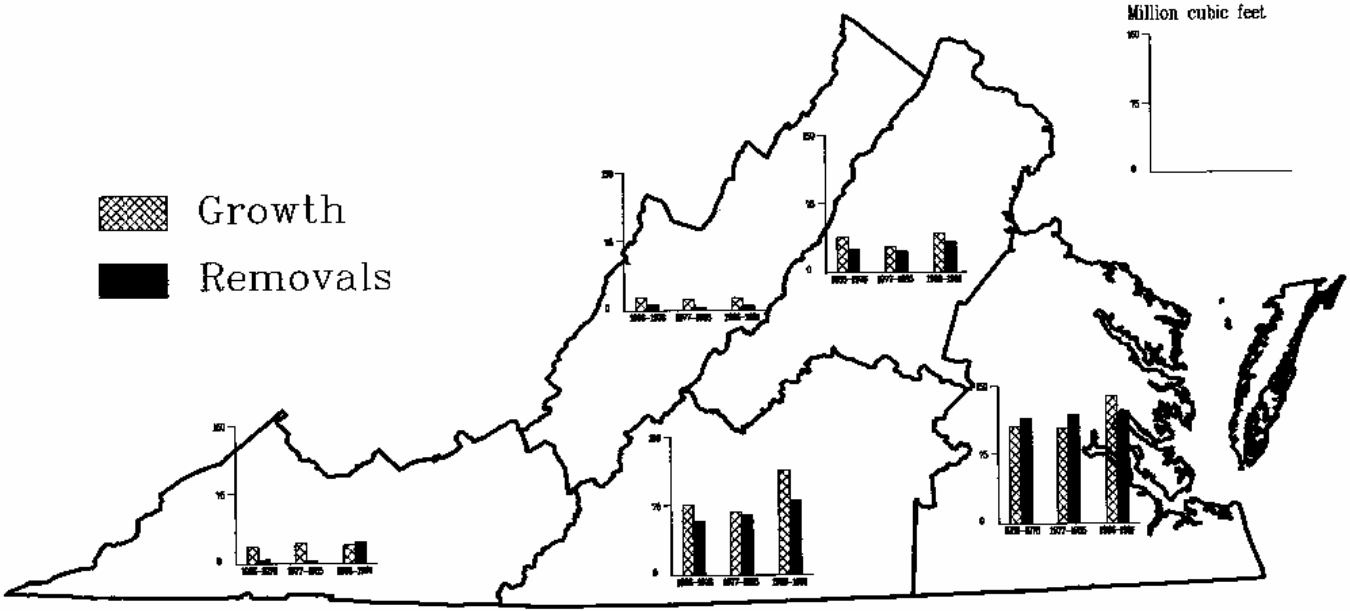


Figure 11—Average net annual growth and annual timber removals of softwood growing stock by Survey Unit, 1966-1976, 1977-1985, and 1986-1991.

cubic feet—surpassing softwood removals by 23 percent. Public land recorded a 21-percent increase in softwood growth to 20 million cubic feet.

The evaluation of softwood growth on a per-acre basis minimizes the effects of shifts in land use, ownership, and broad management classes. Averaged across all ownerships and forest types, softwood growth has increased from 16 to over 20 cubic feet per acre during the latest period. Softwood growth was up from 8 to 10 cubic feet per acre on public land and increased from 13 to 18 cubic feet per acre on NIPF land. The most significant increase occurred on land controlled by forest industry, where softwood growth jumped from 35 to 55 cubic feet per acre. The high growth rate reflects the large proportion of pine plantations in the most productive age classes on industry land. Softwood growth in planted pine stands currently averages 98 cubic feet per acre compared to 61 cubic feet in the 1977-85 period. Softwood growth in natural pine stands increased by a relatively small amount to the present average of 13 cubic feet per acre.

The annual changes in inventory are driven by the relationship between the various components of gross growth. The changes in these various components are presented statewide in table II. Survivor growth is defined as the volume increment on trees measuring 5.0 inches d.b.h. and larger at the beginning of the remeasurement period and surviving until the end of the period. Since the 1977-85 period, survivor growth has increased 28 percent to the current annual average of 306 million cubic feet and comprises 82 percent of gross growth. Ingrowth, the net volume of growing-stock trees reaching 5.0 inches d.b.h. during the year, has remained relatively stable during the last three remeasurement

Table II—Annual components of change in the volume of growing stock on timberland, by Survey Unit and species group, Virginia, 1986-1991

Survey Unit and species group	Gross growth	Components of growth: Survivor growth	Ingrowth	Growth on ingrowth	Growth on removals	Growth on mortality	Mortality	Net growth	Removals	Net change
	Million cubic feet									
Coastal Plain										
Softwood	154.9	127.6	20.8	2.9	3.0	0.6	18.5	136.4	115.3	+21.1
Hardwood	146.7	128.0	14.9	1.2	2.2	0.4	18.8	127.9	125.2	+2.7
Total	301.6	255.6	35.7	4.1	5.2	1.0	37.3	264.3	240.5	+23.8
Southern Piedmont										
Softwood	119.8	96.0	19.1	2.1	2.2	0.4	13.9	105.9	76.2	+29.7
Hardwood	160.1	144.9	12.0	1.0	1.7	0.5	19.5	140.6	89.7	+50.9
Total	279.9	240.9	31.1	3.1	3.9	0.9	33.4	246.5	165.9	+80.6
Northern Piedmont										
Softwood	50.9	39.7	9.3	1.1	0.6	0.2	9.5	41.4	32.6	−8.8
Hardwood	114.4	106.3	6.6	0.5	0.6	0.4	21.3	93.1	40.2	−52.9
Total	165.3	146.0	15.9	1.6	1.2	0.6	30.8	134.5	72.8	+61.7
Northern Mountains										
Softwood	20.1	18.3	1.5	0.1	0.1	0.1	6.4	13.7	5.2	+8.5
Hardwood	95.9	88.0	6.8	0.4	0.3	0.4	24.9	71.0	30.0	+41.0
Total	116.0	106.3	8.3	0.5	0.4	0.5	31.3	84.7	35.2	+49.5
Southern Mountains										
Softwood	26.6	23.9	1.9	0.1	0.6	0.1	6.8	19.8	23.5	-3.7
Hardwood	135.0	123.1	9.8	0.6	0.9	0.6	36.3	98.7	61.0	+37.7
Total	161.6	147.0	11.7	0.7	1.5	0.7	43.1	118.5	84.5	+34.0
State										
Softwood	372.3	305.5	52.6	6.3	6.5	1.4	55.1	317.2	252.6	+64.4
Hardwood	652.1	590.3	50.1	3.7	5.7	2.3	120.8	531.3	346.1	+185.2
Total	1,024.4	895.8	102.7	10.0	12.2	3.7	175.9	848.5	598.9	+249.6

periods at nearly 53 million cubic feet and accounts for 14 percent of gross growth. Growth on ingrowth, growth on removals before removal, and growth on mortality before death accounted for the remaining 4 percent of gross growth. Growth on ingrowth and growth on removals have increased significantly since the previous period, while growth on mortality dropped by 18 percent to 1.4 million cubic feet.

A high proportion of merchantable-sized softwoods established through planting efforts is primarily responsible for the increase in survivor growth during this remeasurement period. Since 1977, the total number of all live softwoods 5.0 inches d.b.h. and larger has increased by less than 10 percent. However, the number of live softwoods 5.0 inches and larger in pine plantations is almost four times that recorded in 1977. The current distribution of softwoods results in a larger number of stems receiving the benefits of plantation management such as genetic improvement, fertilization, and control of hardwood competition. These stems subsequently contribute more to growth estimates.

The recent drop in average net annual growth of hardwoods occurred on land in all three major owner groups (fig. 12). The most severe decline occurred on forest industry timberland, where hardwood growth decreased 17 percent. A significant excess of hardwood growth existed on NIPF and public land, but annual removals of hardwoods exceeded growth by a margin of 9 percent on forest industry land. Declines in hardwood growth occurred in all survey units, narrowing the gap between growth and removals across the State (fig. 13). The margin of growth over removals was highest in the Northern Mountains and Northern Piedmont, where respective ratios of 2.37 to 1 and 2.32 to 1 were recorded. In the Coastal Plain, a balance between hardwood growth and removals was recorded because removals exceeded growth by 18 percent in the 12-county region south of the James River.

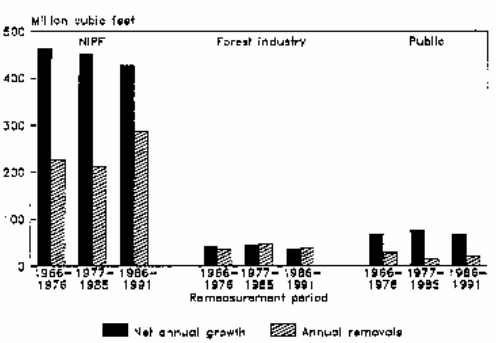


Figure 12—Average net annual growth and annual timber removals of hardwood growing stock by ownership class, 1966-1976, 1977-1985, and 1986-1991.

Hardwood growth per acre currently averages over 34 cubic feet per year. By ownership, hardwood growth was down from 38 to 34 cubic feet per acre on public land and down from 37 to 36 cubic feet on NIPF land. Growth per acre for hardwoods remained stable on forest industry land.

Several factors working in combination brought about the recent reduction in net annual growth of hardwood growing stock. First, ingrowth and survivor growth have declined since the 1977-85 period. Reductions in the number of 2- and 4-inch hardwood stems since the 1977-85 period are now contributing to a smaller number of trees feeding into the 6-inch class, consequently lowering the level of ingrowth. Meanwhile, higher removal rates have dampened past increases in the upper diameter categories, reducing the effective number of stems that can contribute to survivor growth. Second, mortality rates for hardwoods have increased during the remeasurement period. Mortality currently reduced gross growth by 19 percent compared to 14 percent in 1986. Third, the age distribution of hardwood stands in Virginia portrays a resource that is maturing, and perpetuating a higher ratio of hardwood stems that are older, slow-growing trees. The recent slowdown in hardwood growth will probably continue until the young, vigorous hardwood stands created by the increase in harvest activity reach merchantable size and impact the hardwood volume increment.

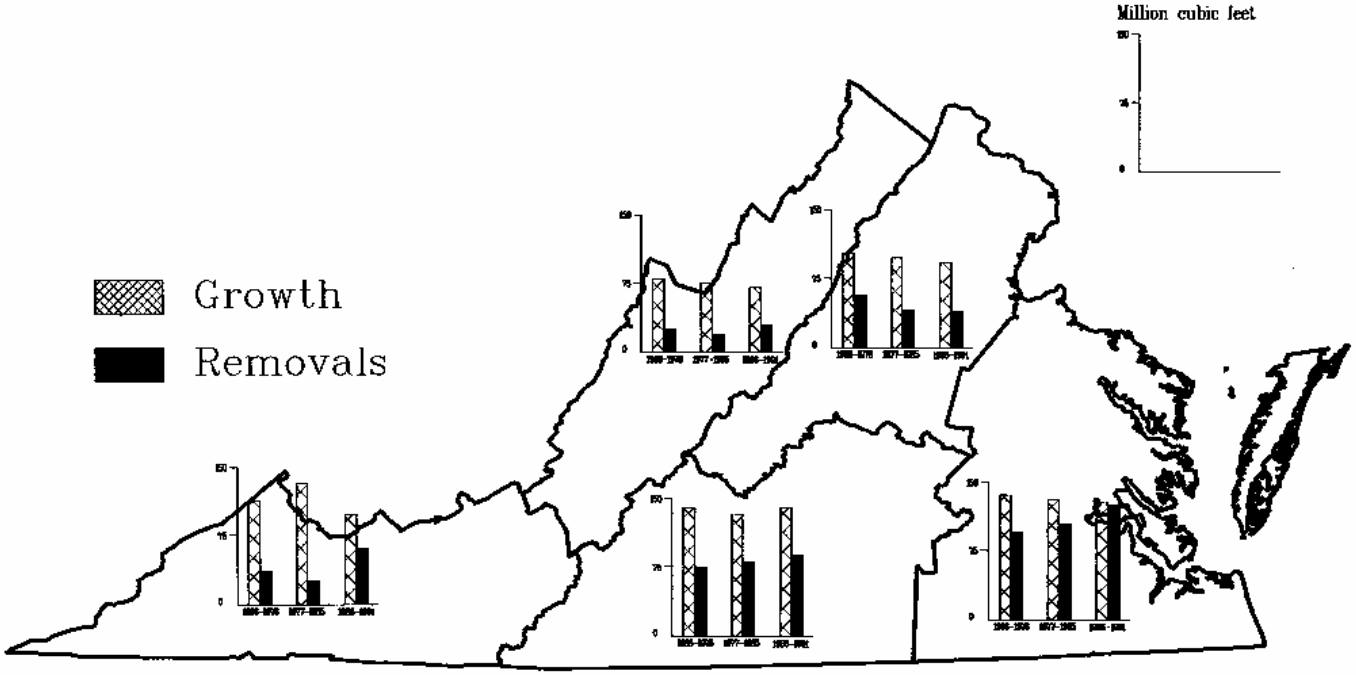


Figure 13—Average net annual growth and annual timber removals of hardwood growing stock by Survey Unit, 1966-1976, 1977-1985, and 1986-1991.

Hardwood Mortality

Mortality of hardwood growing stock climbed 33 percent to an average of 121 million cubic feet per year since the 1977-85 period. Weather and disease were the leading identifiable causes of hardwood mortality, contributing 27 and 36 million cubic feet, respectively. Lands under NIPF control suffered the highest increase in the hardwood mortality rate, up 42 percent to 92 million cubic feet. Hardwood mortality volume increased 31 percent to over 23 million cubic feet on public land and declined 37 percent to 5.3 million cubic feet on forest industry land.

The recent jump in hardwood mortality follows a 59-percent increase that occurred since the 1977-85 period. The accelerated rate of hardwood mortality recorded over the past two survey periods is largely the consequence of an aging hardwood resource. In 1977, the proportion of timberland area in hardwood types above 50 years in age was 41 percent; the current proportion is 54 percent. Increased mortality associated with insects is another contributing factor to the increased mortality of hardwoods. The recent inventories of certain areas in the Northern Piedmont and Northern Mountains indicated extensive gypsy moth infestation, which caused severe defoliation and subsequent mortality of hardwoods, particularly oaks. Statewide, the hardwood mortality directly attributed to insects increased 3.5 times over that recorded in 1986 to the current average of 7.0 million cubic feet.

In contrast to hardwoods, mortality of softwood growing stock dropped 24 percent to 55 million cubic feet. The decline represents a reversal of previous decades—softwood mortality rates had been increasing but apparently peaked in 1986. Past increases were primarily due to periodic outbreaks of pine bark beetles over fairly extensive areas in Virginia. Lower levels of annual insect kills and the higher proportion of vigorous pine plantations contributed to the decline in softwood mortality.

Timber Removals and Products Output

Economic Status

As a renewable resource, Virginia's forests yield a continuous supply of timber products for both the South- and mid-Atlantic forest products industries. Industries that depend on the timber resource play a major role in Virginia's economy. The manufacture of forest products in the State is a billion-dollar industry, made up of 369 primary processors and nearly 1,100 other businesses engaged in every phase of wood products manufacturing. These companies employed nearly 64,000 workers—1 of every 7 persons in manufacturing in the State. The processing of wood products generated an annual payroll in excess of $1.2 billion (U.S. Department of Commerce, Bureau of the Census 1991, 1991). The manufacture and processing of wood products contributed nearly $3 billion of value added to the State's economy, about 10 percent of the total value added by manufacture for all products statewide. Virginia's forests also provide a multitude of other important benefits such as outdoor recreation, wildlife habitat, and aesthetic values. In addition, the forests protect the soil and provide a source of clean air and water. However, this chapter considers only timber-related values and describes output and utilization of timber products harvested from Virginia's timberland.

Sources of Timber Removals and Products Output Data

A combination of sources are used to derive the average annual volumes of timber removals and product output between 1986 and 1991, listed in appendix tables 37-41. In essence, this chapter is a reconciliation of timber product output values obtained from a canvass of all primary manufacturers and total removals data from FIA ground samples. Estimates of total annual volume of trees removed from timberland for timber products, volume of wood residue associated with these removals, and volume associated with diversions of timberland to nonforest uses were derived from the remeasurement of permanent FIA ground samples.

Indices of actual utilization compared with FIA merchantability standards were obtained from measurements collected at 104 active logging operations throughout the State. These indices were applied to removals data from permanent plot remeasurements to estimate the volume of logging residues associated with the unused merchantable portions of growing-stock trees harvested for products. Also included in the logging residues estimate are the merchantable portions of growing-stock trees destroyed during the timber harvesting operations and not used.

Estimates of annual wood receipts, product output, and plant residue production and disposal were obtained from canvasses of all primary wood-using mills in the State. Canvasses of pulpmills within the State have been conducted annually since 1960. The first mill canvass of other primary wood-using plants was conducted in 1965. Subsequent canvasses were made in 1967, 1976, 1978, 1980, 1984, 1987, and 1989. The results of the industrial canvasses for the available years are displayed in table III, which shows the annual fluctuations in industrial output. Values in appendix tables 37-41 are composite averages of the last two surveys reconciled with total removals.

Estimates of total fuelwood (firewood) use are derived from plot remeasurement samples, industry canvasses, and consumption data reported by Skog and Waterson (1986). The proportion of this total cut from timberland is based on FIA plot remeasurement data.

Table III—Output of industrial timber products from roundwood in Virginia, by product, species group, and year of survey

Product and species group	Year of survey					
	1976	1978	1980	1984	1987	1989
	Thousand cubic feet					
Saw logs						
Softwood	80,157	91,443	91,929	92,533	106,536	92,035
Hardwood	109,129	108,349	109,238	131,921	125,643	130,559
Total	189,286	199,792	201,167	224,454	232,179	222,594
Veneer logs and bolts						
Softwood	8,273	9,390	6,369	15,056	11,709	11,196
Hardwood	2,693	4,273	3,022	4,182	5,122	4,448
Total	10,966	13,663	9,391	19,238	16,831	15,644
Pulpwood[1]						
Softwood	73,875	67,936	84,996	102,555	74,810	94,278
Hardwood	75,064	70,884	79,746	109,171	75,762	83,555
Total	148,939	138,820	164,742	211,726	150,572	177,833
Other industrial						
Softwood	3,918	3,877	2,030	5,470	7,329	7,993
Hardwood	2,949	3,719	2,754	2,368	5,605	11,613
Total	6,867	7,596	4,784	7,838	12,934	19,606
All products						
Softwood	166,223	172,646	185,324	215,614	200,384	205,502
Hardwood	189,835	187,225	194,760	247,642	212,132	230,175
Total	356,058	359,871	380,084	463,256	412,516	435,677

[1] Includes roundwood chipped.

Annual Removals

Annual growing-stock removals of all species increased 25 percent, averaging 599 million cubic feet between 1986 and 1991. Softwoods accounted for 42 percent of all growing-stock removals in the State. Annual softwood removals increased 23 percent from 206 to 253 million cubic feet. About 66 percent of the softwood removals came from NIPF land, 28 percent from forest industry land, and 6 percent from public timberland. Softwood removals increased across all ownership categories. On NIPF land, softwood removals increased 20 percent to 168 million cubic feet. Softwood removals on forest industry land were up 16 percent to 70 million cubic feet and more than doubled on public land to 16 million cubic feet. Softwood growing-stock removals from plantations increased more than four-fold and currently account for 18 percent of softwood removals. This compares with 5 percent during the last survey period. Sixty-one percent of the softwood removals came from natural pine stands, compared with 72 percent in the last survey.

Since the last survey, about 30 percent of the softwood removals have come from poletimber, 49 percent from small sawtimber, and 21 percent from large sawtimber trees. These proportions have remained about the same. However, small and large sawtimber contributed slightly less in this survey than in the previous survey.

Hardwood growing-stock removals were up 27 percent from 274 to 348 million cubic feet annually. Hardwood removals increased on NIPF land and public land by 36 and 41 percent, respectively, while dropping 18 percent on forest industry land. NIPF land accounted for 83 percent of all hardwood growing stock removals; forest industry land supplied 11 percent and public land 6 percent. The proportion of removals from large sawtimber increased 3 percent, while the proportions for both poletimber and small sawtimber were down slightly.

Timber Utilization and Product Output from Roundwood

Between 1986 and 1991, 81 percent of the 599 million cubic feet of growing stock removed annually in Virginia (487 million cubic feet) was used for timber products (app. table 39). This total includes more than 54 million cubic feet, or 9 percent of growing-stock removals, used for residential fuelwood. During the same period, nearly 60 million cubic feet, or about 10 percent of the total annual removals, were associated with "other removals." These removals came from silvicultural operations and land use changes where whole trees were not used for any product. Some of the trees on land cleared to a nonforest use are still alive, but are now in an urban or agricultural setting. These removals also include trees on lands reclassified from timberland to reserved timberland status. Inventory volume on such acres is treated as removals from timberland. An additional 52 million cubic feet of growing stock—the remaining 9 percent of total growing-stock removals—were cut and left in the woods as logging residue.

In 1985, the production of 387 million cubic feet of roundwood products generated 42 million cubic feet of wood residue, or approximately 11 percent of roundwood product output. Roundwood product output for this survey period was 26 percent more than in 1985, and volume of logging residues associated with roundwood product output increased by an almost equal amount at 24 percent. This indicates that improvements in the utilization of harvested timber have leveled off since the last survey period. Studies of felled-tree logging operations confirm that rates of utilization of softwood and hardwood timber cut for all roundwood products have changed little since the last survey. For polesize timber, the proportion of growing-stock material meeting FIA merchantability standards that was utilized has increased slightly. Statewide, for all products and tree sizes, approximately 94 percent of the merchantable portion of softwoods was utilized. This percentage was slightly lower than that reported in the last survey period. For hardwoods, almost 86 percent of the merchantable portion was utilized, also slightly less than the last survey.

While utilization of merchantable volume stabilized, use of growing stock for timber products output increased. In 1985, growing-stock removals accounted for 75 percent of the total roundwood product output. Between

1986 and 1991, growing-stock removals averaged 86 percent of the total roundwood product output (app. table 38). At the same time, nongrowing-stock material provided a smaller portion of the product output in this survey period than in the last. For softwoods and hardwoods combined, the proportion of product output from cull trees and salvable dead trees each dropped from 5 percent to 2 percent. Product output from "other sources"—stumps, tops, and limbs of trees on timberland; saplings; and trees on nonforest land, such as wooded pastures or fencerows—dropped from 15 percent in the last survey to 10 percent during the latest remeasurement period.

Saw-Log Production

Saw logs remain the leading roundwood product in Virginia, accounting for 43 percent of total roundwood output (app. table 37). Average annual saw-log production has increased 22 percent since the last survey period and currently totals nearly 243 million cubic feet. The average output of softwood saw logs from roundwood increased 22 percent from 88 to 108 million cubic feet. Growing stock accounted for approximately 98 percent of the softwood saw-log output from roundwood (app. table 38). Cull trees harvested on timberland or trees cut from nontimberland produced the remaining 2 percent of roundwood output. Softwood plant byproducts, such as veneer cores, contributed an additional 1 million cubic feet to bring the total annual softwood saw-log output from all sources to 109 million cubic feet.

Annual hardwood saw-log output increased 22 percent from an average of 111 to 135 million cubic feet. Sawtimber-size growing-stock trees accounted for almost 89 percent of the hardwood saw logs, while poletimber growing stock provided 5 percent. Cull trees harvested on timberland and trees cut from nontimberland produced the remaining 6 percent of roundwood output.

The 1989 industry canvass showed Virginia as a net importer of softwood saw logs (Hutchins 1992). Softwood saw-log imports exceeded exports by almost 1 million cubic feet, or by 12 percent. About 91 percent of the softwood saw logs produced in 1989 were retained for processing in Virginia, while 9 percent, or 8 million cubic feet was exported to other States. More than 9 million cubic feet were imported from other States, bringing Virginia's total use of softwood saw logs in 1989 to 93 million cubic feet. Virginia was also a net importer of hardwood saw logs in 1989. More than 10 million cubic feet were imported, while 6 million cubic feet of saw logs were exported. As reported in previous canvasses, most imports and exports occurred between Virginia and North Carolina; however, trade in saw logs was also conducted with Tennessee, West Virginia, Maryland, Kentucky, and Pennsylvania.

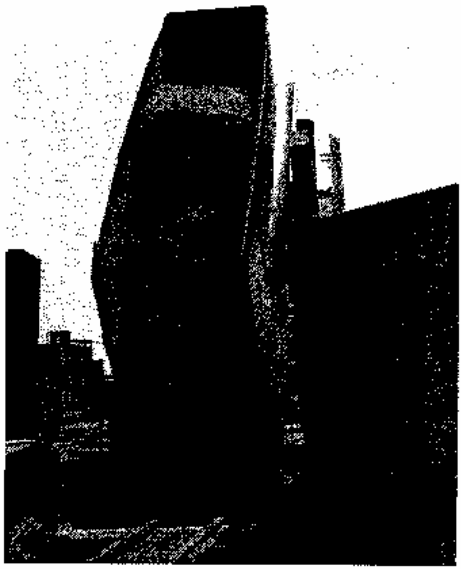
Since 1984, the number of sawmills operating in Virginia has dropped from 410 to 323. Surveys indicate a general trend toward fewer but larger sawmills. Approximately 31 percent of the currently operating mills had receipts totaling less than 1 million board feet compared to 39 percent in 1984. The proportion of mills with receipts averaging between 1.0 and 4.9 million board feet has remained stable since the last survey, at 45 percent. By region, nearly one-third of the mills are located in the Southern Piedmont and more than one-fifth of the mills are located in the Coastal Plain. However, nearly 43 percent of all mills with annual receipts greater than 5 million board feet are located in the Coastal Plain.

Pulpwood Production

With one-third of the total roundwood output, pulpwood is the second leading roundwood timber product in Virginia. Between 1986 and 1991, average annual production increased nearly 16 percent to 188 million cubic feet (app. table 37). Softwood pulpwood production increased 22 percent to 100 million cubic feet and made up 53 percent of the total roundwood pulpwood production. Hardwood pulpwood production increased nearly 9 percent to 88 million cubic feet.

In addition to roundwood, 56 million cubic feet of plant byproducts were used for fiber production. Of the total pulpwood volume, 69 percent originated from growing-stock roundwood, 8 percent from nongrowing-stock roundwood, and 23 percent from mill residues. In this survey period, annual production from all sources averaged 244 million cubic feet (3.3 million cords), representing an increase of 10 percent. When production figures of both plant byproducts and roundwood are combined, pulpwood becomes the primary timber product in Virginia, accounting for 44 percent of all industrial production.

Since 1960, total annual pulpwood production has nearly doubled, increasing from 1.8 million cords to as high as 3.6 million cords in 1984 and 1986. Figure 14 depicts the annual pulpwood production data for individual years between 1960 and 1990. These volumes include fiber produced from both roundwood and plant byproducts. Over the past 30 years, annual pulpwood production in Virginia has fluctuated somewhat; however, the overall trend shows an increase. In 1989, annual production totaled 3.4 million cords after reaching a high of more than 3.6 million cords in 1986. Since the early 1970's, hardwood pulpwood production has roughly equaled softwood pulpwood production and both have increased at about the same rate.



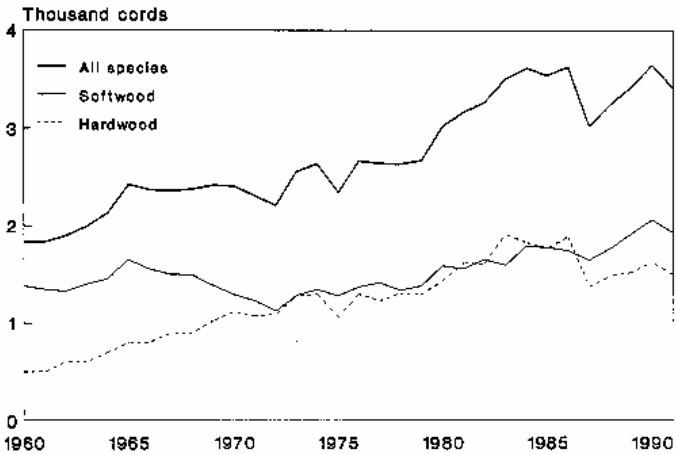


Figure 14—Pulpwood production in Virginia, 1960-1990.

Pulpwood production data for 1989 shows that Virginia has remained a net importer of pulpwood. Imports for both softwoods and hardwoods combined totaled 623,000 cords, while exports totaled 291,000 cords. Data from 1989 shows that softwood exports totaling 183,000 cords exceeded imports by 50,000 cords, or 38 percent. Softwood exports were shipped to North Carolina, Maryland, and Pennsylvania, while imports of 133,000 cords came principally from North Carolina, Maryland, and Delaware. For the same year, Virginia was a net importer of hardwood roundwood pulpwood. About 491,000 cords were imported mostly from North Carolina and West Virginia, while 108,000 cords were exported mostly to Tennessee. Ninety percent of the hardwood roundwood cut in 1989 for pulp production was retained for processing in the State, and 86 percent of the softwood roundwood was retained for processing.

Nine pulpmills are currently in operation in Virginia, the same as reported in the last survey period. Total daily pulping capacity has increased marginally from 8,400 to 8,500 tons (Hutchins 1991). However, since 1976 total daily pulping capacity has increased 18 percent from 7,200 tons.

Veneer-Log Production

Average annual output of veneer logs has increased almost 4 million cubic feet, or 30 percent, since the previous survey. Between 1986 and 1991, more than 17 million cubic feet (app. table 37) of veneer logs were produced annually; accounting for nearly 4 percent of the total output from roundwood. Softwood veneer-log production increased 27 percent to more than 12 million cubic feet, which represents 72 percent of the veneer-log production. Hardwood veneer-log output increased 40 percent to almost 5 million cubic feet continuing the upward trend in hardwood veneer-log production since 1976. All of Virginia's veneer logs were produced from roundwood, and 97 percent was from sawtimber-size trees. Poletimber and other sources provided the remaining 3 percent (app. table 38).

In 1989, Virginia was a net importer of softwood veneer logs and a net exporter of hardwood veneer logs. Almost 98 percent of the State's softwood veneer-log production was retained and processed in Virginia, while only 59 percent of the hardwood veneer logs remained in the State. North Carolina and Kentucky were the principal sources of Virginia's softwood imports. North Carolina, West Virginia, Pennsylvania, and six other States were sources for hardwood veneer imports. Hardwood exports went to North Carolina.

Since 1985, 10 veneer mills have operated in Virginia. Most of these mills produce more than one type of veneer product. One mill currently produces softwood plywood, two are producing both hardwood and softwood veneer, and seven are producing hardwood veneer and hardwood plywood.

Output of Other Industrial Timber Products

The output of all other industrial products, including poles, pilings, wood composition board, and miscellaneous products, accounted for 4 percent of the total output from roundwood. Between 1986 and 1991, output of other industrial timber products averaged 18.3 million cubic feet per year. When output from plant byproducts are included, total production increases to nearly 54 million cubic feet per year (app. table 37). This represents an increase more than three times that measured in the previous survey period. Plant byproducts accounted for 66 percent of other industrial products output in the latest survey period, showing an increase when compared to 54 percent in 1985 and 41 percent in 1976. As the use and manufacture of composition-board products, such as oriented strand board, particle board, and waferboard, have increased, both hardwood roundwood and hardwood plant residues have provided an increasing proportion of the output. While hardwoods accounted for 37 percent of the total output of other industrial products between 1976 and 1985, they increased to 54 percent between 1986 and 1991.

Since 1984, the number of mills producing other industrial products has dropped from 38 to 27. Two of these mills are producing structural board products, such as waferboard and oriented strandboard, while the remainder manufacture nonstructural composition board products, poles and pilings, or posts.

Domestic Fuelwood Production

Between 1986 and 1991, roundwood used for fuelwood averaged 102 million cubic feet per year, or approximately 18 percent of the total timber product output (TPO). This compares with nearly 26 percent of the total roundwood output produced during the previous survey period. Moderating prices for home heating fuels have slowed the expansion of fuelwood markets during the latter part of the eighties.

Showing little change from the previous survey period, hardwoods made up 90 percent of total fuelwood cut during the 1986 to 1991 survey period. Growing-stock trees accounted for 53 percent of the domestic fuelwood produced. Small diameter trees and trees on nonforest land accounted for 34 percent and cull and salvable dead trees on timberland accounted for the remaining 13 percent of domestic fuelwood.

Plant Byproducts Utilization

Between 1986 and 1991, the manufacture of primary timber products generated 164 million cubic feet of mill residues. This includes an average of 68 million cubic feet of coarse residues (chips, veneer cores, slabs, and edgings), 51 million cubic feet of fine residues (sawdust and shavings), and 45 million cubic feet of bark. More than 90 percent of the mill residues were generated from the processing of saw logs.

Although the output of woody residues, both coarse and fine, increased by more than 20 percent over the latest remeasurement period, unused plant residues dropped nearly 37 percent. Of the total plant residues generated each year, only 7.2 million cubic feet, or 6 percent, were not utilized (app. table 41).

Of the total wood residues generated annually, 47 percent was used in the manufacture of fiber products, 28 percent for industrial fuel, and 8 percent for composition-board products. The remaining 11 percent was used for miscellaneous products, such as litter, mulch, and charcoal. During the latest remeasurement period, plant byproducts provided raw material for nearly 17 percent of the total industrial products output each year.

Timber Supply Outlook

Prospective timber supplies available during the next 20 or 30 years are largely determined by actions in previous decades that created new forests and affected their structure. A complex array of natural and man-caused forces have been at work in the past to shape and mold today's forest resource. The outlook for timber supplies is strongly influenced by the quantity of timberland area, present and previous rates of harvest and regeneration, and the structure and makeup of the existing timberland base. In this chapter, we review some of the past practices that shaped the forest resource in Virginia and evaluate prospective changes in timber supply given past and current trends.

Pine Harvest/Regeneration

The relationship between stand establishment, or regeneration, and timber harvesting are two critical activities responsible for influencing the structure and character of a State's forest. Past harvest/regeneration relationships created today's forests, and current relationships will govern the physical attributes of future forests in Virginia.

Since 1986, about 63,000 acres of pine stands underwent a final harvest each year (table IV). During the same period, an annual average of more than 68,000 acres of new pine stands were established on forest and nonforest land (table V). This overall positive ratio of pine harvest to regeneration in Virginia continues to favor the pine resource in the Southeast. The current regeneration surplus of 9 percent represents a slight increase since the 1977-86 period when 66,000 acres of annual pine regeneration exceeded the 62,000 acres of pine harvest by 6 percent (Bechtold and others 1987). This increase in total pine regeneration is attributed to new stand establishment by artificial methods. The average number of acres planted to pine increased 5 percent to over 51,000 acres and accounted for three-fourths of all pine regeneration. Planting on nonforest land more than doubled to nearly 6,000 acres per year. Pine stand establishment by natural means remained stable at 17,000 acres annually. Natural seeding on abandoned agricultural land accounted for more than 35 percent of all natural pine regeneration.

A substantial increase has occurred in the acreage of harvested pine plantations since the previous survey period. Nearly 10,000 acres of planted pine stands underwent a final harvest each year—a more than sixfold increase of the average recorded during the 1977-86 period. On the other hand, the acreage of harvested natural pine stands dropped 11 percent to 53,000 acres annually. Still, the number of newly planted pine acreage surpassed the area of harvested plantations by a margin of over 5 to 1.

Pine regeneration was greater than harvest in the Coastal Plain and Southern Piedmont, the two survey units most heavily dominated by pine. These two regions accounted for 84 percent of the total pine regeneration. In the Coastal Plain, nearly 27,000 acres of pine harvest was offset by almost 32,000 acres of pine regeneration. Meanwhile, some 21,000 acres of pine were harvested and 26,000 acres of new pine stands were established in the Southern Piedmont. The figures for Northern Piedmont and Mountain Survey Units combined showed that about 16,000 acres of pine stands were harvested while only 11,000 acres of pine were successfully regenerated.

Pine harvest/regeneration ratios remained about the same for forest industry and NIPF ownership categories. Forest industry efforts to retain pine production on its timberland were revealed when 26,000 acres of annual pine regeneration outpaced 18,000 acres of pine harvest annually. Planting was the predominant method of pine regeneration on forest industry land. On NIPF timberland, 42,000 acres of pine stands were harvested, while 41,000 acres of pine stands were established each year. The 18 percent increase in artificial regeneration is significant because NIPF owners now account for the majority of planting activity in the State. A marked deficit in pine regeneration only occurred on public land where the 3,000 acres of annual pine harvest was nearly double the acreage of pine regenerated. However, a 72 percent increase in the pine harvest rate was the primary cause for the deficit in this owner category and many of these recently harvested acres are awaiting some form of regeneration.

Although the pine regeneration surplus indicates a positive situation in softwood supplies, several other factors must be considered for a more thorough interpretation of the statistics. First, the area of harvested pine has been outdistancing those areas of pine regenerated on harvested timberland over the past two survey cycles. Since the 1977-86 period, the acreage of pine harvest exceeded acreage of pine regeneration after harvest by 47 percent, and the harvest excess increased to 88 percent during the 1986-92 period. In part, this large deficit is misleading because artificial regeneration on harvested acres may already be scheduled for the future. In addition, many recently established pine stands on harvested timberland contain a substantial hardwood component that may result in stand classification as oak–pine forest type. Most of these young, mixed stands are highly transitory, and many will eventually reenter the pine type classification. Second, the current high rate of planting and natural seeding on agricultural land may not be sustained indefinitely. If this source of new pine stands is eliminated from the regeneration total, pine harvest would then exceed pine regeneration by 11 percent. Third, previous discussions do not include those acres of

Table IV—Area of Virginia's timberland treated or disturbed annually, by broad management and ownership classes, 1986 to 1992

Broad management[1] and ownership classes[2]	Major stand treatments				Natural disturbance
	Final harvest	Partial harvest[3]	Commercial thinning	Other cutting	
			Acres		
Pine plantation					
Public	--	--	277	--	--
Forest industry	6,484	--	8,794	5,292	1,152
Other private	3,111	--	8,132	3,889	4,566
Total	9,595	--	17,203	9,181	5,718
Natural pine					
Public	3,115	--	--	3,120	3,962
Forest industry	11,244	341	900	9,003	1,438
Other private	39,119	3,426	1,601	18,022	19,080
Total	53,478	3,767	2,501	30,145	24,480
Oak-pine					
Public	770	--	--	807	2,057
Forest industry	6,552	885	--	4,692	1,702
Other private	17,765	3,416	599	10,102	14,188
Total	25,087	4,301	599	15,601	17,957
Upland hardwood					
Public	8,714	1,803	--	9,001	41,603
Forest industry	12,839	--	--	15,792	3,404
Other private	71,864	34,011	1,357	76,574	87,704
Total	91,417	35,814	1,357	101,367	132,711
Lowland hardwood					
Public	--	--	--	--	--
Forest industry	1,369	--	--	430	3,057
Other private	5,212	748	--	3,873	11,971
Total	6,581	748	--	4,303	15,028
All classes					
Public	10,599	1,803	277	12,928	47,622
Forest industry	38,488	1,226	9,694	35,209	10,753
Other private	137,071	41,601	11,689	112,460	137,519
Total	186,158	44,630	21,660	160,597	195,894

[1] Broad management class before treatment or disturbance.

[2] Ownership class in 1992. Forest industry includes lands under long-term lease.

[3] Includes high-grading and some selective cutting.

Table V—Area of timberland regenerated annually, by broad management and ownership classes, Virginia, 1986 to 1992

Broad management[1] and ownership classes[2]	Total regeneration	Type of regeneration: Artificial regeneration after a harvest	Natural regeneration after a harvest	Other artificial regeneration on forest land	Other natural regeneration on forest land	Artificial regeneration on nonforest land	Natural reversion on nonforest land
				Acres			
Pine plantation							
Public	452	452	--	--	--	--	--
Forest industry	24,614	13,954	--	9,359	--	1,301	--
Other private	26,337	14,243	--	7,647	--	4,447	--
Total	51,403	28,649	--	17,006	--	5,748	--
Natural pine							
Public	1,108	--	554	--	554	--	--
Forest industry	1,212	--	660	--	352	--	--
Other private	14,717	--	3,844	--	4,831	--	6,042
Total	17,037	--	5,258	--	5,737	--	6,042
Oak-pine							
Public	1,841	770	--	--	520	--	551
Forest industry	10,066	2,925	3,534	3,350	247	--	--
Other private	35,165	10,431	12,861	3,193	3,455	519	4,706
Total	47,062	14,126	16,395	6,543	4,222	519	5,257
Upland hardwood							
Public	7,608	--	5,779	--	1,489	--	338
Forest industry	7,964	710	6,032	1,222	--	--	--
Other private	65,548	3,174	40,756	--	13,393	--	8,225
Total	81,118	3,884	52,567	1,222	14,882	--	8,563
Lowland hardwood							
Public	--	--	--	--	--	--	--
Forest industry	426	--	426	--	--	--	--
Other private	4,137	--	2,057	--	1,634	--	446
Total	4,563	--	2,483	--	1,634	--	446
All classes							
Public	11,007	1,222	6,333	--	2,563	--	889
Forest industry	44,272	17,589	10,852	13,931	599	1,301	--
Other private	145,904	27,848	59,518	10,840	23,313	4,966	19,419
Total	201,183	46,659	76,703	24,771	26,475	6,267	20,308

[1] Broad management class after regeneration.

[2] Ownership class in 1992. Forest industry includes lands under long-term lease.

pine diverted to a nonforest land use. An average of 16,000 acres of pine stands were removed from the timberland base to other land uses each year. The addition of land-clearing to the pine-harvest totals would result in the rate of pine loss exceeding regeneration by almost 15 percent. The NIPF owner category is typically the most susceptible to the conversion of timberland and agricultural land to various nontimber land uses. Moreover, this owner group controls the bulk of agricultural lands that could potentially become timberland. In summary, the positive situation that currently exists for the pine resource cannot be sustained indefinitely without continuation of vigorous regeneration efforts and incentive programs, particularly on private lands.

Oak–pine harvest/regeneration ratios were superior to those of pine. Statewide, the annual rate of oak–pine regeneration exceeded the 25,000 acres of final harvest by 88 percent. Regeneration nearly equaled or exceeded harvest for all three owner groups and across all survey units. The number of new oak-pine stands has risen sharply over the past two survey intervals, mostly as the

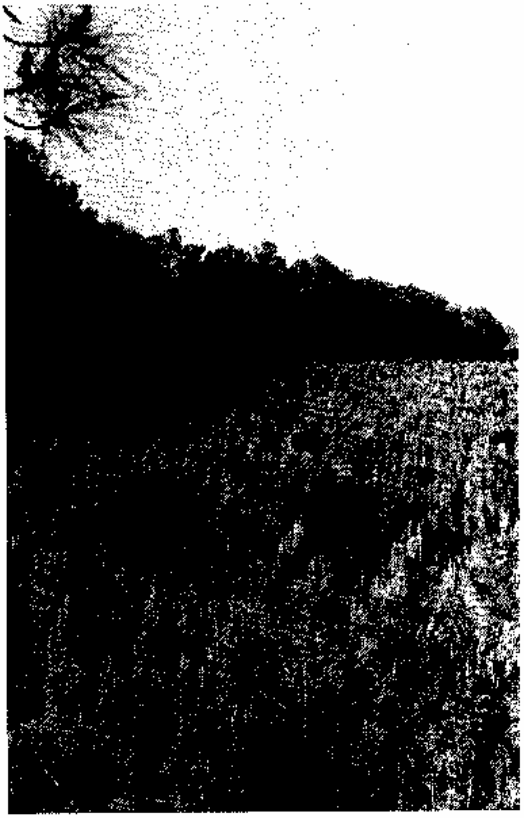
result of increased natural regeneration occurring on cutover timberland. Over 21,000 acres, or 45 percent, of the total oak-pine regeneration was artificially regenerated. However, many of these planted acres, classified as an oak-pine type because of the presence of an excessive hardwood component, will eventually be dominated by planted pine either by natural succession or through selective management that favors the pine and reduces hardwood competition.

Hardwood Harvest/Regeneration

The effective replacement rate of hardwood stands was substantially lower than that recorded for pine and oak-pine stands. Across all survey units and ownership groups, nearly 98,000 acres of hardwood forest type were harvested annually. Meanwhile, 86,000 acres, or 87 percent of the annual harvest, successfully regenerated to new hardwood stands each year. This rate has improved since the 1977-86 survey period when hardwood regeneration averaged 75,000 acres annually, amounting to 77 percent of the annual harvest. This positive trend occurred in all survey units except the Southern Mountains, where high harvest rates outpaced the creation of new, young hardwood stands. Clearing of forest land to an alternate land use continues to absorb substantial acreages of hardwood stands. Each year, 31,000 acres of hardwood stands were converted to a nonforest land use or reclassified to reserved timberland.

The largest deficit in hardwood regeneration to harvest occurred on forest industry land. Hardwoods were only regenerated on 59 percent of the acreage where hardwoods had been harvested, indicating forest industry's preference for southern pine management. On NIPF land, nearly 70,000 acres of cutover and nonforest land regenerated to hardwood, while 77,000 acres of hardwood types were harvested each year. Public land enjoyed the only positive relationship between hardwood harvest and regeneration. The nearly 8,000 acres of annual hardwood regeneration exceeded the harvest rate by 13 percent on these lands.

Although recent overall improvement in the ratio of hardwood harvest to regeneration is promising, establishing high-quality, vigorous hardwood stands should be given high priority to meet increasing demand. Young hardwood stands are subject to many complex forces that affect their structure and development, but newly regenerated hardwood stands may be improving. During the 1977-86 period, only 53 percent of the newly established hardwood stands was adequately stocked and in reasonably good condition for timber production. Since the 1986-92 period, 70 percent of the newly regenerated hardwood stands were in relatively good condition and do no need cultural treatment to minimize loss in growth potential.



Other Cutting/Disturbance

In addition to timber removed from final harvests, timber was removed from another 145,000 acres each year in the form of commercial thinnings, partial harvests, and other miscellaneous cutting (table IV). Commercial thinning occurred on an average of 22,000 acres annually, up from 15,000 acres during the previous survey period. The rate of commercial thinning in pine plantations increased to 17,000 acres annually, more than three times the previous rate. Land under NIPF control accounted for 54 percent of the commercially thinned area, forest industry land accounted for 45 percent, and public land accounted for the remaining 1 percent. Thinning activity produced nearly 4 percent of the State's total softwood removal volume. Partial harvests took place on an average of 45,000 acres annually, and 82 percent occurred in hardwood stands. Better described as either high-grading or pine selection, only a small number of selective cuts were actually designed to improve the quality of the existing stand. In pine stands, partial harvests are better described as diameter-limit cuts. Timber stand improvement and other miscellaneous treatments affected 79,000 acres annually.

Prospective Softwood Timber Supply

The present age structure of Virginia's timberland area, in terms of stand age and broad forest type composition, provides insight into prospective shifts in timber volume through time. At each sample location, a stand age was assigned. FIA field crews assigned an average age to those trees in the stand that would be featured under an even-aged management scheme. In the absence of a manageable stand (generally, less than 60 percent stocked with trees of the same size), an average age of the most dominant trees was estimated. To predict probable changes in softwood timber volume in the next 10 to 15 years, we examine the current age structure of the softwood resource in Virginia and shifts in age structure since 1986. These predictions must be qualified by acknowledging the limitations associated with uncertainties about physical factors, such as severe weather conditions and economic factors affecting the future demand for timber.

The age class distribution of Virginia's 1.9 million acres of natural pine and 1.5 million acres of pine plantations are depicted in figure 15. Since 1986, changes in pine-age structure reflect the increasing influence plantations are having on the pine resource in Virginia. Continued declines in the youngest age classes for natural stands are being offset by mounting acreages in younger planted pine stands. In the 11- to 40-year category, area in natural pine stands has fallen by 24 percent to 777,000 acres, while area in pine plantations has increased 28 percent to 932,000 acres. The intensive planting that began in the 1960's has resulted in substantial acreage of planted pines that have reached merchantable size and are beginning to contribute to the softwood timber supply. During the 1986-92 period, 18 percent of softwood growing-stock removals came from plantations, compared to only 6 percent during the 1977-86 period.

Another distinguishing feature of the pine-age structure is the increasing acreage of well-stocked stands 10 years of age or less. Area of manageable pine stands in this youngest age class increased 18 percent for planted stands and 10 percent for natural stands. The distribution of total pine acreage in the three youngest 10-year age classes currently indicates that over 1.3 million acres, or 68 percent, is in planted stands. All pine stands between 31 and 60 years of age declined 11 percent to 1.0 million acres, while those stands in the oldest age categories (61 years and older) increased 26 percent to 307,000 acres.

Pine supplies in Virginia should remain stable for the future. The age distribution depicts a balanced structure with no severe deficiencies in any age class that may result in a timber shortage for the short- or long-term.

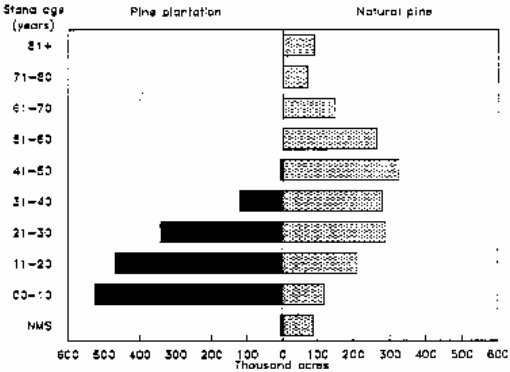
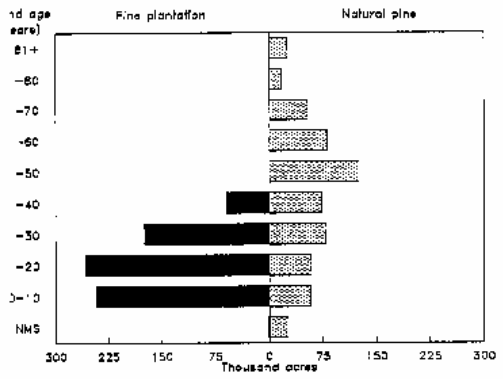


Figure 15—Profile of timberland classified as a pine forest type, by stand age class and stand origin, 1992. "NMS" includes those areas that lack a manageable stand.

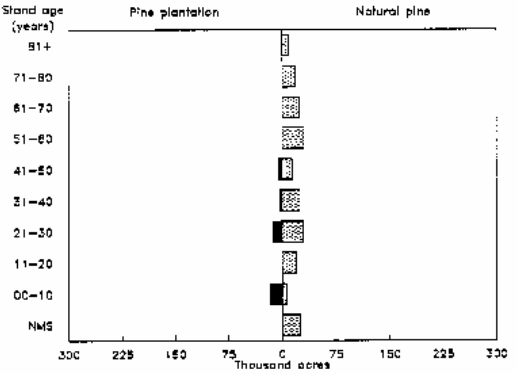
The acreage distribution in the first three age classes (0-30 years) is particularly important because the majority of pine stands in the Southeast are on harvest rotations of 30 years or less. Nearly 60 percent of all manageable pine stands in the State are 30 years of age or younger. The ability to sustain pine supplies in the future will largely depend on stand renewal efforts. Over the past 40 years, pine forests in Virginia have undergone an accelerated level of management that has concentrated on reforestation on both harvested timberland and nonforest land. Even if the number of new pine stands entering the timberland base through planting and natural seeding of nonforest lands uses decreases, continuing aggressive regeneration efforts on cutover forest land should provide an ample supply of softwood timber in the foreseeable future.

However, ample supplies of softwood timber may not guarantee adequate supplies of pine sawtimber. Over the next 10 to 20 years, younger stands and plantations will probably make up an increasing share of the softwood inventory. At the same time, the harvesting of older, natural pine stands will probably continue (softwood timber removals have increased 38 percent in natural pine stands over 40 years of age since 1986). This ongoing, reshaping of the pine resource translates into a higher proportion of smaller trees for southern pine products.

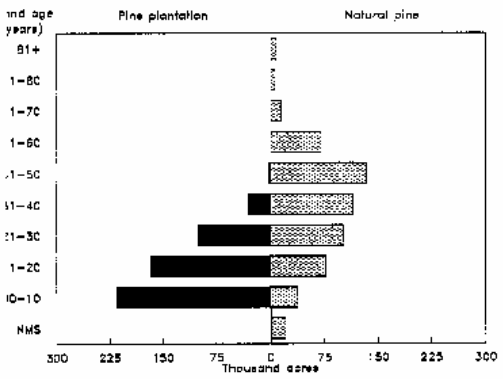
Moreover, projections for the South indicate pine plantation acreage will exceed natural pine acreage, and these plantations will contribute 50 percent to the total softwood harvest by the year 2000 (USDA Forest Service 1988). Area in planted pine already surpasses area in natural pine in the Coastal Plain and Southern Piedmont Survey Units (fig. 16). Assuming the trend conditions and projections are valid, industry will need to effectively utilize more trees from pine plantations to ensure a stable supply of raw material for wood products.



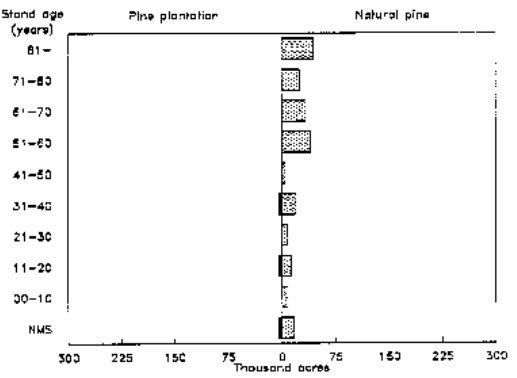
Coastal Plain



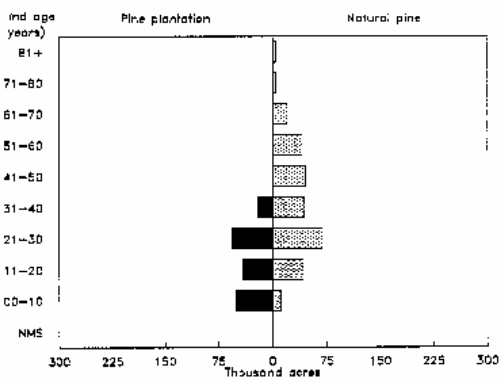
Southern Mountains



Southern Piedmont



Northern Mountains



Northern Piedmont

Figure 16—Profiles of timberland classified as pine forest types, by stand age class, stand origin, and Survey Unit, 1992. "NMS" includes those areas that lack a manageable stand.

This shift to increased plantation management raises some concerns for producers of higher grades of construction lumber and plywood. These producers rely on supplies of large diameter pine sawtimber and will find it difficult to provide higher graded wood products from the younger, faster growing plantation trees. The wood from these plantation trees has more juvenile characteristics, making them structurally inferior and less productive (Saucier and Cubbage 1990). However, since the 1977-86 survey, commercial thinning in pine plantations has increased dramatically. Even though this thinning responded to the large number of plantation trees reaching merchantable size, plantation managers may increase thinning and extend the rotation to offset future volume losses in mature natural stands.

The current outlook for softwood timber supplies has undergone considerable change by major ownership category. The area of timberland controlled by forest industry has declined significantly since 1986, primarily by shifting land to the NIPF category. The most noticeable change occurred in the distribution of planted stands. In the previous survey, forest industry controlled 54 percent of the planted pine acreage. That figure dropped to 46 percent in 1992. A sharp reduction of 43 percent in natural pine stands with severe declines across all age classes occurred on forest industry land. The decrease in natural pine acreage combined with a stabilization in planted pine stands resulted in a much higher proportion of forest industry's pine land in plantations. Sixty-eight percent of the State's pine acreage is under NIPF ownership, where area of pine plantations was up 49 percent to 764,000 acres. This ownership category now supports more acreage in artificially regenerated pine stands than forest industry. Natural pine stands currently total 1.5 million acres under NIPF ownership, down 11 percent since the prior survey. Nevertheless, large increases were recorded in natural pine acreage in manageable stands 60 years and older in age on NIPF land. Only 7 percent of Virginia's pine acreage is on public land. Almost 87 percent of pine lands on public ownership were naturally regenerated, and over half the stands are older than 50 years.

The distribution of the pine resource by ownership suggests that NIPF owners will play an increasing role in the overall softwood timber supply scenario. This owner category controls 78 percent of the pine stands between 31 and 60 years of age and over two-thirds of the collective acreage of pine stands over 60 years of age. Therefore, demand for pine sawtimber will be primarily met by NIPF owners. In addition, as NIPF owners accumulate a greater share of young planted stands and improve planting rates, they will probably supply a greater portion of the smaller-diameter pine products. If current rates of removal remain the same and a sustained level of regeneration is maintained, softwood inventory volume on NIPF land should remain stable. Forest industry can be expected to provide a stable share of softwood fiber for the next 10 to 20 years because planted acreage under 30 years of age is adequate, but whether the decline in the industry's timberland base will continue is uncertain.

Prospective Hardwood Timber Supply

The current age structure of Virginia's hardwood forests indicates an accumulation of stands in older age classes (fig. 17). Acreage in stands classified as a hardwood type (including oak-pine forest type) 51 years and older increased 11 percent to over 6.2 million acres and accounted for 60 percent of all manageable hardwood stands in the State. Moreover, hardwood stands in the oldest age classes (71 years and older) increased 26 percent. Many of these stands have reached maturity and are characterized by decreasing growth and increasing mortality. Indications that an aging hardwood resource was evolving became apparent during the 1970's (Knight and McClure 1977). Historically low harvest rates have contributed to the large buildup of acreage in older hardwood forests and resulted in fewer stands in the younger age classes. To achieve a more balanced age distribution, more mature and overmature hardwood stands should be harvested. This will relieve some of the demand pressure on the softwood resource and improve growth for hardwoods in the long-term.

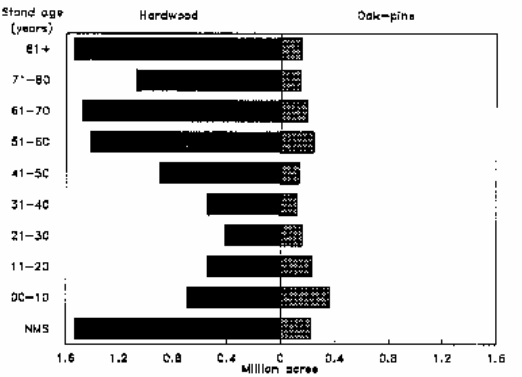
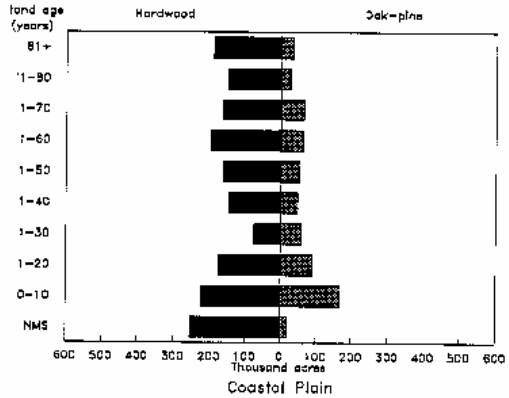
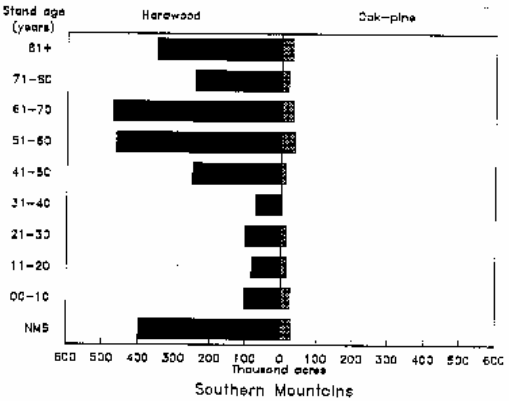
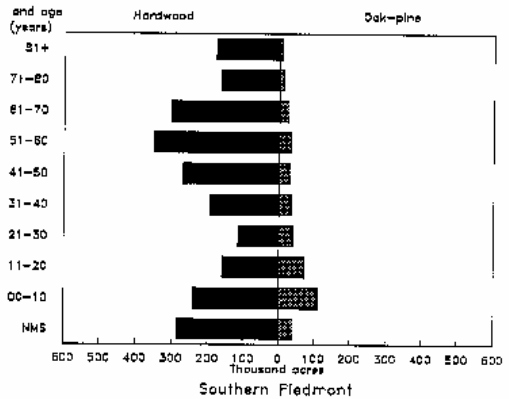


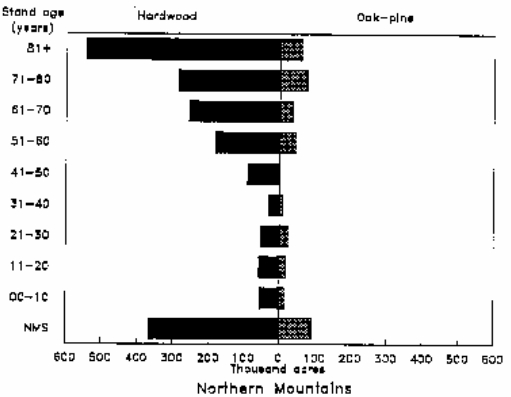
Figure 17—Stand age profile of timberland classified as a hardwood or oak-pine forest type, 1992. "NMS" includes those areas that lack a manageable stand.

Between geographic regions, considerable variation in the age distribution of hardwood forests existed (fig. 18). The Coastal Plain and Southern Piedmont showed a









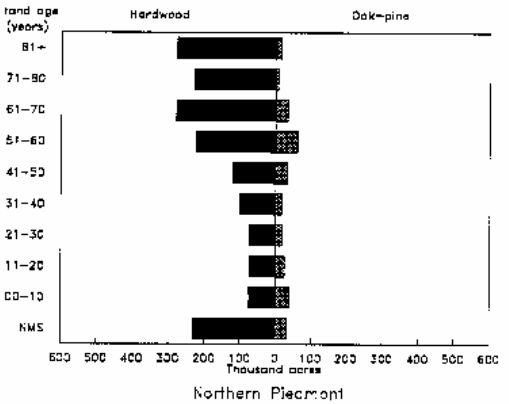


Figure 18—Profiles of timberland classified as a hardwood or oak-pine forest type by Survey Unit, 1992. "NMS" includes those areas that lack a manageable stand.

more balanced age structure and a higher proportion of younger stands than the Northern Piedmont and both Mountain Survey Units. Seventy percent of all manageable hardwood stands 10 years and younger were concentrated in the Coastal Plain and Southern Piedmont—these regions accounted for almost all gains in acreage of young hardwood stands. This recent increase illustrates the effect of increased hardwood harvesting. These areas have lower hardwood growth to removal ratios than those recorded for the Northern Piedmont and both Mountain regions. The narrow gap between growth and removals in the Coastal Plain has resulted in a stable hardwood inventory since 1986. The affect of increased hardwood harvesting should create an age profile that contributes to more stable growth levels over the next 20 years. Most of the mature and overmature stands in the Coastal Plain are concentrated in the bottomland areas, where year-round water makes them unaccessible for harvesting. The Northern Piedmont and both Mountain Survey Units have the highest accumulation of older hardwood stands. Collectively, these three regions control nearly 4.3 million acres, or 68 percent, of Virginia's hardwood forests over 50 years of age. Underutilized, this vast area of hardwood timber offers the greatest opportunity for increasing the timber cut over the next several decades. Despite escalating levels of hardwood removals in the Mountain regions, hardwood growth still surpasses removals by a comfortable margin and inventories are still rising. Unfortunately, this excess of growth could erode if diminished-volume increment and high mortality continue in aging hardwood stands. If existing hardwood markets in Virginia cannot absorb hardwood harvesting opportunities, the reserve of overmature stands will continue to increase, resulting in further growth loss.

The future of hardwood timber supplies is highly dependent on species composition and overall condition of young, immature hardwood forests. The management and regeneration of hardwoods is complex, and adequacy of a new hardwood stand is based on advance reproduction, sprouts expected from cut trees, and seeds from adjacent seed trees. Some hardwood and oak–pine stands that developed after the harvest of pine sites are dominated by hardwoods exhibiting low-quality characteristics, such as poor form, cull, and species traits that have low timber value. Almost 37 percent of newly regenerated hardwood acreage was classified as a pine forest type in the 1977-86 survey. Many of these sites are unsuitable for hardwoods, and conversion to pine is the only logical prescription. New hardwood stands resulting from harvest activity often contain substantial numbers of larger, residual trees that may curtail growth and development of younger trees in the understory. Young stands comprised principally of hardwoods are highly vulnerable to damage and mortality from fire. Substantial amounts of moist, bottomland sites with conditions conducive to successful hardwood regeneration have been converted to agricultural land. To ensure the production of hardwood in quantities that meet anticipated demands, these and other problems must be resolved quickly.

Another prominent feature of the hardwood resource is the large proportion of poorly stocked stands. Over 15 percent, or nearly 1.8 million acres, classified as oak–pine or hardwood forest type are less than 60 percent stocked with trees that would be featured in most timber management regimes. The number of hardwood acres insufficiently stocked has decreased 17 percent since 1986, but many stands still remain in poor condition. Harvest activity since 1986 produced about 18 percent of the poorly stocked hardwood stands. The remaining poorly stocked stands cover a wide variety of physiographic conditions in different levels of productivity. Poor site conditions, inadequate regeneration provisions, and stands principally composed of rough and rotten trees are the main contributors to poor stocking on older hardwood stands. Distribution of poorly stocked stands by region range from 12 percent in the Coastal Plain and Southern Piedmont to 20 percent in the Northern Mountains, and all Survey Units showed a decrease since 1986.

A five-step screening reduction of the 3.4 million acres of timberland classified as a pine type is depicted in figure 19. In the first step, some 96,000 acres of poorly stocked acreage are screened out. Generally, these areas do not support a manageable stand of growing-stock trees, nor do they support enough merchantable volume for harvesting opportunities. Total softwood growing-stock volume per acre with these conditions averaged 165 cubic feet. Nearly all pine acreage poorly stocked is found in natural pine stands, either in recently harvested areas or stands with poor site conditions.

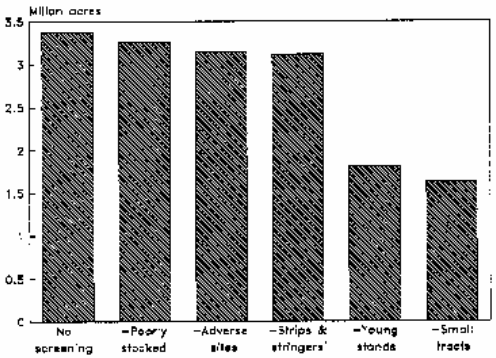


Figure 19—Five step screening reduction applied to the area of timberland classified as a pine forest type, 1992.

In the second step, about 116,000 acres were excluded as adverse sites. Nearly all of these acres were found on slopes of 40 percent or greater. Previous analysis confirms the significantly lower harvest rates on areas with excessive slope (Brown 1990). Statewide, annual removals in pine stands averaged 34 cubic feet per acre on adverse sites compared to almost 60 cubic feet per acre on areas with slopes less than 40 percent and no year-round water problems.

The third step eliminates those pine stands classified as narrow strips and stringers, such as riparian areas, field edges, and strips adjacent to roads. This excluded about 32,000 acres of naturally regenerated pine stands. The largest reduction occurred in the fourth screening step where stands under 21 years of age were excluded. Based on the assumption that these young stands will not be available for harvest until sometime in the future, 1.3 million acres were deducted. Over three-fourths of this acreage was found in plantations, illustrating the ongoing intensity in artificial regeneration efforts.

The fifth and final step excludes almost 178,000 acres of pine stands concentrated in small forested tracts on NIPF land. For all NIPF owners, the acreage of the tract that the inventory plot samples is recorded. Using aerial photography, the percentage of the tract covered by forest is determined and applied to the total acreage of the tract to determine the acreage of forest on the parcel. This acreage, referred to as forested tract size, was collected to examine relationships between timber harvesting and various tract sizes and to analyze trends in forest fragmentation. The distribution of Virginia's NIPF timberland area by forested tract size is illustrated in table VI. This fifth screen is based on the assumption that smaller parcels (10 acres or less) are economically less attractive for timber harvesting or in a primarily urban setting where timber production is not the ownership objective.

Table VI—Area of Virginia's timberland, by forested tract size and NIPF owner classes, 1992

Forested tract size (acres)	All ownerships	Other corporate	Farmer	Other individual
		Acres		
< = 10	1,275,629	82,461	208,178	984,990
11 - 50	3,495,691	283,144	1,166,849	2,085,698
51 - 100	2,816,960	199,638	1,067,743	1,349,579
101 - 200	2,051,753	280,947	803,541	987,286
201 - 500	1,500,142	357,570	449,875	692,697
501 +	969,326	385,775	174,180	409,371
All classes	11,909,501	1,549,535	3,870,366	6,489,600

In this particular exercise, 3.4 million acres of pine stands in Virginia is discounted to 1.6 million acres, or by 51 percent. If the screening criteria are accepted, one could conclude that only 49 percent of the pine acreage currently offers unhindered logging opportunities.

Age profiles for hardwoods showed some differences by major owner category. Public lands had notably higher proportions of acreage in older stands, while forest industry showed a distribution heavily skewed toward the youngest age class. The majority of Virginia's public land is national forest in the western, mountainous regions where steep terrain has historically inhibited conventional harvesting practices. About one-third of hardwood stands controlled by forest industry is 30 years or younger in age. Forest industry land was the only major ownership to lose hardwood acreage (23 percent). This loss was largely a result of hardwood to pine conversion after harvesting. The age distribution of hardwood stands on NIPF land, where 61 percent of the hardwood stands are older than 50 years of age, also indicates an aging resource.

The trends shown by these inventories seem to indicate that the long-time buildup of hardwood inventory in Virginia, and elsewhere in the Southeast, is coming to an end. In the Coastal Plain, where hardwood growth is leveling off and starting to decline, harvest activity is increasing to meet the growing demand for hardwood fiber. As long as sound harvesting and regeneration practices are practiced, a better stand-age distribution could evolve, and hardwood growth could increase in this region. In both Mountain Survey Units, a large inventory of hardwood has accumulated over the past several decades and growth still exceeds removals by a healthy margin. Even with this seemingly great abundance, legitimate concerns about the future exist. About one-half of the current inventory in the Northern and Southern Mountains is composed of timber species considered inferior for high-quality saw logs and veneer logs, such as chestnut oak, black locust, and red maple. Moreover, overall tree quality is questionable when 56 percent of the hardwood sawtimber in Virginia resides in grade 3 or 4 trees. Finally, inaccessibility, especially on steep, adverse sites reduces harvestable inventory. An increase in hardwood growth in the Mountain Survey Units over the next 20 years or longer is unlikely unless steps are taken to accelerate the rates of hardwood harvesting and regeneration.

In summary, the greatest gains in overall forest productivity in Virginia can be accomplished through improved utilization and management of the hardwood resource. One avenue to a more well-balanced and vigorous hardwood resource is improved markets for small-diameter and poor-quality hardwoods. Past management of hardwoods has encouraged specialized markets to absorb only a limited range of tree sizes and species, contributing to the large number of poorly stocked stands. Currently, over 2.0 billion cubic feet of hardwood in rough and rotten trees can be found across all management types and ownerships. This represents an average of 133 cubic feet per acre. If technology makes these trees more attractive for alternative timber products and improves access to hardwood timber in previously inaccessible areas, it may be possible to expand the current base of hardwood markets.

Timber Availability

The recent surge in softwood growth combined with the accumulation of older, high volume hardwood stands appears to indicate ample supplies of timber for the foreseeable future in Virginia. However, a host of factors affect the amount of the resource that is actually available for commercial logging and consumptive use at any given time. Weather, terrain, environmental concerns, public policy, landowner attitudes and objectives, and the physical attributes of the resource restricting the availability of timber supplies must be included in any discussion of the long-term prospects for adequate quantities of timber products.

Forest Inventory and Analysis assumes that all timberland in the Southeast is available for harvest unless statute or other administrative designation officially prohibits timber cutting. While landowners are not asked about their intent to sell timber, information on the physical attributes of the timber resource that can influence availability is collected. With this information, analysts and users of the data can screen out selected physical attributes to reach a more realistic assessment of timberland area and volume that offer unencumbered logging opportunity. Criteria are identified as inhibitive to harvesting, and acres or volumes associated with those criteria are excluded from the initial resource base. These discounting criteria are only assumptions and do not imply that the acres and volume affected will never be harvested. The screening procedure does, however, provide a more practical way to evaluate the resource in terms of timber supply.

Applying these same criteria to the total softwood growing-stock volume in all stand types, the 6.6 billion cubic feet of softwood volume was reduced to 4.8 billion cubic feet, or 73 percent of the original total (fig. 20). The single largest reduction occurred when softwood volume in stands under 21 years of age were eliminated. The substantial amount of volume contained in pine plantations 20 years of age or less accounted for this large drop. This reduction is somewhat inflated because many of these plantations are dominated by softwoods that have reached merchantable size and could be harvested for small-diameter timber products. The second largest decrease resulted when softwood volume contained in small tracts on NIPF land was deducted. Natural pine stands contain 62 percent of the softwood volume concentrated in forested tracts 10 acres or smaller. Many of these natural stands are characterized by older, large-diameter pines in small parcels of forest land within a predominantly urbanized landscape setting and will probably never be harvested for timber products.

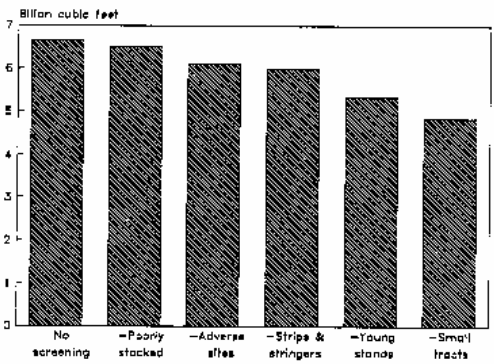


Figure 20—Five step screening reduction applied to the volume of softwood growing stock, 1992.

The results of the same discounting procedure applied to the hardwood resource indicated a larger reduction to timberland area and growing-stock volume. The area of hardwood and oak–pine stands dropped from 12 million acres to 5.6 million acres, or by 54 percent (fig. 21). The largest reductions resulted when poorly stocked stands and hardwood stands occurring on adverse sites were eliminated. Hardwood growing-stock volume was reduced by 41 percent to 11.7 billion cubic feet after all screening variables were applied (fig. 22). The single largest reduction occurred when the adverse site criterion was applied.

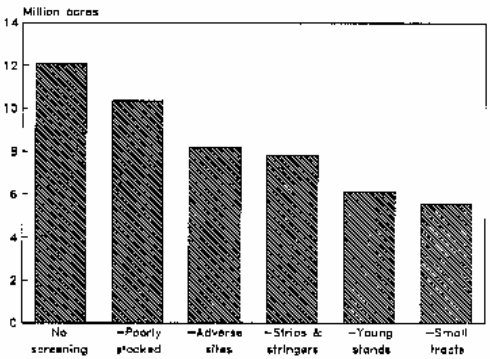


Figure 21—Five step screening reduction applied to the area of timberland classified as a hardwood or oak–pine forest type, 1992.

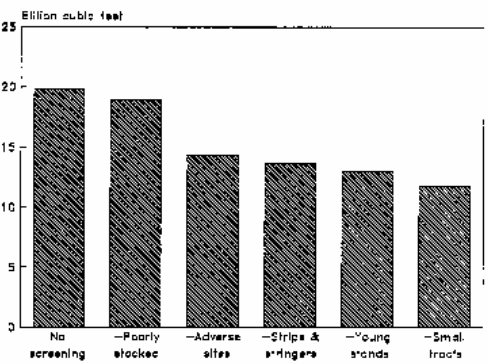
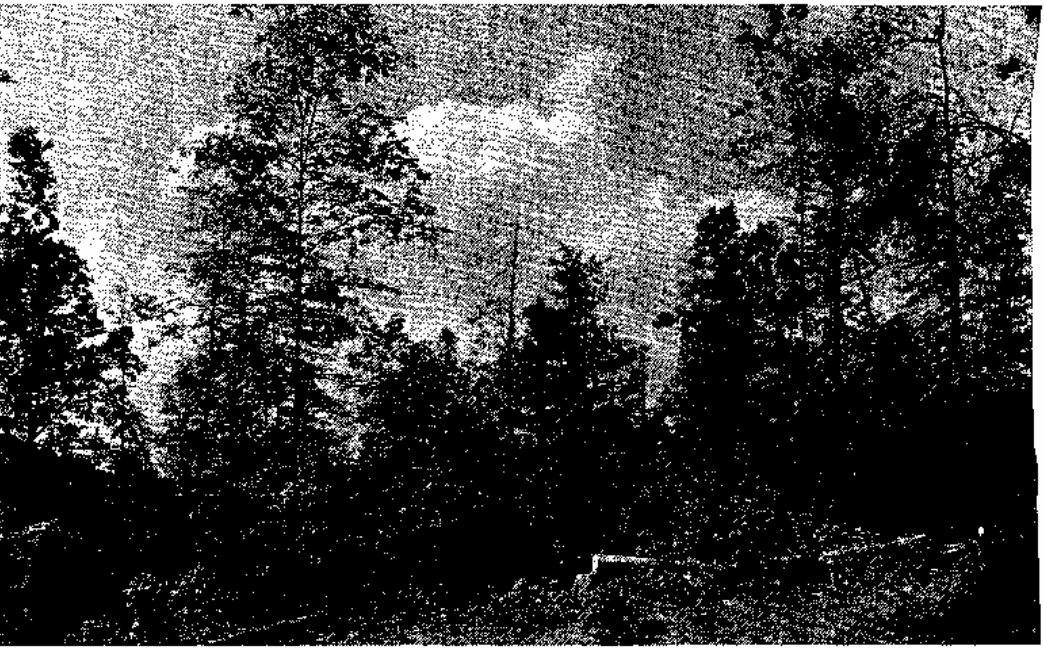


Figure 22—Five step screening reduction applied to the volume of hardwood growing stock, 1992.



Management Opportunities

This chapter describes possible management opportunities for improving Virginia's timberland. The growing demand for timber and timber products from a shrinking timberland base make it imperative to maximize timber growth and improve the quality of the resource on as many timberland acres as possible. Factors, such as the diversity and fragmentation of timberland ownership, the high cost of intensive forest management, and environmental constraints and regulations, complicate or impede efforts to manage timberland for this purpose. Identifying management opportunities that would enhance timber growth also benefit nontimber amenities by promoting healthier forest conditions. Therefore, where intensive forest management is practical these treatment opportunities should be considered as a guide for future action.

Field crews assign an optimum treatment opportunity at each sample location based on the current stand conditions they encounter. The treatment opportunity assigned describes the single most important silvicultural action that could be taken to improve the growth and quality of the stand. Since stand conditions vary greatly by broad management class and ownership group, the treatments discussed are broad and general. Table VII provides a summary of the treatment opportunities identified.

Adverse Sites

Adverse sites, those acres with excessively steep slopes or year-round water problems, limit the management opportunities on nearly 2.9 million acres, or 19 percent of Virginia's timberland. Steep slopes, those areas with slopes of 40 percent or greater, account for 95 percent of the acreage classified as adverse. Most of the stands on steep slopes are located in the two Mountain Survey Units, while those areas with year-round water problems—the remaining 5 percent of adverse sites—are located in the eastern half of the State. More than half of the acres on adverse sites were in relatively good condition and required no treatment. Twenty-two percent were in need of a harvest, while 20 percent were in need of regeneration. Over 95 percent of the adverse sites were classified as hardwood or oak–pine with the remainder classified as pine types. Three-fourths of all adverse sites are located on NIPF land, about 22 percent are on public land, and the remainder are on forest industry land. Proportionately, adverse sites make up 31 percent of the public timberland, 18 percent of NIPF land, and 6 percent of forest industry land.

During the latest remeasurement cycle, only 7 percent of the acres classified as adverse sites experienced some form of timber cutting, allowing timber growth to more

Table VII—Area of Virginia's idle cropland and timberland, by broad management, ownership, and treatment opportunity classes, 1992

Broad management and ownership classes[1]	Total area	Broad treatment opportunity class: Salvage	Harvest	Commercial thinning	Other stand improvement	Stand conversion	Regeneration[2]	Stands in relatively good condition	Adverse sites or conditions[3]
					Acres				
Idle cropland									
Public	--	--	--	--	--	--	--	--	--
Forest industry	--	--	--	--	--	--	--	--	--
Other private	437,468	--	--	--	--	--	437,468	--	--
Total	437,468	--	--	--	--	--	437,468	--	--
Pine plantation									
Public	32,409	--	--	1,973	7,041	--	--	23,395	--
Forest industry	675,688	--	--	172,784	46,831	--	--	456,051	--
Other private	764,249	2,884	--	198,949	76,398	--	7,131	473,809	5,080
Total	1,472,324	2,884	--	373,706	130,268	--	7,131	953,255	5,080
Natural pine stands									
Public	212,988	3,713	38,086	9,520	6,986	--	2,707	122,794	29,180
Forest industry	164,527	2,297	18,854	46,398	10,774	--	9,307	72,284	4,613
Other private	1,502,934	16,449	71,793	219,309	119,740	11,192	57,637	910,675	95,939
Total	1,880,427	22,459	128,733	275,227	137,500	11,192	69,651	1,105,953	129,712
Oak-pine stands									
Public	204,625	--	12,890	--	14,644	--	12,099	90,518	74,476
Forest industry	215,709	--	25,308	4,384	18,307	--	6,799	142,738	18,183
Other private	1,520,873	9,733	139,965	23,639	164,456	7,018	121,737	929,376	124,949
Total	1,941,207	9,733	178,163	28,023	197,407	7,018	140,625	1,162,630	217,608
Upland hardwood stands									
Public	1,606,625	10,473	272,557	2,495	58,284	--	82,504	588,082	514,130
Forest industry	425,979	--	47,213	--	29,533	12,817	67,830	214,960	53,626
Other private	7,586,067	28,831	657,218	38,624	544,719	31,462	742,972	3,723,281	1,818,960
Total	9,518,571	39,304	976,988	41,119	630,536	44,279	893,306	4,526,323	2,386,716
Lowland hardwood stands									
Public	26,761	--	14,391	--	--	--	4,310	6,969	1,091
Forest industry	72,882	--	22,173	--	4,372	--	2,707	26,919	17,711
Other private	535,378	4,381	66,170	--	35,171	--	147,235	177,451	104,971
Total	635,021	4,381	102,734	--	39,543	--	154,252	210,338	123,773
All classes									
Public	1,983,288	14,186	337,924	13,988	84,955	--	101,620	811,758	618,857
Forest industry	1,554,783	2,297	113,548	223,566	109,817	12,617	86,633	911,952	94,133
Other private	12,346,989	62,278	935,146	480,521	940,482	49,672	1,514,180	6,214,791	2,149,899
Total	15,885,018	78,761	1,386,618	718,075	1,135,254	62,489	1,702,433	7,938,499	2,862,889

[1] Forest industry includes lands under long-term lease.

[2] Includes 101,628 acres where high-quality hardwood regeneration could be accomplished by felling residual trees to release advance understory hardwood reproduction and promote stump sprouting.

[3] Areas where management opportunities are severely limited because of steep slopes or poor drainage.

than double the rate of removals. Volume of growing stock per acre averaged 1,842 cubic feet per acre, 9 percent more than the average volume on operable sites. These stands averaged 68 years of age, with net annual growth of 35 cubic feet per acre, while the average age for all stands was 46 years of age, and the net annual growth averaged 55 cubic feet per acre.

Because applying treatments to adverse stands is difficult, they have been excluded from the management opportunities presented in this chapter (table VII). However, these stands are not excluded from the productive timberland base. Advanced logging techniques and increasing prices for high-quality timber are making most adverse sites more accessible and economically feasible to log. Although these sites restrict management options to less intensive management, they provide areas for many nontimber benefits, such as watershed management, recreational opportunities, and wildlife habitat.

Stands In Good Condition

Manageable stands in good condition and on operable sites occupy more than 7.9 million acres, or 51 percent, of Virginia's timberland. This represents an increase of nearly 450,000 acres over that measured in the previous survey period. These stands are generally 60-percent or better stocked with young or vigorous trees of acceptable quality and free from significant damage or excessive competition. By broad forest type, 64 percent of the operable pine acreage is in good condition (fig. 23), as is 63 percent of the operable hardwood acreage (fig. 24). Almost 59 percent of forest industry-controlled timberland is in good condition and needs no immediate treatment, as is 52 percent of NIPF timberland and 41 percent of public land. Hardwood and oak–pine stands together account for 74 percent of the acres in good condition, natural pine stands account for 14 percent, and pine plantations account for 12 percent. As a proportion, about 65 percent of the pine plantations, 59 percent of the natural pine stands, and 60 percent of the oak–pine stands are in good condition. In comparison, only 47 percent of the upland hardwood stands and 33 percent of lowland hardwood stands are in good condition. Across all broad management classes, stands in good condition averaged 40 years of age and contained 1,735 cubic feet of growing stock per acre. Net annual growth of growing stock averaged 61 cubic feet per acre, well above the average 55 cubic feet per acre for all stands. Continued protection from catastrophic fire, intermediate treatment of stands as needed, and prompt regeneration after harvest will ensure long-term productivity and a high rate of growth on these timberland acres.

Treatment Opportunities

Three out of every 10 acres of Virginia's timberland offer opportunities to improve and increase the State's future timber supply. Conditions range from overmature and overstocked stands to low-stocked stands in need of regeneration. Without treatment, these stands will remain far less productive than their potential. The six management opportunities identified below would increase the quantity and improve the quality of timber on these acres.

1. *Salvage and regenerate seriously damaged stands on 79,000 acres.* These stands have been heavily damaged by disease, insects, weather, or fire and without treatment will experience excessive mortality. Salvageable, damaged stands accounted for less than 1 percent of Virginia's timberland; however, those stands that have experienced enough mortality to bring the stocking below 60 percent are included under the regeneration opportunity. These stands averaged 65 years of age and contained 2,117 cubic feet of growing stock per acre. Upland hardwood stands accounted for nearly half of the stands in need of salvage, with disease being the most damaging agent. Natural pine stands and pine plantations accounted for another 32 percent of the stands in need of salvage.

2. *Harvest and regenerate mature stands on 1.4 million acres.* Nearly 9 percent of Virginia's timberland falls into this category where stands are characterized by advanced age, high volumes, low-growth rates, and significant mortality. These stands averaged 88 years of age and supported 2,801 cubic feet of growing stock per acre. Net annual growth per acre averaged 51 cubic feet. Hardwood stands accounted for 78 percent of all stands in need of harvest. Oak–pine stands accounted for 13 percent of stands in need of harvest, and pine stands accounted for the remaining 9 percent. More than two-thirds of the harvestable acreage was on NIPF timberland and 24 percent was on public timberland.

3. *Thin, young immature stands densely stocked with merchantable trees on 718,000 acres.* Five percent of the State's timberland is in stands overstocked with trees that are receiving intense competition from each other. Without commercial thinning these stands will stagnate, and much of the growth potential will be lost to suppression mortality. These stands averaged 29 years of age and contained 2,689 cubic feet of growing stock per acre. Net annual growth per acre averaged 152 cubic feet. Pine stands accounted for 90 percent of the commercial thinning opportunity. Nearly 58 percent of the pine stands in need of thinning were pine plantations. By ownership, 67 percent of stands that need thinning were on NIPF land; 31 percent were on forest industry land; and the remaining 2 percent were on public land.

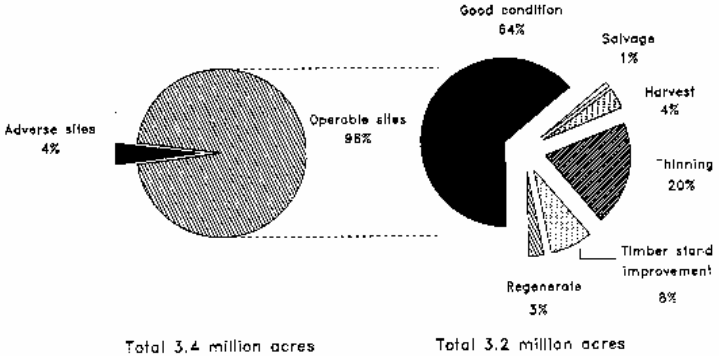


Figure 23—Pine timberland acreage by treatment opportunity, 1992.

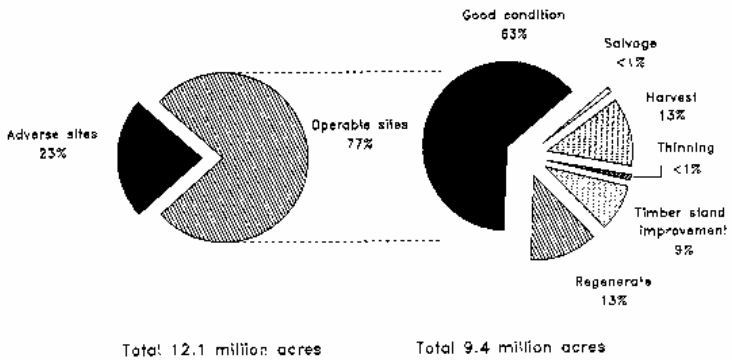


Figure 24—Hardwood timberland acreage by treatment opportunity, 1992.

4. *Remove undesirable trees and competing vegetation from immature stands on 1.1 million acres.* The more than 7 percent of the State's timberland in this category are characterized by immature stands receiving intense competition from rough trees or other inhibiting vegetation. Many acres in need of timber stand improvement (TSI) are the result of past cutting practices, such as partial harvests and high grading where residual trees impede regeneration and inhibit growth. Also included are those stands heavily stocked with immature trees and requiring a precommercial thinning. Stands needing TSI averaged 15 years of age and contained 667 cubic feet of growing stock per acre. Net annual growth of growing stock averaged 44 cubic feet per acre. By broad forest class, hardwood stands accounted for 59 percent of the acres in need of TSI, while oak-pine stands accounted for another 17 percent. Natural pine stands and pine plantations together accounted for 24 percent. Timberland held by NIPF owners accounted for 83 percent of the acres in need of timber stand improvement, forest industry land accounted for 10 percent, and public land accounted for about 7 percent.

5. *Convert stands with species obviously unsuitable for the site to a more productive species on 62,000 acres.* Less than 1 percent of the State's timberland falls into this category where off-site species make up a manageable stand but, from the standpoint of timber production, produce below the site's potential. These stands averaged 37 years of age and contained 1,170 cubic feet of growing stock per acre. Net annual growth of growing stock averaged 40 cubic feet per acre. Oak-pine and

hardwood stands accounted for 82 percent of the area needing conversion. By ownership, 79 percent of the acres in need of stand conversion were on NIPF land, and 21 percent were on forest industry.

6. *Regenerate 1.3 million acres so poorly stocked with acceptable trees that a manageable stand does not exist.* Currently, about 8 percent of Virginia's timberland falls into this category. Timberland acres in need of regeneration have dropped nearly 18 percent, or 270,000 acres, since the previous survey period. Conditions on most of these acres are the result of past harvesting practices. Almost one-fourth of the acres needing regeneration experienced a final harvest between 1986 and 1992. Many of these acres may naturally regenerate on their own. However, in the absence of treatment, a manageable stand may not appear for decades on a substantial portion of these acres. More than one-half of the stands in need of regeneration have been in this category since the previous survey period. Average age of stands in need of regeneration was 35 years. This is indicative of these stands, where remnants of former stands, cull seedlings and saplings, and other undesirable vegetation prevent the development of a manageable stand. Volume of growing stock in these poorly stocked stands averaged only 567 cubic feet per acre and net annual growth of growing stock averaged 20 cubic feet per acre. Of the timberland acres with a regeneration opportunity, 83 percent were classified as hardwood, 11 percent as oak–pine, and 6 percent as pine forest types. This represents species currently growing and does not necessarily reflect the best-suited or pre-harvest species.

In addition to the 1.3 million acres of poorly stocked timberland, 437,000 acres of idle cropland represent a regeneration opportunity. In the past, these acres have been a major source of new stands and represent a relatively inexpensive way to maintain Virginia's pine resource. Including both poorly stocked timberland and idle cropland, regeneration opportunities exist on 1.7 million acres. Since NIPF owners control 89 percent of the acres in need of regeneration, efforts to correct and improve the situation should be directed toward this ownership category.

Help Is Available

Several sources of financial and professional assistance are available to aid Virginia's NIPF land owners in timberland management. The Stewardship Incentives Program, the Forestry Incentives Program, the Agriculture Conservation Program, and the Conservation Reserve Program are all Federal cost-share programs designed to aid NIPF landowners with the cost of tree planting and other timber management practices. The State also offers cost-share assistance in the Reforestation of Timberlands (RT) program. In addition, professional advice and services are available through the Department of Forestry, Commonwealth of Virginia; the Cooperative Extension Services, Virginia Polytechnic Institute; and private forestry consultants. Many forest products companies also offer lease arrangements, cooperative agreements, and technical assistance to private landowners.

Literature Cited

Bechtold, William A.; Brown, Mark J.; Tansey, John B. 1987. Virginia's forests. Resour. Bull. SE-95. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southeastern Forest Experiment Station. 89 p.

Brown, Mark J. 1990. Harvest rates on adverse sites in the Southeast. Southern Journal of Applied Forestry. 14(4):166-170.

Cost, Noel D. 1978. Multiresource inventories—a technique for measuring volume in standing trees. Res. Pap. SE-196. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southeastern Forest Experiment Station. 18 p.

Hanson, Mark H.; Frieswyk, Thomas; Glover, Joseph F.; Kelly, John F. 1992. The eastwide forest inventory data base: users manual. Gen. Tech. Rep. NC-151. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 48 p.

Hutchins, Cecil C., Jr. 1992. Changes in output of industrial timber products in Virginia, 1987-1989. Resour. Bull. SE-129. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southeastern Forest Experiment Station. 18 p.

Hutchins, Cecil C., Jr. 1991. Southern pulpwood production, 1989. Resour. Bull. SE-119. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southeastern Forest Experiment Station. 28 p.

Knight, Herbert A.; McClure, Joe P. 1977. Virginia's timber. Resour. Bull. SE-44. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southeastern Forest Experiment Station. 53 p.

Saucier, Joseph R.; Cubbage, Frederick W., comps. 1990. Proceedings of southern plantationwood quality workshop: a workshop on management, utilization, and economics of the South's changing pine resource; 1989 June 6-7; Athens, GA. Gen. Tech. Rep. SE-63. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southeastern Forest Experiment Station. 95 p.

Sheffield, Raymond M.; Cost, Noel D.; Bechtold, William A.; McClure, Joe P. 1985. Pine growth reductions in the Southeast. Resour. Bull. SE-83. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southeastern Forest Experiment Station. 112 p.

Skog, Kenneth E.; Waterson, Irene A. 1986. Residential fuelwood use in the United States: 1980-1981. Resour. Bull. WO-3. Washington, DC: U.S. Department of Agriculture. 45 p.

U.S. Department of Agriculture, Forest Service. 1988. The South's fourth forest: alternatives for the future. For. Resour. Rep. 24. Washington, DC. 512 p.

U.S. Department of Agriculture, Forest Service. 1992. Forest Service resource inventories: an overview. Washington, DC. 39 p.

U.S. Department of Commerce, Bureau of the Census. 1991. 1987 census of manufacturers, geographic area series, Virginia. MC87-A-47. Washington, DC. 55 p. plus appendix.

U.S. Department of Commerce, Bureau of the Census. 1991. 1989 county business patterns, Virginia. CBP-89-48. Washington, DC. 235 p.

Appendix

Procedure

The procedures used in the sixth statewide inventory and evaluation of Virginia's forest resources included several basic steps.

1. Initial estimates of forest and nonforest areas were based on the classification of 78,669 sample clusters systematically spaced on the latest available aerial photographs. A subsample of 7,007 of the 16-point clusters was ground checked, and a linear regression was fitted to the data to develop the relationship between the photo and ground classification of the subsample. This procedure provides a means for adjusting the initial estimates of area for changes in land use since date of photography and for photo misclassification.

2. Estimates of timber volume and forest classification were based on measurements recorded at 4,235 ground sample locations systematically distributed on timberland. The plot design at each location was based on a cluster of 10 points. In most cases, variable plots, established by using a basal-area factor of 37.5 square feet per acre, were systematically spaced within a single forest condition at 5 of the 10 cluster points. Trees less than 5 inches d.b.h. were tallied on a fixed-radius plot around each point center.

3. Seedlings, shrubs, vines, grasses, forbs, and other lesser vegetation occurring within a 36-foot radius of selected point centers were identified and recorded at each forest sample location. Each distinctive zone of lesser vegetation was classified based on its height, density, and species composition. When merged with the tree tally, this information provided a vegetative profile of each condition sampled. Additional nontimber attributes measured or classified included land use, terrain features, soils, erosion, litter, water, snags, tree cavities, livestock grazing, and recreational use.

4. Equations prepared from detailed measurements collected on standing trees in Virginia, and similar measurements taken throughout the Southeast, were used to compute the volume of individual tally trees. A mirror caliper and sectional aluminum poles were used to obtain the additional measurements required to construct volume equations (Cost 1978). Forest biomass estimates were made with equations developed by the Utilization

of Southern Timber Research Work Unit of the Southeastern Forest Experiment Station in Athens, GA. In addition, felled trees were measured at 104 active cutting operations to provide utilization factors for the different timber products and species groups and to supplement the standing-tree volume study.

5. Growth, removals, and mortality were estimated from the remeasurement of 4,324 permanent sample plots established at the time of the 1986 inventory. Periodic surveys of timber products output, conducted in cooperation with the Division of Forestry, along with the annual pulpwood production study for the South, provided additional information for breakdowns of removals by product.

6. Ownership information was collected from correspondence, public records, and local contacts. In counties where the sample missed a particular ownership class, temporary samples were added and measured to describe forest conditions within the ownership class.

7. All field data were sent to Asheville for editing and were entered into disk and magnetic-tape storage for processing. Final estimates were based on statistical summaries of the data.

Reliability of the Data

Statistical analysis of these data indicates a sampling error of ± 0.24 percent for the estimate of timberland, 1.14 percent for total growing-stock volume, 1.29 percent for growing-stock growth, and 4.65 percent for growing-stock removals. As the totals are broken down by forest type, species, tree diameter, or other subdivisions, the sampling error increases. If homogeneity of variances is assumed, the order of this increase may be approximated by using the following tabulation showing the sampling errors in terms of one standard error, or two chances out of three. For example, a subset of the State totals with an estimate of 7.9 billion cubic feet would have an estimated sampling error of 2 percent, or 0.16 billion cubic feet. This means that, two times out of three, the true growing-stock volume for this subset would be within the range defined by 7.9 ± 0.16, or from 7.7 to 8.1 billion cubic feet.

Sampling error for selected areas and volumes[1]

Sampling error[2] (percent)	Timberland	Volume of growing stock: Inventory	Net growth	Removals
	M acres	*Million cubic feet*		
1	889.8	--	--	--
2	222.4	8,605.6	353.0	--
3	98.9	3,824.7	156.9	1,439.2
4	55.6	2,151.4	88.2	809.6
5	35.6	1,376.9	56.5	518.1
10	8.9	344.2	14.1	129.5
15	4.0	153.0	6.3	57.6
20	2.2	86.1	3.5	32.4
25	1.4	55.1	2.3	20.7

[1] Sampling error of volume or area totals in question may be computed with the following formula:

$$SE_s = SE_t \frac{\sqrt{X_t}}{\sqrt{X_s}},$$

where

SE_s = sampling error for subdivision of Survey Unit or State total,

SE_t = sampling error for Survey Unit or State total,

X_s = sum of values for the variable of interest (area or volume) for subdivision of Survey Unit or State,

X_t = total area or volume for Survey Unit or State.

[2] By random-sampling formula.

Definitions

Basal area. The area in square feet of the cross section at breast height of a single tree or of all the trees in a stand, usually expressed in square feet per acre.

Biomass. The aboveground green weight of solid wood and bark in live trees 1.0 inch d.b.h. and larger from the ground to the tip of the tree. All foliage is excluded. The weight of wood and bark in lateral limbs, secondary limbs, and twigs under 0.5 inch in diameter at the point of occurrence on sapling-size trees is included but is excluded on poletimber and sawtimber-size trees.

Bole. That portion of a tree between a 1-foot stump and a 4-inch top diameter outside bark (d.o.b.) in trees 5.0 inches d.b.h. and larger.

Broad management class. A classification of timberland based on forest type and stand origin.

Pine plantation. Stands that have been artificially regenerated by planting or direct seeding and with a southern yellow pine, white pine–hemlock, or other softwood forest type.

Natural pine. Stands that have not been artificially regenerated and with a southern yellow pine, white pine–hemlock, or other softwood forest type.

Oak–pine. Stands with a forest type of oak–pine.

Upland hardwood. Stands with a forest type of oak–hickory, chestnut oak, southern scrub oak, or maple–beech–birch.

Lowland hardwood. Stands with a forest type of oak–gum–cypress, elm–ash–cottonwood, palm, or other tropical.

Census water. Streams, sloughs, estuaries, canals, and other moving bodies of water one-eighth of a statute mile in width and greater, lakes, reservoirs, ponds, and other permanent bodies of water 40 acres in area and greater.

Commercial forest land. (see: Timberland).

Commercial species. Tree species currently or potentially suitable for industrial wood products. Noncommercial species are excluded.

Cropland. Land under cultivation within the past 24 months, including orchards and land in soil-improving crops but excluding land cultivated in developing improved pasture. Also includes idle farmland.

D.b.h. Tree diameter in inches (outside bark) at breast height (4.5 feet above the ground).

Diameter class. A classification of trees based on tree d.b.h. Two-inch diameter classes are commonly used by Forest Inventory and Analysis, with the even inch as the approximate midpoint for a class. For example, the 6-inch class includes trees 5.0–6.9 inches d.b.h.

Farm. Land on which agricultural operations are being conducted and sale of agricultural products totaled $1,000 or more during the year.

Farm operator. A person who operates a farm, either doing the work or directly supervising the work.

Farmer-owned land. (see: Other private land).

Forest industry land. Land owned by companies or individuals operating primary wood-using plants.

Forest industry-leased land. Land leased or under management contracts to forest industry from other owners for periods of one forest rotation or longer. Land under cutting contracts is not included.

Forest land. Land at least 16.7 percent stocked by forest trees of any size, or formerly having had such tree cover, and not currently developed for nonforest use.

Forest type. A classification of forest land based on the species forming a plurality of live-tree stocking.

White pine–hemlock. Forests in which eastern white pine, red pine, or jack pine, singly or in combination, constitute a plurality of the stocking. (Common associates include hemlock, birch, and maple.)

Spruce–fir. Forests in which spruce or true firs, singly or in combination, constitute a plurality of the stocking. (Common associates include maple, birch, and hemlock.)

Longleaf–slash pine. Forests in which longleaf or slash pine, singly or in combination, constitute a plurality of the stocking. (Common associates include oak, hickory, and gum.)

Loblolly–shortleaf pine. Forests in which loblolly pine, shortleaf pine, or other southern yellow pines, except longleaf or slash pine, singly or in combination, constitute a plurality of the stocking. (Common associates include oak, hickory, and gum.)

Oak–pine. Forests in which hardwoods (usually upland oaks) constitute a plurality of the stocking but in which pines account for 25 to 50 percent of the stocking. (Common associates include gum, hickory, and yellow-poplar.)

Oak–hickory. Forests in which upland oaks or hickory, singly or in combination, constitute a plurality of the stocking, except where pines account for 5 to 50 percent, in which case the stand would be classified oak–pine. (Common associates include yellow-poplar, elm, maple, and black walnut.)

Oak–gum–cypress. Bottom-land forests in which tupelo, blackgum, sweetgum, oaks, or southern cypress, singly or in combination, constitue a plurality of the stocking, except where pines account for 25 to 50 percent, in which case the stand would be classified oak–pine. (Common associates include cottonwood, willow, ash, elm, hackberry, and maple.)

Elm–ash–cottonwood. Forests in which elm, ash, or cottonwood, singly or in combination, constitute a plurality of the stocking. (Common associates include willow, sycamore, beech, and maple.)

Maple–beech–birch. Forests in which maple, beech, or yellow birch, singly or in combination, constitute a plurality of the stocking. (Common associates include hemlock, elm, basswood, and white pine.)

Palm, other tropicals. Forests in which palms and other tropicals constitute a plurality of the stocking.

Gross growth. Annual increase in merchantable volume of trees in the absence of cutting and mortality. (Gross growth includes survivor growth, ingrowth, growth on ingrowth, growth on removals prior to removal, and growth on mortality prior to death.)

Growing-stock trees. Live sawtimber-size trees of commercial species containing at least a 12-foot log, or two noncontiguous saw logs each 8 feet or longer, meeting minimum grade requirements (hardwoods must qualify as a log grade of either 3 or 4; softwoods must qualify as a log grade 3) with at least one-third of the gross board-foot volume (International 1/4-inch rule) between a 1-foot stump and the minimum saw-log top being sound, or a live tree below sawtimber size that will prospectively qualify under the above standards.

Growing-stock volume. Volume (cubic feet) of solid wood in growing-stock trees 5.0 inches d.b.h. and larger, from a 1-foot stump to a minimum 4.0-inch top diameter, outside bark, on the central stem. Volume of solid wood in primary forks from the point of occurrence to a minimum 4.0-inch top diameter outside bark is included.

Hardwoods. Angiosperms; dicotyledonous trees (including all palm species, which are monocotyledonous), usually broadleaf and deciduous.

Soft hardwoods. Soft-textured hardwoods, such as boxelder, red and silver maples, hackberry, loblolly–bay, sweetgum, yellow-poplar, magnolia, sweetbay, water tupelo, blackgum, sycamore, cottonwood, black cherry, willow, basswood, and elm.

Hard hardwoods. Hard-textured hardwoods such as sugar maple, birch, hickory, dogwood, persimmon (forest grown), black locust, beech, ash, honeylocust, holly, black walnut, mulberry, and all commercial oaks.

Idle farmland. Cropland, orchard, improved pasture, and farm sites not tended within the past 2 years, and currently less than 16.7 percent stocked with live trees.

Improved pasture. Land currently improved for grazing by cultivation, seeding, irrigation, or clearing of trees or brush.

Industrial wood. All roundwood products except fuelwood.

Ingrowth. The number or net volume of trees that grow large enough during a specified year to qualify as saplings, poletimber, or sawtimber.

Land area. The area of dry land and land temporarily or partly covered by water, such as marshes, swamps, and river floodplains (omitting tidal flats below mean high tide), streams, sloughs, estuaries, and canals less than one-eighth of a statute mile in width and greater, lakes, reservoirs, and ponds less than 40 acres in area.

Live trees. All trees 1.0 inch d.b.h. and larger that are not dead at the time of inventory.

Live-tree volume. Volume (cubic feet) of wood above the ground line in live trees 1.0 inch d.b.h. and larger. The volume in twigs and lateral limbs smaller than 0.5 inch in diameter at the point of occurrence on sapling-size trees is included but is excluded on poletimber and sawtimber-size trees.

Log grade. A classification of logs based on external characteristics as indicators of quality or value.

Logging residues. The unused merchantable portion of growing-stock trees cut or destroyed during logging operations.

Manageable stand. Timberland at least 60 percent stocked with growing-stock trees that can be featured together under a management scheme.

Merchantable portion. That portion of live trees 5.0 inches d.b.h. and larger between a 1-foot stump and a minimum 4.0-inch top diameter outside bark on the central stem. That portion of primary forks from the point of occurrence to a minimum 4.0-inch top diameter outside bark is included.

Merchantable volume. Solid-wood volume in merchantable portion of live trees.

Miscellaneous Federal land. Federal land other than national forests, land administered by the Bureau of Land Management, and land administered by the Bureau of Indian Affairs.

Miscellaneous private land. (see: Other private land).

Mortality. The merchantable volume in trees that have died from natural causes during a specified period.

National forest land. Federal land that has been legally designated as national forests or purchase units, and other land under the administration of the Forest Service, including experimental areas and Bankhead–Jones Title III land.

Net annual growth. The net change in merchantable volume for a specific year in the absence of cutting (gross growth minus mortality for that specified year).

Net volume. Gross volume of wood less deductions for rot, sweep, or other defect affecting use for timber products.

Noncommercial species. Tree species of typically small size, poor form, or inferior quality that normally do not develop into trees suitable for industrial wood products.

Nonforest land. Land that has never supported forests and land formerly forested where timber production is precluded by development for other uses.

Nonindustrial private forest (NIPF) land. (see: Other private land).

Nonstocked forest land. Timberland less than 16.7 percent stocked with growing-stock trees.

Other private land. Privately owned land excluding forest industry land or forest industry-leased land. Also referred to as nonindustrial private forest (NIPF) land.

Farmer-owned land. Owned by farm operators, excluding incorporated farm ownerships.

Other individual land. Owned by individuals other than farm operators.

Other corporate land. Owned by corporations, including incorporated farm ownerships.

Other removals. The growing-stock volume of trees removed from the inventory by cultural operations such as timber stand improvement, land clearing, and other changes in land use that result in the removal of the trees from timberland.

Plant residues. Wood material generated in the production of timber products at primary manufacturing plants.

Coarse residues. Material, such as slabs, edgings, trim, veneer cores and ends, which is suitable for chipping.

Fine residues. Material, such as sawdust, shavings, and veneer chippings, which is not suitable for chipping.

Plant byproducts. Residues (coarse or fine) utilized in the further manufacture of industrial products or for consumer use, or utilized as fuel.

Unused plant residues. Residues (coarse or fine) that are not used for any product, including fuel.

Poletimber-size trees. Live trees at least 5.0 inches d.b.h. but smaller than sawtimber size.

Primary wood-using plants. Industries that receive roundwood or chips from roundwood for the manufacture of products, such as veneer, pulp, and lumber.

Productive-reserved forest land. (see: Reserved timberland).

Rangeland. Land on which the natural vegetation is predominantly native grasses, grasslike plants, forbs, or shrubs valuable for forage, not qualifying as timberland and not developed for another land use. Rangeland includes natural grassland and savannah.

Reserved timberland. Forest land sufficiently productive to qualify as timberland but withdrawn from timber utilization through statute or administrative designation.

Rotten trees. Live trees of commercial species that do not contain at least one 12-foot saw log, or two noncontiguous saw logs, each 8 feet or longer, now or prospectively, primarily because of rot or missing sections, and with less than one-third of the gross board-foot tree volume in sound material.

Rough trees. Live trees of commercial species that do not contain at least one 12-foot saw log, or two noncontiguous saw logs, each 8 feet or longer, now or prospectively, primarily because of roughness, poor form, splits, and cracks, and with less than one-third of the gross board-foot tree volume in sound material; and live trees of noncommercial species.

Roundwood (roundwood logs). Logs, bolts, or other round sections cut from trees for industrial or consumer uses.

Roundwood chipped. Any timber cut primarily for pulpwood, delivered to nonpulpmills, chipped, and then sold to pulpmills as residues, including chipped tops, jump sections, whole trees, and pulpwood sticks.

Roundwood products. Any primary product, such as lumber, poles, pilings, pulp, or fuelwood, that is produced from roundwood.

Salvable dead trees. Standing or down dead trees considered utilizable by Forest Inventory and Analysis standards.

Saplings. Live trees 1.0 to 5.0 inches d.b.h.

Saw log. A log meeting minimum standards of diameter, length, and defect, including logs at least 8 feet long, sound and straight, and with a minimum diameter inside bark for softwoods of 6 inches (8 inches for hardwoods).

Saw-log portion. That part of the bole of sawtimber trees between a 1-foot stump and the saw-log top, including the portion of forks large enough to contain a saw log.

Saw-log top. The point on the bole of sawtimber trees above which a conventional saw log cannot be produced. The minimum saw-log top is 7.0 inches in diameter outside bark (d.o.b.) for softwoods and 9.0 inches (d.o.b.) for hardwoods.

Sawtimber-size trees. Softwoods 9.0 inches d.b.h. and larger and hardwoods 11.0 inches d.b.h. and larger.

Sawtimber volume. Growing-stock volume in the sawlog portion of sawtimber-size trees in board feet (International 1/4-inch rule).

Seedlings. Trees less than 1.0 inch in d.b.h. Only seedlings of a commercial species that are not overtopped and are more than 6 inches tall for softwoods and 1 foot tall for hardwoods are counted.

Site class. A classification of forest land in terms of inherent capacity to grow crops of industrial wood based on fully stocked natural stands, by annual production capacity.

Softwoods. Gymnosperms; in the order Coniferales, usually evergreen (includes the genus *Taxodium*, which is deciduous), having needles or scalelike leaves.

Pines. Yellow pine species, which include loblolly, longleaf, slash, pond, shortleaf, pitch, Virginia, sand, spruce, and Table Mountain pines.

Other softwoods. Cypress, eastern red-cedar, white cedar, eastern white pine, eastern hemlock, spruce, and fir.

Stand-size class. A classification of forest land based on the diameter class distribution of live trees in the stand.

Sawtimber stands. Stands at least 16.7 percent stocked with live trees, with half or more of total stocking in sawtimber and poletimber trees, and with sawtimber stocking at least equal to poletimber stocking.

Poletimber stands. Stands at least 16.7 percent stocked with live trees, of which half or more of total stocking is in poletimber and sawtimber trees, and with poletimber stocking exceeding that of sawtimber.

Sapling–seedling stands. Stands at least 16.7 percent stocked with live trees of which more than half of total stocking is saplings and seedlings.

State, county, and municipal land. Land owned by States, counties, and local public agencies or municipalities, or land leased to these governmental units for 50 years or more.

Stocking. The degree of occupancy of land by trees, measured by basal area or the number of trees in a stand and spacing in the stand, compared with a minimum standard, depending on tree size, required to fully utilize the growth potential of the land.

Fully stocked. 100 percent or more stocking.

Medium stocked. 60 to 89 percent stocking.

Poorly stocked. Less than 60 percent stocking.

Density of trees and basal area per acre required for full stocking

D.b.h. class	*Trees per acre for full stocking*	*Basal area per acre*
Seedlings	600	--
2	560	--
4	460	--
6	340	67
8	240	84
10	155	85
12	115	90
14	90	96
16	72	101
18	60	106
20	51	111

Survivor growth. The merchantable volume increment on trees 5.0 inches d.b.h. and larger in the inventory at the beginning of the year and surviving to its end.

Timberland. Forest land that is capable of producing 20 cubic feet of industrial wood per acre per year and not withdrawn from timber utilization.

Timber products. Roundwood products and byproducts.

Timber removals. The merchantable volume of trees removed from the inventory by harvesting, cultural operations, such as stand improvement, land clearing, or changes in land use.

Top. The portion of the main stem and forks from a 4.0-inch diameter outside bark to the tips of the main stem and forks, plus all other limbs above the 4.0-inch top at least 0.5 inch in diameter at their point of occurrence.

Treatment opportunity. A classification of the management or treatment that would most improve for timber production the existing condition of the stand being sampled.

Tree. Woody plants having one erect perennial stem or trunk at least 3 inches d.b.h., a more or less definitely formed crown of foliage, and a height of at least 13 feet.

Tree grade. A classification of sawtimber trees based on the log grade of the butt log in the tree.

Unproductive forest land. (see: Woodland).

Upper-stem portion. That part of the main stem or fork of sawtimber trees above the saw-log top to minimum top diameter 4.0 inches outside bark or to the point where the main stem or fork breaks into limbs.

Urban and other areas. Areas developed for residential, industrial, or recreational purposes, school yards, cemeteries, roads, railroads, airports, beaches, powerlines and other rights-of-way, or other nonforest land not included in any other specified land use class.

Woodland. Forest land incapable of producing 20 cubic feet per acre per year of industrial wood under natural conditions, because of adverse site conditions.

CONVERSION FACTORS

Cubic feet of wood per average cord (excluding bark)

D.b.h. class	All species	Pine	Other softwood	Hardwood
6	60.6	61.0	68.2	60.0
8	68.5	68.1	78.0	68.4
10	73.5	73.1	81.4	73.4
12	76.7	76.7	85.2	76.4
14	78.8	79.4	88.2	78.4
16	80.4	81.8	90.4	79.8
18	81.4	83.3	92.4	80.8
20	82.3	84.8	93.3	81.5
22	82.8	86.0	95.1	82.1
24+	83.9	87.7	97.8	83.0
Average	74.9	72.0	85.0	75.3

Rough cord per M cubic feet (without bark) =

$$a + b\left(\frac{1}{d.b.h.}\right) + c\left(\frac{1}{d.b.h.}\right)^2$$

Where	*Pine*	*Other softwoods*	*Hardwoods*
a =	10.01850	9.15960	11.88410
b =	34.42135	28.75973	3.74431
c =	22.73994	25.54418	157.39417

Metric equivalents of units used in this report

1 acre = 4,046.86 square meters or 0.404686 hectare
1 cubic foot = 0.028317 cubic meter
1 inch = 2.54 centimeters or 0.0254 meter
Breast height (4.5 feet) = 1.4 meters above ground level
1 square foot = 929.03 square centimeters or 0.0929 square meter
1 square foot per acre basal area = 0.229568 square meter per hectare
1 pound = 0.454 kilogram
1 ton = 0.907 metric ton

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Table 1—Area, by land class, Virginia, 1992

Land class	Area
	Acres
Forest land	
Timberland	15,447,550
Reserved timberland	531,980
Woodland	47,344
Total	16,026,874
Nonforest land	
Cropland	3,332,421
Pasture and range	3,030,334
Other[1]	3,020,220
Total	9,382,975
All land[2]	25,409,849

[1] Includes swampland, industrial, and urban areas, other nonforest land, and 137,148 acres classed as water by Forest Inventory and Analysis standards but defined by Bureau of Census as land.
[2] From the U.S. Bureau of Census, 1980.

Table 2—Area of timberland, by ownership class, Virginia, 1992

Ownership class	Area
	Acres
National forest	1,468,126
Other Federal	
Bureau of Land Management	--
Indian	425
Miscellaneous Federal	220,854
Total	221,279
State	211,364
County and municipal	82,517
Forest industry	1,537,397
Forest industry-leased	17,366
Other private	
Farmer	3,870,366
Other individual	6,489,600
Other corporate	1,549,535
Total	11,909,501
All ownerships	15,447,550

Table 3—Area of timberland, by stand-size and ownership classes, Virginia, 1992

Stand-size class	All ownerships	National forest	Other public	Forest industry	Forest industry-leased	Other private
			Acres			
Sawtimber	7,599,417	841,089	310,217	442,594	4,581	6,000,936
Poletimber	4,710,024	497,721	130,266	506,026	12,785	3,563,226
Sapling and seedling	3,034,010	124,463	70,867	564,613	--	2,274,067
Nonstocked	104,099	4,853	3,810	24,164	--	71,272
All classes	15,447,550	1,468,126	515,160	1,537,397	17,366	11,909,501

Table 4—Area of timberland, by stand-volume and ownership classes, Virginia, 1992

Stand volume class (board feet/acre[1])	All ownerships	National forest	Other public	Forest industry	Forest industry-leased	Other private
			Acres			
Less than 2,000	5,488,428	398,914	119,623	925,012	1,338	4,043,541
2,000 - 3,999	2,383,471	259,854	68,957	158,851	8,639	1,889,170
4,000 - 5,999	1,884,694	229,663	88,933	100,855	2,808	1,462,335
6,000 - 7,999	1,878,108	234,157	60,547	88,695	4,581	1,490,128
8,000 - 9,999	1,271,602	157,254	44,660	77,203	--	992,485
10,000 or more	2,541,247	188,284	134,440	186,681	--	2,031,842
All classes	15,447,550	1,468,126	515,160	1,537,397	17,366	11,909,501

[1] International 1/4-inch rule.

Table 5—Area of timberland, by stocking class of growing-stock trees and ownership class, Virginia, 1992

Stocking class	All ownerships	National forest	Other public	Forest industry	Forest industry-leased	Other private
			Acres			
Overstocked	849,365	57,802	43,798	152,715	2,003	593,047
Fully stocked	5,396,605	390,162	180,229	779,260	15,363	4,031,591
Moderately stocked	6,930,673	832,250	233,685	471,118	--	5,393,620
Poorly stocked	2,037,749	183,059	53,638	88,092	--	1,702,960
Nonstocked	233,158	4,853	3,810	36,212	--	188,283
All classes	15,447,550	1,468,126	515,160	1,537,397	17,366	11,909,501

Table 6—Area of timberland, by site and ownership classes, Virginia, 1992

Site class (ft^3/acre/year)	All ownerships	National forest	Other public	Forest industry	Forest industry-leased	Other private
			Acres			
> 164	144,645	9,022	5,493	11,923	--	118,207
120-164	419,272	21,837	8,094	30,200	--	359,341
85-119	3,297,378	97,726	142,038	326,740	11,447	2,719,427
50-84	9,542,524	745,036	301,363	1,060,351	5,919	7,429,855
20-49	2,043,731	594,705	58,172	108,183	--	1,282,671
All classes	15,447,550	1,468,126	515,160	1,537,397	17,366	11,909,501

Table 7—Area of timberland, by forest type and site index class, Virginia, 1992

Forest type	All classes	Site index class (50-year basal)								
		< 50	50-59	60-69	70-79	80-89	90-99	100-109	110-119	> 119
					Acres					
Softwood types										
White pine–hemlock	216,920	3,599	9,024	54,081	64,235	57,825	18,161	9,995	--	--
Spruce–fir	--	--	--	--	--	--	--	--	--	--
Longleaf pine	--	--	--	--	--	--	--	--	--	--
Slash pine	--	--	--	--	--	--	--	--	--	--
Loblolly pine	1,998,447	3,388	17,204	323,190	1,033,158	468,560	136,030	11,925	2,982	--
Shortleaf pine	118,428	4,143	27,853	42,792	36,937	--	4,011	3,692	--	--
Virginia pine	802,645	15,843	78,716	323,445	305,480	63,533	15,628	--	--	--
Sand pine	--	--	--	--	--	--	--	--	--	--
Eastern redcedar	87,498	--	12,577	36,645	38,276	--	--	--	--	--
Pond pine	1,753	--	1,753	--	--	--	--	--	--	--
Spruce pine	--	--	--	--	--	--	--	--	--	--
Pitch pine	66,119	13,126	22,657	28,710	3,626	--	--	--	--	--
Table Mountain pine	62,941	31,535	27,590	--	3,816	--	--	--	--	--
Total	3,352,751	71,644	197,374	808,863	1,484,528	588,818	173,830	25,612	2,982	--
Hardwood types										
Oak–pine	1,941,207	104,220	247,913	477,609	709,604	275,390	103,751	22,720	--	--
Oak–hickory	8,276,238	165,752	750,228	1,717,471	2,600,829	1,575,440	981,891	390,668	78,327	15,630
Chestnut oak	1,095,830	138,210	368,433	344,802	146,620	77,076	17,577	3,112	--	--
Southern scrub oak	5,002	--	5,002	--	--	--	--	--	--	--
Oak–gum–cypress	392,257	--	20,352	83,496	150,992	93,244	31,495	8,919	2,759	--
Elm–ash–cottonwood	242,764	--	12,034	31,095	72,310	58,092	56,029	13,204	--	--
Maple–beech–birch	141,503	--	8,581	41,006	37,668	34,146	15,156	4,948	--	--
Total	12,094,799	408,182	1,412,543	2,695,479	3,718,023	2,113,388	1,205,699	444,569	81,086	15,630
All types	15,447,550	479,826	1,609,917	3,502,342	5,202,551	2,703,306	1,379,529	470,181	84,068	15,630

Table 8—Area of timberland, by forest type and ownership class, Virginia, 1992

Forest type	All ownerships	Ownership class				
		National forest	Other public	Forest industry	Forest industry-leased	Other private
		Acres				
Softwood types						
White pine–hemlock	216,920	25,910	4,181	5,857	--	180,972
Spruce–fir	--	--	--	--	--	--
Longleaf pine	--	--	--	--	--	--
Slash pine	--	--	--	--	--	--
Loblolly pine	1,996,447	--	78,569	767,941	7,922	1,141,715
Shortleaf pine	118,428	--	4,016	4,394	--	110,018
Virginia pine	802,645	13,170	51,087	52,823	--	685,565
Sand pine	--	--	--	--	--	--
Eastern redcedar	87,498	--	--	--	--	87,498
Pond pine	1,753	--	--	--	--	1,753
Spruce pine	--	--	--	--	--	--
Pitch pine	66,119	30,591	--	--	--	35,528
Table Mountain pine	62,941	37,551	--	1,256	--	24,134
Total	3,352,751	107,222	138,153	832,271	7,922	2,267,183
Hardwood types						
Oak–pine	1,941,207	149,686	54,939	215,709	--	1,520,873
Oak–hickory	8,276,236	825,534	255,580	382,608	9,444	6,803,070
Chestnut oak	1,095,830	369,476	39,374	33,927	--	653,053
Southern scrub oak	5,002	--	--	--	--	5,002
Oak–gum–cypress	392,257	--	9,896	49,147	--	333,214
Elm–ash–cottonwood	242,764	--	16,865	23,735	--	202,164
Maple–beech–birch	141,503	16,208	353	--	--	124,942
Total	12,094,799	1,360,904	377,007	705,126	9,444	9,642,318
All types	15,447,550	1,468,126	515,160	1,537,397	17,366	11,909,501

Table 9—Area of timberland, by forest type and stand-size class, Virginia, 1992

Forest type	All stands	Stand-size class: Sawtimber	Poletimber	Sapling-seedling	Nonstocked areas
			Acres		
Softwood types					
White pine–hemlock	216,920	149,168	27,200	36,040	4,512
Spruce–fir	--	--	--	--	--
Longleaf pine	--	--	--	--	--
Slash pine	--	--	--	--	--
Loblolly pine	1,998,447	540,383	769,513	667,179	19,372
Shortleaf pine	118,428	73,408	32,401	12,619	--
Virginia pine	802,645	302,027	343,964	152,683	3,971
Sand pine	--	--	--	--	--
Eastern redcedar	87,498	8,328	16,792	53,678	8,700
Pond pine	1,753	1,753	--	--	--
Spruce pine	--	--	--	--	--
Pitch pine	66,119	44,746	12,847	8,526	--
Table Mountain pine	62,941	29,392	27,629	5,920	--
Total	3,352,751	1,149,205	1,230,346	938,645	36,555
Hardwood types					
Oak–pine	1,941,207	772,230	577,187	582,487	9,303
Oak–hickory	8,276,236	4,520,304	2,330,651	1,380,118	45,163
Chestnut oak	1,095,830	683,052	391,306	21,472	--
Southern scrub oak	5,002	--	--	5,002	--
Oak–gum–cypress	392,257	203,329	113,683	65,848	9,387
Elm–ash–cottonwood	242,764	143,711	52,924	42,438	3,691
Maple–beech–birch	141,503	127,586	13,917	--	--
Total	12,094,799	6,450,212	3,479,678	2,097,365	67,544
All types	15,447,550	7,599,417	4,710,024	3,034,010	104,099

Table 10—Area of timberland, by forest-type group, detailed forest type, and Survey Unit, Virginia, 1992

Forest-type group and detailed forest type	State	Coastal Plain	Southern Piedmont	Northern Piedmont	Northern Mountains	Southern Mountains
			Acres			
White pine–hemlock						
White pine	163,560	--	6,719	5,796	38,838	111,207
White pine–hemlock	43,934	--	4,944	6,997	17,820	14,173
Hemlock	9,426	--	--	--	4,512	4,914
Total	216,920	--	11,663	13,793	61,170	130,294
Spruce–fir						
Balsam fir	--	--	--	--	--	--
Red spruce–balsam fir	--	--	--	--	--	--
Total	--	--	--	--	--	--
Longleaf–slash						
Longleaf slash	--	--	--	--	--	--
Slash pine	--	--	--	--	--	--
Total	--	--	--	--	--	--
Loblolly–shortleaf						
Loblolly pine	1,996,447	1,259,562	563,447	173,438	--	--
Shortleaf pine	118,428	2,810	103,123	12,495	--	--
Virginia pine	802,645	68,167	406,293	210,600	60,149	57,436
Eastern redcedar	87,498	--	15,189	35,436	13,438	23,435
Pond pine	1,753	1,753	--	--	--	--
Pitch pine	66,119	--	--	4,052	48,190	13,877
Table Mountain pine	62,941	--	--	--	47,841	15,100
Total	3,135,831	1,332,292	1,088,052	436,021	169,618	109,848
Total, all softwoods	3,352,751	1,332,292	1,099,715	449,814	230,788	240,142
Oak–pine						
White pine–N. red oak–white ash	287,436	--	16,149	29,200	128,108	114,979
Eastern red cedar–hardwood	74,423	--	20,450	29,898	9,300	14,775
Longleaf pine–scrub oak	--	--	--	--	--	--
Shortleaf pine–oak	141,391	5,236	99,805	17,918	7,556	10,876
Virginia pine–S. red oak	501,815	51,626	146,575	158,438	106,946	38,232
Loblolly pine–hardwood	709,361	561,494	124,180	23,687	--	--
Slash pine–hardwood	--	--	--	--	--	--
Other oak–pine	226,781	5,282	10,596	30,021	134,489	46,413
Total	1,941,207	623,638	418,755	289,160	386,379	225,275
Oak–hickory						
Post oak–black oak						
Chestnut oak	99,460	5,410	13,086	26,191	21,307	33,466
White oak–red oak–hickory	2,006,523	324,833	460,812	351,823	406,938	462,117
White oak	158,842	33,735	34,575	49,086	26,941	15,506
N. red oak	92,156	--	--	19,482	24,605	48,069
Yellow-poplar–white oak–N. red oak	2,167,007	208,821	810,284	548,165	242,792	556,955
Southern scrub oak	5,002	--	--	--	5,002	--
Sweetgum–yellow-poplar	727,688	412,814	203,369	82,984	--	28,521
Mixed hardwood	3,024,560	384,173	620,642	383,535	855,055	981,154
Total	8,377,068	1,380,372	2,117,220	1,603,351	1,851,855	2,424,270
Oak–gum–cypress						
Swamp chestnut oak–cherrybark oak	20,485	20,485	--	--	--	--
Sweetgum–water oak–willow oak	130,580	105,702	16,499	8,379	--	--
Sugarberry–elm–green ash	94,351	36,263	30,982	27,126	--	--
Overcup oak–water hickory	2,759	2,759	--	--	--	--
Atlantic white cedar	--	--	--	--	--	--
Cypress–water tupelo	40,155	40,155	--	--	--	--
Sweetbay–blackgum–red maple	103,927	99,711	4,216	--	--	--
Total	392,257	305,075	51,677	35,505	--	--
Elm–ash–cottonwood						
River birch–sycamore	178,448	43,270	71,347	32,981	22,887	7,963
Cottonwood	2,936	2,936	--	--	--	--
Willow	18,061	6,770	7,769	3,522	--	--
Sycamore–pecan–elm	43,319	7,913	13,788	12,218	9,400	--
Total	242,764	60,889	92,904	48,721	32,287	7,963
Maple–beech–birch						
Sugar maple–beech–yellow birch	141,503	--	--	--	35,520	105,983
Total	141,503	--	--	--	35,520	105,983
Total, all hardwoods	12,094,799	2,369,974	2,678,556	1,976,737	2,306,041	2,763,491
All types	15,447,550	3,702,266	3,778,271	2,426,551	2,536,829	3,003,633

Table 11—Area of timberland, by stand-age and broad management classes, all ownerships, Virginia, 1992

Stand-age class (years)	All classes	Broad management class				
		Pine plantation	Natural pine	Oak–pine	Upland hardwood	Lowland hardwood
		Acres				
0-10	1,705,241	525,030	119,501	363,584	689,955	27,171
11-20	1,455,053	468,744	211,060	227,336	491,761	56,152
21-30	1,207,990	342,906	288,204	160,660	402,096	14,124
31-40	1,055,712	119,904	277,445	113,824	519,567	24,972
41-50	1,381,383	8,609	325,203	132,799	851,853	42,919
51-60	1,926,517	--	263,851	242,636	1,356,744	63,286
61-70	1,819,932	--	148,808	194,780	1,418,716	59,628
71-80	1,282,400	--	70,466	137,927	1,027,139	46,868
81 +	1,784,681	--	89,586	150,772	1,460,950	83,393
No manageable stand	1,848,641	7,131	88,323	216,889	1,319,790	216,508
All classes	15,447,550	1,472,324	1,880,427	1,941,207	9,518,571	635,021

Table 12—Area of timberland, by stand-age and broad management classes, public ownerships, Virginia, 1992

Stand-age class (years)	All classes	Broad management class				
		Pine plantation	Natural pine	Oak–pine	Upland hardwood	Lowland hardwood
		Acres				
0-10	87,480	12,682	7,052	11,228	56,518	--
11-20	84,401	13,043	10,360	13,722	47,276	--
21-30	103,983	1,677	20,415	23,098	58,320	473
31-40	47,294	4,548	24,644	2,103	15,999	--
41-50	117,948	459	38,729	8,617	68,960	1,183
51-60	186,696	--	31,229	31,569	122,807	1,091
61-70	290,391	--	25,621	13,255	251,515	--
71-80	286,060	--	27,788	47,933	204,251	6,090
81 +	545,941	--	24,423	22,411	485,493	13,614
No manageable stand	233,092	--	2,707	30,689	195,386	4,310
All classes	1,983,286	32,409	212,966	204,625	1,506,525	26,761

Table 13—Area of timberland, by stand-age and broad management classes, forest industry,[1] Virginia, 1992

Stand-age class (years)	All classes	Broad management class				
		Pine plantation	Natural pine	Oak–pine	Upland hardwood	Lowland hardwood
		Acres				
0-10	375,867	234,340	7,101	76,059	53,691	4,676
11-20	309,417	216,917	26,453	19,265	30,230	16,552
21-30	249,672	176,341	30,772	21,311	18,951	2,297
31-40	99,099	48,068	24,346	11,696	14,989	–
41-50	84,757	--	27,658	11,978	38,014	7,107
51-60	78,688	--	15,525	23,346	31,115	8,702
61-70	106,844	--	6,683	14,529	80,628	5,004
71-80	43,560	--	7,705	10,418	23,245	2,192
81 +	94,687	--	8,977	12,059	58,069	15,582
No manageable stand	112,172	--	9,307	15,048	77,047	10,770
All classes	1,554,763	675,666	164,527	215,709	425,979	72,882

[1] Includes 17,366 acres of other private land under long-term lease.

Table 14—Area of timberland, by stand-age and broad management classes, other private ownerships,[1] Virginia, 1992

Stand-age class (years)	All classes	Broad management class				
		Pine plantation	Natural pine	Oak–pine	Upland hardwood	Lowland hardwood
		Acres				
0-10	1,241,894	275,008	105,348	276,297	559,746	22,495
11-20	1,061,235	238,784	174,247	194,349	414,255	39,600
21-30	854,335	164,888	237,017	116,251	324,825	11,354
31-40	909,319	67,288	228,455	100,025	488,579	24,972
41-50	1,158,678	8,150	258,816	112,204	744,879	34,629
51-60	1,681,133	--	217,097	187,721	1,202,822	53,493
61-70	1,422,697	--	114,504	166,996	1,086,573	54,624
71-80	952,780	--	34,975	79,576	799,643	38,586
81 +	1,144,053	--	56,166	116,302	917,388	54,197
No manageable stand	1,503,377	7,131	76,309	171,152	1,047,357	201,428
All classes	11,909,501	764,249	1,502,934	1,520,873	7,586,067	535,378

[1] Excludes 17,366 acres of other private land under long-term lease to forest industry.

Table 15—Basal area per acre of live trees 5.0 inches d.b.h. and larger, by broad management class, species group, and ownership class, Virginia, 1992

Broad management class and species group	All ownerships	National forest	Other public	Forest industry	Forest industry-leased	Other private
			Square feet			
Pine plantation						
Softwood	55.2	75.1	51.8	52.2	127.6	57.3
Hardwood	5.4	--	8.3	5.2	--	5.5
Total	60.6	75.1	60.1	57.4	127.6	62.8
Natural pine						
Softwood	72.0	71.8	82.7	80.7	--	89.9
Hardwood	19.7	26.3	22.5	19.6	--	19.1
Total	91.7	98.1	105.2	100.4	--	89.0
Oak-pine						
Softwood	25.9	30.5	26.1	21.5	--	26.2
Hardwood	41.7	50.6	44.7	33.6	--	42.2
Total	67.6	81.1	70.8	55.1	--	68.3
Upland hardwood						
Softwood	3.9	3.9	4.4	3.9	7.6	3.9
Hardwood	79.6	87.2	88.6	64.2	97.6	79.1
Total	83.5	91.2	93.0	68.1	105.1	83.0
Lowland hardwood						
Softwood	5.6	--	4.1	9.4	--	5.2
Hardwood	81.8	--	121.2	71.7	--	80.1
Total	87.4	--	125.3	81.2	--	85.3
All classes						
Softwood	21.3	11.7	25.7	36.9	87.6	19.6
Hardwood	58.9	78.9	68.2	29.3	32.6	60.8
Total	80.2	90.6	93.9	66.3	120.1	80.4

Note: Data may not add to totals because of rounding.

Table 16—Area of reserved timberland and woodland, by forest-type group, Virginia, 1992

Forest-type group	All areas	Reserved timberland	Woodland
		Acres	
White pine-hemlock	9,358	9,358	--
Spruce-fir	--	--	--
Longleaf-slash pine	--	--	--
Loblolly-shortleaf pine	48,526	43,104	5,422
Oak-pine	22,227	22,227	--
Oak-hickory	421,423	382,240	39,183
Oak-gum-cypress	67,852	65,113	2,739
Elm-ash-cottonwood	9,938	9,938	--
Maple-beech-birch	--	--	--
All types	579,324	531,980	47,344

Table 17—Number of live trees on timberland, by species and diameter class, Virginia, 1992

Species	All classes	1.0-2.9	3.0-4.9	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0 and larger
					Diameter class (inches at breast height)								
	Thousand trees												
Softwood													
Longleaf pine	–	–	–	--	–	–	--	–	–	–		--	--
Slash pine	–	–	–	--	–	–	–	--	–	–	--		
Shortleaf pine	80,489	16,772	16,878	16,815	12,997	9,009	5,016	2,027	698	191	86	–	--
Loblolly pine	960,922	317,206	258,739	184,128	111,276	47,249	21,703	10,145	5,394	2,793	1,350	932	7
Pond pine	518	--	–	--	76	167	108	36	33	60	29	6	3
Virginia pine	613,167	248,344	146,939	97,272	62,957	34,798	15,898	5,250	1,348	322	29	10	--
Pitch pine	35,108	11,006	5,202	3,294	4,946	4,168	3,366	1,972	745	282	109	18	--
Table Mountain pine	25,048	5,745	4,847	4,364	4,664	2,749	1,508	859	276	21	15	–	--
Spruce pine	–	--	–	--	–	–	--	--	–	–		–	-
Sand pine		--	–	--		–	–	--	--	--	–	–	--
Eastern white pine	173,068	86,860	36,881	15,610	11,210	8,316	4,927	2,991	2,665	1,557	1,099	918	34
Eastern hemlock	52,728	24,400	13,091	6,293	3,754	1,821	1,390	574	567	266	192	280	98
Spruce and fir	1,574	1,302	–	--	106	–	137	29	--	--	--	–	--
Baldcypress	937		–	143	–	100	70	169	112	91	90	109	53
Pondcypress	176	–	--	--	32	–	26	--	31	12	19	32	24
Cedars	231,894	155,250	51,970	17,579	4,576	1,580	564	246	129	--	--	--	
Total softwoods	2,175,627	866,885	534,547	345,498	216,594	109,957	54,713	24,298	11,998	5,595	3,018	2,305	219
Hardwood													
Select white oaks[1]	544,067	247,649	97,779	65,055	40,745	33,454	22,886	14,883	9,675	5,389	2,921	3,292	339
Select red oaks[2]	195,315	85,293	36,989	19,749	12,536	10,747	8,811	6,770	4,902	3,328	2,335	3,415	440
Chestnut oak	388,811	98,662	74,340	63,892	54,848	35,028	23,291	14,984	8,879	6,358	3,465	4,375	489
Other white oaks	47,331	29,511	7,691	2,500	3,257	1,808	1,093	712	375	192	87	79	26
Other red oaks	639,730	336,261	98,522	64,339	48,690	34,631	21,823	15,252	8,980	5,506	2,634	2,939	153
Hickory	466,407	270,990	85,805	39,647	26,999	17,558	11,201	6,613	3,778	1,899	1,014	856	47
Yellow birch	4,794	2,800	542	691	79	388	–	135	25	40	51	43	
Hard maple	131,596	82,415	25,489	10,187	5,555	3,046	1,716	1,430	775	375	259	303	47
Soft maple	1,618,900	1,164,859	251,218	95,692	48,028	24,463	16,019	9,247	4,227	2,239	1,443	1,339	126
Beech	183,732	122,453	27,559	9,128	6,990	4,824	3,938	2,864	2,092	1,646	898	1,233	107
Sweetgum	752,244	514,351	138,265	45,218	23,286	14,034	7,362	4,512	2,094	928	541	591	62
Tupelo and blackgum	692,110	541,770	89,696	27,251	13,087	8,722	5,450	2,632	1,627	787	438	539	111
Ash	168,086	98,255	32,644	16,986	8,647	4,931	3,339	1,780	1,088	590	452	311	63
Cottonwood	274	–	160	–		70	32		--	–	–	12	
Basswood	21,663	8,097	3,233	2,880	2,024	1,659	1,245	840	749	406	207	267	46
Yellow-poplar	628,179	322,903	113,620	53,974	37,808	28,377	24,750	17,840	12,984	7,567	4,171	3,974	311
Bay and magnolia	50,582	38,088	6,503	2,420	1,376	1,401	311	321	115	15	–	32	--
Black cherry	153,839	110,124	28,232	8,108	3,390	1,639	1,097	580	320	175	36	106	22
Black walnut	20,572	4,106	4,940	3,378	2,403	2,535	1,126	1,016	462	214	222	150	20
Sycamore	27,305	12,823	6,312	1,807	2,084	1,056	958	529	700	431	249	324	32
Black locust	118,039	58,867	22,054	14,909	6,535	7,013	4,251	2,189	1,154	595	270	202	--
Elm	89,579	55,459	16,774	9,946	3,415	1,835	1,233	413	284	165	60	89	6
Other eastern hardwoods	2,496,813	1,953,594	367,680	105,285	37,819	16,375	8,153	3,786	1,897	1,102	588	470	54
Total hardwoods	9,440,868	6,159,330	1,536,047	664,042	389,601	255,603	170,085	109,348	67,082	39,947	22,341	24,941	2,501
All species	11,616,495	7,026,215	2,070,594	1,009,540	606,195	365,560	224,798	133,646	79,080	45,542	25,359	27,246	2,720

[1] Includes white, swamp white, swamp chestnut, and chinkapin oaks.

[2] Includes cherrybark, northern red, and shumard oaks.

Table 18—Number of growing-stock trees on timberland, by species and diameter class, Virginia, 1992

Species	All classes	Diameter class (inches at breast height) 1.0-2.9	3.0-4.9	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0 and larger
	Thousand trees												
Softwood													
Longleaf pine	--	–	--	.	--	--	--	–	–	–	–		--
Slash pine	–	–	--	–			--	–	--	--	–	--	
Shortleaf pine	77,415	14,421	16,656	16,815	12,773	8,777	4,971	2,027	698	191	86	.	--
Loblolly pine	943,035	304,528	255,300	183,127	110,809	47,103	21,653	10,085	5,363	2,793	1,341	926	7
Pond pine	503		.	–	76	167	93	36	33	60	29	6	3
Virginia pine	569,172	217,308	138,810	94,661	61,707	34,347	15,482	5,188	1,326	304	29	10	–
Pitch pine	31,527	8,603	4,691	2,984	4,946	3,906	3,318	1,925	745	282	109	18	–
Table Mountain pine	19,663	3,224	3,435	4,185	3,779	2,494	1,469	765	276	21	15	--	–
Spruce pine	--	--	–	.	--	--	–	–	–	–	–		--
Sand pine	--	--	–	.	–	--	--	–	–	–	--	.	--
Eastern white pine	163,761	79,919	35,302	15,471	11,035	8,098	4,749	2,991	2,647	1,537	1,099	878	34
Eastern hemlock	49,319	21,526	12,792	6,293	3,662	1,705	1,390	574	567	266	178	280	86
Spruce and fir	1,574	1,302	–	--	106	--	137	28	–	--	–	--	
Baldcypress	931	--		143	--	100	70	169	112	91	90	109	47
Pondcypress	176	–	--	.	32	–	26	--	31	12	19	32	24
Cedars	196,744	129,914	44,517	16,520	4,397	1,580	490	197	129	--	--	--	.
Total softwoods	2,053,820	780,745	511,503	339,199	213,322	108,278	53,848	23,986	11,927	5,557	2,995	2,259	201
Hardwood													
Select white oaks[1]	453,399	178,096	85,971	60,082	39,421	32,322	22,170	14,656	9,455	5,179	2,846	2,993	198
Select red oaks[2]	150,187	57,937	26,081	16,859	10,463	10,167	8,508	6,463	4,746	3,181	2,270	3,145	367
Chestnut oak	288,906	55,428	50,968	52,175	46,866	31,528	20,143	12,826	7,159	5,413	2,810	3,319	271
Other white oaks	39,929	23,909	7,104	1,968	3,037	1,608	1,035	599	340	168	87	63	11
Other red oaks	526,587	248,680	83,436	59,454	46,459	33,448	20,872	14,762	8,908	5,197	2,569	2,679	123
Hickory	338,745	162,318	72,681	37,311	25,427	16,516	10,743	6,436	3,681	1,814	998	790	30
Yellow birch	2,870	1,372	542	551	79	115	--	68	25	40	35	43	–
Hard maple	73,433	31,036	21,898	8,438	5,146	2,584	1,508	1,306	721	313	226	237	20
Soft maple	899,045	567,513	168,776	73,524	40,949	20,261	13,179	7,720	3,345	1,850	1,040	815	73
Beech	115,235	68,418	18,723	7,341	5,996	3,996	3,359	2,554	1,836	1,437	713	801	61
Sweetgum	602,610	391,130	119,156	42,195	21,852	12,985	6,934	4,385	2,023	863	516	520	51
Tupelo and blackgum	258,268	156,032	53,240	21,716	10,649	7,106	4,719	2,173	1,355	612	341	282	43
Ash	91,620	41,997	20,430	12,455	6,331	3,874	2,847	1,488	1,016	492	365	296	49
Cottonwood	242		160	–	--	70	–	--	.	--	--	12	--
Basswood	13,106	2,260	1,446	2,735	1,704	1,620	1,067	778	695	406	192	160	43
Yellow-poplar	558,020	272,186	101,675	51,226	35,812	27,215	24,184	17,563	12,710	7,383	4,056	3,791	220
Bay and magnolia	29,309	20,696	3,879	1,830	1,290	1,028	245	225	69	15	–	32	--
Black cherry	67,752	48,082	11,254	4,354	1,394	1,029	816	394	163	175	19	48	14
Black walnut	11,413	720	2,534	2,025	1,476	2,010	990	878	355	140	195	80	10
Sycamore	20,546	7,834	5,315	1,262	2,021	1,019	935	504	679	402	241	304	30
Black locust	59,905	25,854	9,857	9,567	4,272	4,636	2,922	1,349	822	390	162	74	--
Elm	48,663	23,243	11,618	7,547	2,854	1,464	1,046	384	198	154	60	89	6
Other eastern hardwoods	138,881	71,184	23,034	17,086	10,565	7,353	4,317	2,430	1,236	870	414	362	40
Total hardwoods	4,788,671	2,455,924	899,778	491,711	324,053	223,954	152,539	99,921	61,547	36,494	20,155	20,935	1,660
All species	6,842,491	3,236,669	1,411,281	830,910	537,375	332,232	206,387	123,907	73,474	42,051	23,150	23,194	1,861

[1] Includes white, swamp white, swamp chestnut, and chinkapin oaks.

[2] Includes cherrybark, northern red, and shumard oaks.

Table 19—Merchantable volume of live trees on timberland, by species and diameter class, Virginia, 1992

Species	All classes	Diameter class (inches at breast height) 5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0 and larger
	Thousand cubic feet										
Softwood											
Longleaf pine	--	–	–	--	--	–	--	–	–	--	--
Slash pine	–	--	–	--	--	–	--	–	–		-
Shortleaf pine	482,815	51,882	96,521	120,512	104,960	61,499	30,498	10,604	6,339	–	–
Loblolly pine	3,002,066	454,107	679,314	551,646	431,458	305,409	229,869	158,323	95,761	94,930	1,249
Pond pine	12,522	--	436	1,868	1,959	1,128	1,065	2,974	1,758	625	709
Virginia pine	1,852,690	342,380	493,122	467,725	324,649	152,539	52,356	17,266	1,793	860	--
Pitch pine	246,295	9,987	29,924	45,700	62,067	52,378	25,379	12,800	6,453	1,607	–
Table Mountain pine	134,254	12,566	29,663	31,756	27,701	21,863	8,796	1,008	901	--	–
Spruce pine	--	--	–	.	–	–		--	–	.	.
Sand pine	–	--	–	--		–	--	.	–	–	–
Eastern white pine	672,090	45,258	72,020	89,188	79,939	73,848	91,813	71,080	64,024	79,022	5,918
Eastern hemlock	168,405	14,313	18,519	16,453	20,252	12,440	18,172	11,793	11,911	25,542	19,010
Spruce and fir	3,686	--	606	--	2,275	805	--	--	--	--	–
Baldcypress	40,800	573	–	1,216	1,616	4,529	3,763	4,367	5,149	10,424	9,163
Pondcypress	10,342	--	164	–	585	--	1,399	679	1,363	3,245	2,887
Cedars	97,525	42,968	23,431	14,527	8,140	4,456	4,003	--	--		--
Total softwoods	6,723,490	974,034	1,443,740	1,340,571	1,065,601	690,894	467,113	290,894	195,452	216,255	38,936
Hardwood											
Select white oaks[1]	2,974,122	187,880	273,956	411,413	440,580	421,799	389,603	280,919	196,227	311,901	59,844
Select red oaks[2]	1,552,470	59,780	81,807	128,476	169,908	186,539	186,706	169,348	151,003	337,723	81,180
Chestnut oak	2,811,389	173,086	341,301	383,727	394,188	365,158	288,989	275,456	184,230	337,009	68,245
Other white oaks	119,019	6,672	19,513	20,401	18,659	15,935	13,433	8,684	5,688	6,376	3,658
Other red oaks	2,772,091	182,574	309,264	403,745	396,340	412,740	337,179	271,210	168,966	264,751	25,322
Hickory	1,304,216	95,487	164,249	209,577	219,335	193,042	152,402	103,312	73,183	85,282	8,347
Yellow birch	19,776	2,285	735	4,189	--	3,286	797	1,745	2,365	4,374	--
Hard maple	278,290	32,375	36,735	35,218	33,380	39,267	29,694	18,902	16,159	29,078	7,482
Soft maple	1,815,334	289,519	308,427	275,505	274,794	230,160	141,785	99,312	76,928	100,924	17,980
Beech	604,106	27,988	44,049	53,417	71,128	78,639	78,118	80,822	54,149	101,272	14,524
Sweetgum	966,743	111,551	150,579	173,174	150,500	136,041	89,154	49,682	37,510	57,860	10,692
Tupelo and blackgum	548,452	67,650	74,885	93,633	94,370	61,360	54,273	31,375	21,726	34,530	14,650
Ash	396,448	43,434	48,075	59,317	60,396	48,461	41,576	28,723	27,430	27,802	11,234
Cottonwood	3,044	–		1,350	796	–	--	--		898	–
Basswood	186,936	7,576	14,485	20,917	26,758	24,899	28,916	21,269	14,210	18,275	9,631
Yellow-poplar	3,548,929	171,980	264,911	360,495	515,367	541,234	543,043	411,854	291,352	389,369	59,324
Bay and magnolia	51,657	6,626	7,627	15,889	5,341	8,034	3,743	650	--	3,747	–
Black cherry	119,938	20,492	18,157	14,241	20,223	13,966	10,743	9,272	1,606	8,292	2,946
Black walnut	143,895	7,307	14,102	25,328	20,421	27,548	14,568	9,322	14,067	8,897	2,335
Sycamore	168,947	6,761	16,704	14,242	19,403	14,706	24,495	21,300	15,493	28,811	7,032
Black locust	326,326	33,999	33,228	65,791	64,265	47,774	35,028	22,801	11,847	11,592	--
Elm	131,112	22,908	20,534	21,538	21,869	11,895	10,047	7,694	3,964	9,050	1,615
Other eastern hardwoods	1,045,828	247,414	201,971	173,374	137,442	91,483	63,373	51,256	32,856	37,774	8,885
Total hardwoods	21,889,068	1,805,342	2,445,294	2,964,957	3,155,464	2,973,966	2,537,665	1,974,808	1,400,959	2,215,587	414,926
All species	28,612,558	2,779,376	3,889,034	4,305,528	4,221,065	3,664,860	3,004,778	2,265,802	1,596,411	2,431,842	453,862

[1] Includes white, swamp white, swamp chestnut, and chinkapin oaks.

[2] Includes cherrybark, northern red, and shumard oaks.

Table 20—Volume of growing stock on timberland, by species and diameter class, Virginia, 1992

Species	All classes	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0 and larger
		Diameter class (inches at breast height)									
		Thousand cubic feet									
Softwood											
Longleaf pine	–		–	–	–	–	–	–	–	–	–
Slash pine	–	–				–		–	–	–	–
Shortleaf pine	478,749	51,882	95,280	118,169	104,478	61,499	30,498	10,604	6,339	–	
Loblolly pine	2,992,353	452,173	676,777	550,648	430,441	303,965	229,004	158,323	95,427	94,346	1,249
Pond pine	12,288	–	436	1,868	1,725	1,128	1,065	2,974	1,758	675	709
Virginia pine	1,826,173	336,869	485,160	482,983	318,965	151,410	51,738	16,595	1,793	860	–
Pitch pine	241,300	9,256	29,924	43,339	61,243	51,299	25,379	12,800	6,453	1,607	–
Table Mountain pine	124,454	12,198	25,193	29,243	26,965	20,150	8,796	1,008	901	–	–
Spruce pine	–	–	–	–	–	–	–	–	–	–	–
Sand pine	–	–	–	–	–	–	–	–	–	–	–
Eastern white pine	662,598	44,870	71,184	87,086	77,648	73,848	91,313	70,255	64,024	76,454	5,918
Eastern hemlock	164,998	14,313	18,133	15,922	20,252	12,440	18,172	11,793	10,959	25,542	17,472
Spruce and fir	3,686	–	606	–	2,275	805	–		–	–	
Baldcypress	39,822	573	–	1,216	1,616	4,529	3,763	4,367	5,149	10,424	8,185
Pondcypress	10,342	–	184	–	585	–	1,399	679	1,363	3,245	2,887
Cedars	91,625	39,235	22,685	14,527	7,110	4,065	4,003	–	–	–	–
Total softwoods	6,648,388	961,169	1,425,562	1,325,001	1,053,301	685,138	465,130	289,398	194,166	213,103	36,420
Hardwood											
Select white oaks[1]	2,880,077	176,790	268,248	401,362	432,717	418,232	383,245	272,700	192,923	293,523	40,337
Select red oaks[2]	1,483,753	53,167	72,468	123,552	165,199	181,072	182,483	164,495	148,225	321,193	71,899
Chestnut oak	2,461,032	146,348	304,448	353,618	351,596	324,496	247,070	245,628	161,574	278,666	47,588
Other white oaks	108,746	5,591	18,699	18,760	17,986	14,121	12,676	7,738	5,688	5,477	2,010
Other red oaks	2,691,521	170,445	299,498	395,165	386,339	403,730	335,933	261,973	166,558	250,254	22,626
Hickory	1,262,353	91,033	157,455	201,294	212,732	188,306	150,524	100,327	72,446	81,139	6,097
Yellow birch	14,657	1,931	735	1,441	–	1,767	797	1,745	1,767	4,374	–
Hard maple	251,498	27,974	34,892	31,008	30,616	37,740	28,581	16,306	14,392	25,764	4,223
Soft maple	1,538,216	234,395	272,650	239,316	236,036	199,860	120,180	89,783	62,096	70,937	12,963
Beech	523,191	23,756	39,490	46,580	62,198	71,779	71,455	73,242	47,223	76,324	11,144
Sweetgum	924,199	102,964	143,408	164,828	144,904	133,805	87,149	47,131	36,459	54,054	9,487
Tupelo and blackgum	459,042	55,567	61,906	79,422	83,764	54,649	47,863	25,701	19,005	22,315	8,850
Ash	341,198	33,864	37,893	48,174	54,162	41,611	39,951	25,834	23,403	26,419	9,887
Cottonwood	2,248	–	–	1,350		–	–	–	–	898	–
Basswood	172,284	7,261	12,835	20,582	23,627	23,796	27,891	21,269	12,904	13,364	8,755
Yellow-poplar	3,471,878	164,428	254,496	351,547	507,262	536,722	539,222	405,741	286,813	379,488	46,159
Bay and magnolia	43,147	5,798	7,432	11,893	4,362	6,618	2,647	650	–	3,747	–
Black cherry	79,531	12,230	8,147	9,634	16,204	10,390	6,113	9,272	1,074	4,301	2,166
Black walnut	115,219	4,120	10,013	21,143	18,311	23,170	11,359	6,306	12,492	6,596	1,709
Sycamore	161,394	5,265	16,077	13,679	18,901	13,990	24,366	20,273	14,928	27,438	6,476
Black locust	233,206	23,329	24,509	46,022	47,339	33,930	26,970	16,934	8,613	5,560	–
Elm	114,495	17,684	17,553	18,246	19,584	11,263	8,212	7,324	3,964	9,050	1,615
Other eastern hardwoods	605,623	52,627	70,160	86,186	81,680	62,645	44,939	42,392	25,801	31,675	7,518
Total hardwoods	19,838,406	1,416,568	2,133,022	2,684,802	2,914,519	2,794,682	2,399,626	1,862,764	1,318,358	1,982,556	321,509
All species	26,486,794	2,377,737	3,558,584	4,009,803	3,967,820	3,479,820	2,864,756	2,152,162	1,512,524	2,205,659	357,929

[1] Includes white, swamp white, swamp chestnut, and chinkapin oaks.

[2] Includes cherrybark, northern red, and shumard oaks.

Table 21—Volume of sawtimber on timberland, by species and diameter class, Virginia, 1992

Species	All classes	Diameter class (inches at breast height) 9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0 and larger
		Thousand board feet							
Softwood									
Longleaf pine	--	–	--	--	--	–		–	–
Slash pine	--	–	--	--	–	–	..	--	–
Shortleaf pine	1,500,943	440,098	472,174	315,625	170,523	62,980	39,543	--	–
Loblolly pine	8,960,423	1,963,519	1,935,401	1,567,994	1,295,244	959,314	603,777	632,039	9,135
Pond pine	64,405	7,106	7,782	5,876	5,878	17,540	10,923	4,135	5,167
Virginia pine	4,104,468	1,674,366	1,356,113	710,090	260,695	88,296	10,012	4,896	--
Pitch pine	922,548	145,863	262,126	253,223	137,196	74,258	39,423	10,459	--
Table Mountain pine	408,569	116,969	125,738	104,436	48,958	5,904	5,554	–	-
Spruce pine	--	--	–	–	--	–	--	.	--
Sand pine	–	–	–	--	--	--	–	.	--
Eastern white pine	2,814,877	312,903	341,339	366,219	490,161	400,306	381,230	482,236	40,483
Eastern hemlock	684,809	54,402	84,592	58,911	92,669	63,802	62,103	153,416	114,914
Spruce and fir	14,254	–	10,107	4,147	--	–	–	–	–
Baldcypress	211,147	3,850	6,368	19,756	18,007	22,305	27,606	60,760	52,495
Pondcypress	57,240	–	2,357	--	6,782	3,516	7,422	19,225	17,938
Cedars	136,914	59,008	33,669	21,579	22,658	–	--	.	–
Total softwoods	19,880,587	4,778,084	4,638,766	3,427,866	2,548,769	1,692,221	1,187,593	1,367,166	240,132
Hardwood									
Select white oaks[1]	8,930,625	--	1,469,816	1,563,838	1,695,384	1,297,253	970,780	1,590,903	242,651
Select red oaks[2]	5,517,673	–	553,494	598,641	771,443	742,123	701,160	1,545,434	405,378
Chestnut oak	7,050,054	--	1,159,285	1,243,264	1,046,948	1,117,661	774,653	1,436,652	271,591
Other white oaks	296,919	–	65,452	59,733	59,380	38,915	30,080	30,324	13,035
Other red oaks	8,070,248	–	1,329,167	1,634,034	1,499,392	1,260,329	848,269	1,361,449	137,608
Hickory	3,533,910	.	734,246	769,715	679,430	489,207	373,676	450,015	37,621
Yellow birch	49,767	–	–	6,950	3,511	8,048	8,441	22,817	–
Hard maple	684,894	–	115,313	154,174	123,799	74,170	67,620	127,806	22,012
Soft maple	3,187,312	--	767,741	761,259	507,111	409,747	297,529	367,638	76,287
Beech	1,621,815	--	226,971	271,938	278,227	291,198	190,926	315,238	47,317
Sweetgum	2,356,572	--	521,487	575,311	421,487	246,394	203,163	325,322	63,408
Tupelo and blackgum	1,058,626	--	267,511	206,904	203,356	117,789	94,106	120,189	58,771
Ash	950,282	--	175,384	163,070	173,328	121,138	116,440	141,399	58,523
Cottonwood	5,073	--	--		--	–	–	5,073	–
Basswood	580,003	--	81,300	94,631	121,119	99,163	63,226	69,858	50,706
Yellow-poplar	13,291,881	--	1,824,604	2,338,277	2,652,439	2,170,989	1,634,931	2,349,810	320,831
Bay and magnolia	74,759	--	13,642	26,764	11,554	3,087	--	20,712	--
Black cherry	219,012	.	57,631	42,769	28,005	46,682	5,582	24,639	13,704
Black walnut	301,859	–	62,459	84,257	43,205	25,101	51,009	28,139	7,689
Sycamore	576,532	--	62,051	52,903	103,890	95,014	74,246	148,643	39,885
Black locust	514,511	–	166,462	124,633	101,909	55,403	33,801	22,303	–
Elm	253,867	--	66,505	44,409	35,432	33,437	18,913	46,088	9,083
Other eastern hardwoods	1,234,740		280,795	244,216	191,730	193,685	123,109	156,355	44,850
Total hardwoods	60,370,934	--	10,001,316	11,260,590	10,752,079	8,946,533	6,681,650	10,806,806	1,921,950
All species	80,251,521	4,778,084	14,640,082	14,688,446	13,300,848	10,638,754	7,869,253	12,173,972	2,162,082

[1] Includes white, swamp white, swamp chestnut, and chinkapin oaks.

[2] Includes cherrybark, northern red, and shumard oaks.

Table 22—Volume of sawtimber on timberland, by species, size class, and tree grade, Virginia, 1992

Species	All size classes: All grades	Tree grade 1	Tree grade 2	Tree grade 3	Tree grade 4	Trees 15.0 inches d.b.h. and larger: All grades	Tree grade 1	Tree grade 2	Tree grade 3	Tree grade 4
	Thousand board feet									
Softwood										
Yellow pines[1]	15,961,346	2,987,085	4,047,310	8,926,951	--	4,495,847	1,816,380	1,188,888	1,490,579	--
Eastern white pine[2]	2,814,877	282,589	840,041	1,673,375	18,872	1,794,416	252,879	612,580	924,235	4,722
Spruce and fir[2]	14,254	--		14,254	--	--	--	--	--	--
Cypress[3]	268,387	98,099	88,080	64,452	17,756	236,056	98,099	73,995	48,146	15,816
Other eastern softwoods[2]	821,723	42,067	160,888	559,444	59,324	509,562	42,067	150,778	286,664	30,053
Total	19,880,587	3,409,840	5,136,319	11,238,476	95,952	7,035,881	2,209,425	2,026,241	2,749,624	50,591
Hardwood[3]										
Select white and red oaks	14,448,298	2,253,109	5,029,703	6,407,206	758,280	10,062,509	2,253,109	4,258,361	3,220,703	330,336
Other white and red oaks	15,417,221	1,436,055	4,366,445	8,130,719	1,484,002	9,926,286	1,436,055	3,625,206	4,152,296	712,729
Hickory	3,533,910	327,085	946,295	2,006,107	254,423	2,029,949	327,085	737,322	850,304	115,238
Yellow birch	49,767	--	3,694	30,781	15,292	42,817	--	3,694	23,831	15,292
Hard maple	684,894	14,144	179,868	419,077	71,805	415,407	14,144	141,143	233,522	26,598
Sweetgum	2,356,572	354,954	935,715	946,948	118,955	1,259,774	354,954	639,254	212,290	53,276
Ash, walnut, and black cherry	1,471,153	161,344	477,723	737,857	94,129	886,683	161,344	381,306	298,867	44,066
Yellow-poplar	13,291,881	2,891,011	5,053,559	4,699,321	647,990	9,129,000	2,891,011	3,909,155	2,032,600	296,234
Other eastern hardwoods	9,117,238	415,211	1,896,033	5,255,356	1,550,638	5,357,703	415,211	1,559,773	2,828,329	756,390
Total	60,370,934	7,852,913	18,889,035	28,633,472	4,995,514	39,108,028	7,852,913	15,255,214	13,650,742	2,350,159
All species	80,251,521	11,262,753	24,025,354	39,871,948	5,091,466	46,144,909	10,062,338	17,281,455	16,400,366	2,400,750

[1] For yellow pines, tree grade is based on "Southern Pine Tree Grades for Yard and Structural Lumber," Research Paper SE-40, published by the Southeastern Forest Experiment Station, Asheville, NC, 1968. Tree grade 4 does not apply to yellow pine.

[2] For other softwoods (excluding cypress), tree grade is based on "Tree Grades for Eastern White Pine," Research Paper NE-214, published by the Northeastern Forest Experiment Station, Radnor, PA, 1971.

[3] For hardwoods and cypress, tree grades 1, 2, and 3 are based on "Hardwood Tree Grades for Factory Lumber," Research Paper NE-333, published by the Northeastern Forest Experiment Station, Radnor, PA, 1976. Grade 4 trees are sawtimber trees not qualifying as tree grades 1, 2, or 3. The butt log of these trees qualify as construction (tie and timber) logs based on "A Guide to Hardwood Log Grading (revised)," General Technical Report NE-1, published by the Northeastern Forest Experiment Station, Radnor, PA, 1971.

Table 23—Volume of live timber and associated green weight of forest biomass on timberland, by class of material, softwood, and hardwood, Virginia, 1992

Class of material	Volume (excludes bark)			Associated green weight (includes bark)		
	All species	Softwood	Hardwood	All species	Softwood	Hardwood
	Thousand cubic feet			*Hundred thousand pounds*		
Sawtimber trees						
Saw-log portion	15,307,142	3,800,578	11,506,564	11,781,065	2,713,790	9,067,275
Upper stem	2,558,529	461,079	2,097,450	1,974,793	332,935	1,641,858
Total[1]	17,865,671	4,261,657	13,604,014	13,755,858	3,046,725	10,709,133
Poletimber trees[1]	8,621,123	2,386,731	6,234,392	6,365,114	1,728,019	4,637,095
All growing stock[1]	26,486,794	6,648,388	19,838,406	20,120,972	4,774,744	15,346,228
Rough trees[1]	1,809,455	70,863	1,738,592	1,386,843	52,594	1,334,249
Rotten trees[1]	316,309	4,239	312,070	264,248	3,043	261,205
Saplings[2]	4,256,127	825,241	3,430,886	3,133,469	541,286	2,592,183
Stumps, tops, and limbs[3]	6,485,388	1,327,818	5,157,570	4,937,328	953,083	3,984,245
Total, all classes	39,354,073	8,876,549	30,477,524	29,842,860	6,324,750	23,518,110

[1] Bole portion only.

[2] Includes entire tree aboveground.

[3] Of live trees 5.0 inches d.b.h. and larger.

Table 24—Total volume of live trees on timberland, by species and diameter class, Virginia, 1992

Species	All classes	Diameter class (inches at breast height) 1.0-2.9	3.0-4.9	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0 and larger
	Thousand cubic feet												
Softwood													
Longleaf pine	--	--	--	--	--	--	--	--	--	--	--	--	--
Slash pine	-	--	-	--	--	--	--	--	--	--	--	--	--
Shortleaf pine	595,103	4,469	20,560	70,881	116,281	139,856	119,959	69,672	34,386	11,922	7,117	--	--
Loblolly pine	3,952,122	74,736	268,176	646,454	829,344	643,646	493,765	346,137	259,119	177,858	107,338	106,157	1,392
Pond pine	14,310	--	-	--	517	2,175	2,252	1,285	1,212	3,375	1,989	706	799
Virginia pine	2,484,901	59,761	203,083	453,106	590,920	545,715	374,608	175,077	59,899	19,710	2,042	980	-
Pitch pine	295,019	2,701	5,569	12,654	35,802	53,297	71,731	80,263	29,122	14,680	7,384	1,836	--
Table Mountain pine	162,095	1,636	4,218	16,199	34,856	36,517	31,625	24,894	9,989	1,142	1,019	--	--
Spruce pine	--	--	--	--	--	--	--	--	--	--	--	--	--
Sand pine	--	--	--	--	--	--	--	--	--	--	--	--	--
Eastern white pine	857,788	21,574	44,987	60,372	87,181	105,248	93,250	85,599	106,116	81,950	73,707	91,021	6,803
Eastern hemlock	220,734	6,174	15,495	20,191	22,702	19,494	23,516	14,332	20,840	13,475	13,592	29,151	21,772
Spruce and fir	4,685	323	--	--	754	--	2,672	936	-	--	--	--	--
Baldcypress	49,463	--	-	965	--	1,501	1,965	5,474	4,528	5,239	6,163	12,466	11,162
Pondcypress	12,941	--	--	--	250	--	748	--	1,761	852	1,704	4,040	3,586
Cedars	227,388	34,878	58,901	65,605	30,115	17,902	9,830	5,406	4,751	--	--	--	--
Total softwoods	8,876,549	205,252	618,989	1,346,427	1,748,702	1,565,351	1,225,921	789,075	531,723	330,183	222,055	246,357	45,514
Hardwood													
Select white oaks[1]	3,955,168	57,231	132,207	276,908	358,473	521,549	551,112	523,955	481,983	347,309	242,103	385,868	76,472
Select red oaks[2]	2,009,500	19,791	55,391	83,260	104,807	160,950	211,113	230,945	230,288	208,612	185,934	417,124	101,285
Chestnut oak	3,626,586	22,809	107,656	243,221	434,819	476,564	484,046	446,067	352,790	335,599	224,836	412,547	85,637
Other white oaks	170,193	6,216	10,264	9,862	26,014	26,297	23,676	20,207	16,890	10,898	7,062	8,035	4,772
Other red oaks	3,726,920	81,093	144,607	274,042	403,781	508,918	493,344	509,630	414,535	333,346	207,162	325,158	31,324
Hickory	1,802,464	55,836	100,834	150,517	217,026	263,181	269,710	234,876	184,638	124,721	88,077	102,822	10,226
Yellow birch	26,130	908	496	3,112	919	5,209	--	4,051	972	2,125	2,985	5,353	--
Hard maple	400,154	18,928	34,530	45,598	46,488	43,430	40,573	47,728	35,835	22,829	19,508	35,232	9,475
Soft maple	2,954,146	287,225	393,667	414,028	388,635	337,109	332,321	276,267	170,056	118,989	92,467	121,621	21,761
Beech	829,723	27,995	32,968	42,571	58,230	68,190	89,153	97,941	96,834	100,437	67,601	128,511	19,292
Sweetgum	1,445,193	110,423	168,396	165,673	186,734	204,628	174,433	156,121	101,658	56,554	42,666	65,722	12,185
Tupelo and blackgum	901,414	109,612	104,383	97,123	94,368	114,679	114,008	74,215	65,175	38,089	25,412	43,238	20,112
Ash	540,333	22,968	44,550	61,497	59,184	70,056	70,221	55,743	47,688	32,790	31,260	31,607	12,769
Cottonwood	3,792	--	226	--	--	1,600	932	--	--	--	--	1,034	--
Basswood	223,528	2,093	3,865	10,057	17,192	24,301	30,792	28,598	33,305	24,373	16,257	21,630	11,065
Yellow-poplar	4,310,107	72,524	172,206	228,117	315,369	415,830	586,767	812,013	612,040	463,323	327,553	437,121	67,244
Bay and magnolia	81,126	8,533	8,307	9,750	9,677	19,234	6,386	9,592	4,482	760		4,405	--
Black cherry	223,979	37,102	39,836	28,231	22,432	17,129	23,975	16,514	12,662	10,869	1,969	9,792	3,469
Black walnut	182,884	739	6,645	10,502	17,733	30,996	24,445	32,843	17,398	11,168	16,636	10,924	2,855
Sycamore	212,236	3,852	9,377	9,191	20,386	16,904	22,713	17,138	28,544	24,716	17,923	33,301	8,190
Black locust	450,896	14,868	27,450	47,896	42,279	81,408	78,870	58,702	42,583	27,853	14,568	14,419	--
Elm	197,609	12,807	21,271	33,540	25,797	26,106	26,019	14,020	11,964	9,012	4,630	10,559	1,884
Other eastern hardwoods	2,203,443	409,756	428,445	357,505	262,887	215,807	189,621	112,151	77,341	61,808	40,093	46,305	10,724
Total hardwoods	30,477,524	1,383,309	2,047,577	2,612,199	3,113,210	3,651,075	3,824,230	3,579,318	3,039,661	2,366,180	1,677,702	2,672,328	510,735
All species	39,354,073	1,589,561	2,666,566	3,958,626	4,861,912	5,216,426	5,050,151	4,368,393	3,571,384	2,696,363	1,899,757	2,918,685	556,249

[1] Includes white, swamp white, swamp chestnut, and chinkapin oaks.

[2] Includes cherrybark, northern red, and shumard oaks.

Table 25—Green weight of forest biomass on timberland, by species and diameter class, Virginia, 1992

Species	All classes	Diameter class (inches at breast height) 1.0-2.9	3.0-4.9	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0 and larger
	Hundred thousand pounds												
Softwood													
Longleaf pine	–	–	–	–	–	–	–	–	–	–	–	–	–
Slash pine	–	–	–	–	–	–	–	–	–	–	–	–	–
Shortleaf pine	409,169	2,558	12,462	42,387	79,068	98,589	85,614	50,068	24,696	8,603	5,124	–	–
Loblolly pine	2,825,984	37,869	157,002	460,932	611,124	473,293	361,234	253,024	187,525	128,665	77,861	76,451	1,004
Pond pine	10,195	–	–	–	388	1,560	1,599	906	882	2,383	1,420	498	559
Virginia pine	1,859,212	52,087	165,360	343,330	435,342	400,239	274,813	127,908	43,759	14,193	1,508	703	–
Pitch pine	199,270	2,155	5,077	8,247	23,944	36,206	48,042	40,230	19,534	9,770	4,870	1,195	–
Table Mountain pine	100,764	1,369	3,885	8,513	20,535	22,506	20,042	18,029	6,482	738	865	–	–
Spruce pine	–	–	–	–	–	–	–	–	–	–	–	–	–
Sand pine	–	–	–	–	–	–	–	–	–	–	–	–	–
Eastern white pine	544,165	8,850	20,411	39,992	58,695	71,084	63,367	56,819	68,743	52,060	45,810	54,416	3,818
Eastern hemlock	166,453	3,631	9,857	16,183	19,883	16,522	18,553	11,592	15,911	9,986	8,629	19,789	13,807
Spruce and fir	3,396	190	–	–	538	–	1,979	689		–		–	–
Baldcypress	40,184	–	–	370	–	1,049	1,432	4,164	3,586	4,173	5,011	10,357	10,042
Pondcypress	9,904	–	–	–	145	–	503	–	1,271	630	1,283	3,173	2,899
Cedars	156,054	21,051	37,502	46,785	22,658	13,154	7,333	4,054	3,517	–	–	–	
Total softwoods	6,324,750	129,740	411,546	966,739	1,272,420	1,134,202	885,511	565,483	375,906	231,201	153,281	166,592	32,129
Hardwood													
Select white oaks[1]	3,192,340	44,872	97,682	196,436	280,659	416,308	446,698	429,653	397,154	288,241	201,869	326,096	66,672
Select red oaks[2]	1,634,604	16,682	41,347	61,789	85,786	132,975	173,221	190,538	189,652	170,649	151,393	338,154	82,418
Chestnut oak	2,862,356	20,815	83,489	174,062	330,708	367,251	380,234	354,707	284,198	271,073	183,419	340,152	72,248
Other white oaks	136,365	4,371	7,155	7,107	20,046	20,718	19,266	17,030	14,086	9,240	6,005	6,991	4,350
Other red oaks	3,143,096	63,310	107,353	204,440	342,126	434,118	423,618	437,372	355,647	286,934	177,968	281,590	28,620
Hickory	1,448,011	48,726	88,612	104,648	164,993	205,021	215,377	190,897	152,726	104,395	74,240	89,171	9,305
Yellow birch	21,003	786	433	2,332	704	4,127	–	3,234	842	1,768	2,448	4,329	–
Hard maple	326,928	15,638	28,931	32,601	36,611	35,136	33,462	39,644	30,054	19,351	18,664	30,447	8,379
Soft maple	2,149,708	217,875	279,326	284,351	291,729	248,584	245,243	203,855	124,480	86,961	66,459	86,533	15,212
Beech	667,503	23,115	27,907	25,389	44,021	54,073	71,910	79,439	79,521	82,640	55,127	107,340	16,021
Sweetgum	1,030,050	73,669	111,931	107,949	132,213	147,822	127,523	115,894	76,284	43,086	32,715	51,155	9,809
Tupelo and blackgum	621,288	84,627	77,122	52,806	58,560	73,643	76,171	51,657	46,347	28,102	19,702	33,888	18,653
Ash	342,869	13,675	28,026	46,896	43,724	45,381	43,987	33,820	27,721	18,734	17,609	16,992	8,304
Cottonwood	2,596		158	–	–	1,012	637	–	–	–	–	789	–
Basswood	151,621	1,413	2,699	5,820	11,199	16,080	20,423	19,481	22,888	16,891	11,274	15,476	7,977
Yellow-poplar	3,040,288	53,651	113,877	139,666	213,778	288,563	412,103	436,205	439,170	335,006	237,469	320,926	49,975
Bay and magnolia	49,661	5,114	5,264	5,592	6,026	11,892	3,897	5,815	2,774	485	–	2,702	–
Black cherry	143,783	17,876	26,667	16,555	14,800	11,887	16,270	11,541	9,048	7,719	1,415	7,333	2,672
Black walnut	158,759	585	5,527	8,660	15,052	26,579	21,306	28,332	15,520	9,906	14,487	10,084	2,721
Sycamore	151,724	2,647	6,469	4,430	12,108	10,708	15,863	12,258	21,312	18,726	13,854	26,466	6,888
Black locust	435,623	12,554	23,104	40,642	40,502	80,588	77,842	58,520	43,152	28,383	15,172	15,164	–
Elm	128,187	9,370	14,909	20,003	16,312	16,197	16,757	9,104	7,954	6,190	3,082	7,059	1,250
Other eastern hardwoods	1,679,747	333,056	349,773	249,859	190,564	154,511	123,832	86,308	60,620	49,840	33,364	39,673	8,347
Total hardwoods	23,518,110	1,064,522	1,527,661	1,791,932	2,352,221	2,803,174	2,965,640	2,815,404	2,401,160	1,883,320	1,336,735	2,158,520	417,821
All species	29,842,860	1,194,262	1,939,207	2,758,671	3,624,641	3,937,376	3,851,151	3,380,887	2,777,066	2,114,521	1,490,016	2,325,112	449,950

[1] Includes white, swamp white, swamp chestnut, and chinkapin oaks.

[2] Includes cherrybark, northern red, and shumard oaks.

Table 26—Volume of growing stock on timberland, by species and forest-type group, Virginia, 1992

Species	All types	White pine–hemlock	Spruce–fir	Longleaf–slash	Loblolly–shortleaf	Oak–pine	Oak–hickory	Oak–gum–cypress	Elm–ash–cottonwood	Maple–beech–birch
					Forest-type group					
					Thousand cubic feet					
Softwood										
Longleaf pine	--	--	--	--	-	-	--	--	–	-
Slash pine	–	--	–	--	-	-	--	--	--	--
Shortleaf pine	478,749	1,231	–	–	281,558	107,104	88,856	--	–	--
Loblolly pine	2,992,353	–	–	–	2,420,862	378,715	166,797	21,968	3,911	--
Pond pine	12,288	-	--	--	3,729	7,850	709	--	-	–
Virginia pine	1,826,173	10,294	--	-	1,327,347	289,502	195,656	2,923	451	–
Pitch pine	241,300	5,615	–	–	102,205	67,275	66,204	–	–	--
Table mountain pine	124,454	1,406	–	–	83,581	15,325	24,142	–	–	–
Spruce pine	--	--	--	–	-	--	--	--	--	
Sand pine	–	--	–	--	--	-	--	--	--	
Eastern white pine	662,598	295,175	–	–	34,424	203,676	128,705	–	–	618
Eastern hemlock	164,998	34,711	–	–	872	61,490	58,128	–	--	9,797
Spruce and fir	3,686	--	--	–	--	–	–	--	.	3,686
Baldcypress	39,822	--	--	--	--	–	457	37,170	2,195	--
Pondcypress	10,342	–	–	--	–	–	.	10,342	–	--
Cedars	91,625	–	–	–	30,458	18,078	40,160	1,528	1,401	--
Total softwoods	6,648,388	348,432	–	–	4,285,136	1,149,016	769,814	73,931	7,958	14,101
Hardwood										
Select white oaks[1]	2,880,077	13,788	–	–	95,375	308,730	2,422,560	33,179	1,844	4,801
Select red oaks[2]	1,483,753	7,014	--	--	12,321	64,331	1,344,742	21,278	686	33,381
Chestnut oak	2,461,032	14,380	--	–	15,938	148,382	2,279,175	--	–	5,157
Other white oaks	108,746	--	--	--	4,610	14,361	80,231	9,052	492	--
Other red oaks	2,691,521	8,980	–	--	131,958	332,359	2,120,046	93,038	4,048	1,092
Hickory	1,262,353	1,788	–	–	18,218	56,911	1,150,995	7,639	11,441	15,363
Yellow birch	14,557	--	--	–	--	1,628	1,512	--	--	11,417
Hard maple	251,496	--	--	--	2,299	24,164	137,012	-	1,281	86,740
Soft maple	1,538,216	13,655	–	--	59,383	127,916	1,148,427	116,435	60,720	10,680
Beech	523,191	3,566	--	--	8,348	30,511	409,668	7,862	837	62,399
Sweetgum	924,199	--	--	–	104,966	110,401	561,471	127,174	20,187	--
Tupelo and blackgum	459,042	2,508	--	-	17,214	40,800	240,500	157,562	458	–
Ash	341,198	–	–	--	7,408	8,922	219,406	78,196	19,818	7,448
Cottonwood	2,248	–	–	–	--	--	–	1,350	898	--
Basswood	172,284	--	–	–	--	2,650	148,675	--	-	21,059
Yellow-poplar	3,471,878	10,964	--	–	149,973	220,829	3,011,259	28,907	33,342	16,604
Bay and magnolia	43,147	--	--	--	259	531	40,417	1,516	--	424
Black cherry	79,531	980	–	--	4,428	2,720	62,225	–	967	8,211
Black walnut	115,219	--	–	–	836	3,754	104,016	795	4,891	927
Sycamore	161,394	--	--	–	1,835	3,799	84,361	4,659	66,740	--
Black locust	233,206	13,711	--	--	4,006	10,039	198,012	–	545	6,793
Elm	114,495	–	–	--	3,846	2,640	74,235	20,187	12,169	1,418
Other eastern hardwoods	505,623	10,123	–	–	3,521	20,138	358,412	16,619	72,995	23,815
Total hardwoods	19,838,406	101,455	--	–	846,742	1,534,516	16,198,257	725,448	314,459	317,529
All species	26,486,794	449,887	--	--	4,931,878	2,683,532	16,968,071	799,379	322,417	331,630

[1] Includes white, swamp white, swamp chestnut, and chinkapin oaks.

[2] Includes cherrybark, northern red, and shumard oaks.

Table 27—Volume of growing stock on timberland, by ownership class, species group, and diameter class, Virginia, 1992

Ownership class and species group	All classes	Diameter class (inches at breast height) 5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0 and larger
	Thousand cubic feet										
National forest											
Softwood	362,446	38,317	57,801	65,528	63,009	57,740	39,283	20,118	8,435	11,545	670
Hardwood	2,300,198	190,124	280,764	332,542	305,850	300,827	222,645	198,319	156,765	272,225	40,137
Total	2,662,644	228,441	338,565	398,070	368,859	358,567	261,928	218,437	165,200	283,770	40,807
Other public											
Softwood	358,643	37,494	61,327	68,192	43,583	48,087	44,603	26,448	16,902	12,007	-
Hardwood	941,611	63,634	77,579	115,487	141,173	113,370	106,667	99,363	74,922	135,048	14,368
Total	1,300,254	101,128	138,906	183,679	184,756	161,457	151,270	125,811	91,824	147,055	14,368
Forest industry											
Softwood	1,136,304	230,510	336,713	233,866	133,028	69,416	43,777	31,985	24,388	28,603	4,018
Hardwood	1,017,489	103,788	122,452	133,580	147,636	140,192	128,182	88,374	57,124	83,391	12,770
Total	2,153,793	334,298	459,165	367,446	280,664	209,608	171,959	120,359	81,512	111,994	16,788
Forest industry-leased											
Softwood	20,363	1,581	7,504	9,950	1,328	--	--	--	–	–	–
Hardwood	7,869	1,227	2,250	630	2,936	–	826	--	–	--	–
Total	28,232	2,808	9,754	10,580	4,264	–	826	--	–	–	--
Other private											
Softwood	4,770,632	653,267	962,217	947,465	812,353	509,895	337,467	210,847	144,441	160,948	31,732
Hardwood	15,571,239	1,057,795	1,649,977	2,102,563	2,316,924	2,240,293	1,941,306	1,476,708	1,029,547	1,501,892	254,234
Total	20,341,871	1,711,062	2,612,194	3,050,028	3,129,277	2,750,188	2,278,773	1,687,555	1,173,988	1,662,840	285,966
All ownerships											
Softwood	6,648,388	961,169	1,425,562	1,325,001	1,053,301	685,138	465,130	289,398	194,166	213,103	36,420
Hardwood	19,838,406	1,416,568	2,133,022	2,684,802	2,914,519	2,794,682	2,399,626	1,862,764	1,318,358	1,992,656	321,509
Total	26,486,794	2,377,737	3,558,584	4,009,803	3,967,820	3,479,820	2,864,756	2,152,162	1,512,524	2,205,659	357,929

Table 28—Volume of sawtimber on timberland, by ownership class, species group, and diameter class, Virginia, 1992

Ownership class and species group	All classes	Diameter class (inches at breast height) 9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0 and larger
		Thousand board feet							
National forest									
Softwood	1,254,554	237,349	275,219	287,469	211,670	115,508	49,923	73,156	4,260
Hardwood	6,548,336	--	1,031,236	1,185,738	971,192	929,386	773,844	1,429,101	227,839
Total	7,802,890	237,349	1,306,455	1,473,207	1,182,862	1,044,894	823,767	1,502,257	232,099
Other public									
Softwood	1,269,590	248,650	190,329	241,808	249,223	155,559	105,655	78,366	--
Hardwood	3,107,259	--	483,372	460,762	476,901	478,185	381,022	741,713	85,304
Total	4,376,849	248,650	673,701	702,570	726,124	633,744	486,677	820,079	85,304
Forest industry									
Softwood	2,560,613	826,120	590,708	351,259	240,374	189,724	149,771	187,516	25,141
Hardwood	2,921,079	--	506,639	575,104	585,340	421,222	289,670	467,021	76,083
Total	5,481,692	826,120	1,097,347	926,363	825,714	610,946	439,441	654,537	101,224
Forest industry-leased									
Softwood	41,327	35,600	5,727	--	--	--	--	--	--
Hardwood	13,952	--	9,917	--	4,035	--	--	--	--
Total	55,279	35,600	15,644	--	4,035	--	--	--	--
Other private									
Softwood	14,754,503	3,430,365	3,576,783	2,547,320	1,847,502	1,231,430	882,244	1,028,128	210,731
Hardwood	47,780,308	--	7,970,152	9,038,986	8,714,611	7,117,740	5,237,124	8,168,971	1,532,724
Total	62,534,811	3,430,365	11,546,935	11,586,306	10,562,113	8,349,170	6,119,368	9,197,099	1,743,455
All ownerships									
Softwood	19,880,587	4,778,084	4,638,766	3,427,856	2,548,769	1,692,221	1,187,593	1,367,166	240,132
Hardwood	60,370,934	--	10,001,316	11,260,590	10,752,079	8,946,533	6,681,660	10,806,806	1,921,950
Total	80,251,521	4,778,084	14,640,082	14,688,446	13,300,848	10,638,754	7,869,253	12,173,972	2,162,082

Table 29—Volume of growing stock on timberland, by broad management class, species group, and stand-age class, Virginia, 1992

Broad management class and species group	All classes	No manageable stand	Stand-age class (years)								
			0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81+
			Thousand cubic feet								
Pine plantation											
Softwood	1,469,711	--	17,814	391,290	724,603	287,079	48,925	--	--	--	--
Hardwood	116,416	--	12,655	22,587	57,355	16,812	7,007	--	--	--	--
Total	1,586,127	--	30,469	413,877	781,958	303,891	55,932	--	--	--	--
Natural pine											
Softwood	3,163,857	15,021	15,876	104,305	393,170	561,872	770,461	654,293	362,654	126,375	159,830
Hardwood	631,781	2,521	14,106	19,583	53,020	95,295	110,772	133,001	90,410	36,244	76,829
Total	3,795,638	17,542	29,982	123,888	446,190	657,167	881,233	787,294	453,064	162,619	236,659
Oak-pine											
Softwood	1,149,016	56,234	14,209	68,340	97,612	88,257	115,450	215,415	198,676	123,292	171,531
Hardwood	1,534,516	54,405	39,945	68,103	97,682	122,880	180,901	284,896	265,538	179,372	240,794
Total	2,683,532	110,639	54,154	136,443	195,294	211,137	296,351	500,311	464,214	302,664	412,325
Upland hardwood											
Softwood	783,915	53,339	9,418	39,319	38,911	61,912	91,836	125,834	124,269	112,544	125,533
Hardwood	16,515,786	855,983	191,200	245,263	404,940	782,757	1,648,571	3,115,491	3,354,614	2,323,738	3,593,229
Total	17,299,701	909,322	200,618	284,582	444,851	844,669	1,740,407	3,241,325	3,478,883	2,436,282	3,718,762
Lowland hardwood											
Softwood	81,889	6,187	827	1,042	1,274	3,234	3,573	7,476	14,844	8,974	34,458
Hardwood	1,039,907	131,675	3,014	30,216	19,246	40,959	86,314	170,030	168,769	156,735	232,949
Total	1,121,796	137,862	3,841	31,258	20,520	44,193	89,887	177,506	183,613	165,709	267,407
All classes											
Softwood	6,648,388	130,781	58,144	604,296	1,256,570	1,002,354	1,030,245	1,003,018	700,443	371,185	491,352
Hardwood	19,838,406	1,044,584	260,920	385,752	632,243	1,058,703	2,033,565	3,703,418	3,879,331	2,696,089	4,143,801
Total	26,486,794	1,175,365	319,064	990,048	1,888,813	2,061,057	3,063,810	4,706,436	4,579,774	3,067,274	4,635,153

Table 30—Average net annual growth and removals of live timber and growing stock on timberland, by species, Virginia, 1986-1991

Species	Live timber[1]		Growing stock	
	Net annual growth	Annual timber removals	Net annual growth	Annual timber removals
	Thousand cubic feet			
Softwood				
Yellow pines	283,955	232,066	283,047	230,187
Eastern white pine	23,701	18,864	23,668	18,479
Spruce and fir	49	--	49	--
Cypress	1,070	85	1,065	85
Other eastern softwoods	9,503	4,212	9,341	4,109
Total softwoods	318,278	255,027	317,170	252,860
Hardwood				
Select white and red oaks	108,097	87,351	107,076	85,510
Other white and red oaks	130,295	86,762	129,277	82,721
Hickory	25,603	17,077	25,384	16,077
Yellow birch	183	--	179	--
Hard maple	6,641	3,987	6,620	3,376
Sweetgum	33,221	33,346	32,538	32,153
Ash, walnut, and black cherry	16,858	8,857	15,735	7,386
Yellow-poplar	116,481	68,774	115,641	67,384
Tupelo and blackgum	8823	8349	8415	7467
Bay and magnolia	1,241	654	1,196	654
Other eastern hardwoods	98,888	56,960	89,175	43,474
Total hardwoods	546,329	372,117	531,236	346,202
All species	864,607	627,144	848,406	599,062

[1] Merchantable portion only.

Table 31—Average net annual growth and removals of growing stock on timberland, by ownership class, softwood, and hardwood, Virginia, 1986-1991

Ownership class	Net annual growth			Annual timber removals		
	All species	Softwood	Hardwood	All species	Softwood	Hardwood
	Thousand cubic feet					
National forest	50,304	6,593	43,711	16,604	2,640	13,964
Other public	37,008	12,976	24,032	19,188	13,041	6,147
Forest industry	119,970	84,339	35,631	108,716	69,535	39,181
Forest industry-leased	1,382	936	446	--	--	--
Other private	639,742	212,326	427,416	454,554	167,644	286,910
All ownerships	848,406	317,170	531,236	599,062	252,860	346,202

Table 32—Average net annual growth and removals of sawtimber on timberland, by species, Virginia, 1986-1991

Species	Net annual growth	Annual timber removals
	Thousand board feet	
Softwood		
Yellow pines	910,911	734,348
Eastern white pine	132,942	91,650
Spruce and fir	249	--
Cypress	6,198	--
Other eastern softwoods	27,798	16,514
Total softwoods	1,078,098	842,512
Hardwood		
Select white and red oaks	496,991	299,124
Other white and red oaks	534,126	281,596
Hickory	106,649	48,264
Yellow birch	651	--
Hard maple	24,780	11,440
Sweetgum	107,046	85,312
Ash, walnut, and black cherry	54,986	22,074
Yellow-poplar	551,935	282,073
Tupelo and blackgum	25,920	20,667
Bay and magnolia	3,167	672
Other eastern hardwoods	286,068	125,610
Total hardwoods	2,192,319	1,176,832
All species	3,270,417	2,019,344

Table 33—Average net annual growth and removals of sawtimber on timberland, by ownership class, softwood, and hardwood, Virginia, 1986-1991

Ownership class	Net annual growth			Annual timber removals		
	All species	Softwood	Hardwood	All species	Softwood	Hardwood
	Thousand board feet					
National forest	190,727	32,218	158,509	53,749	9,174	44,575
Other public	147,852	49,911	97,941	51,067	34,598	16,469
Forest industry	342,036	222,617	119,419	289,724	182,437	107,287
Forest industry-leased	7,935	6,997	938	--	--	--
Other private	2,581,867	766,355	1,815,512	1,624,804	616,303	1,008,501
All ownerships	3,270,417	1,078,098	2,192,319	2,019,344	842,512	1,176,832

Table 34—Average annual mortality of live timber, growing stock, and sawtimber on timberland, by species, Virginia, 1986-1991

Species	Live timber[1]	Growing stock	Sawtimber
	Thousand cubic feet		*Thousand board feet*
Softwood			
Yellow pines	53,360	50,660	120,204
Eastern white pine	3,791	3,257	10,087
Spruce and fir	--	--	--
Cypress	93	93	597
Other eastern softwoods	1,381	1,135	1,366
Total softwoods	58,625	55,145	132,254
Hardwood			
Select white and red oaks	27,537	21,727	72,964
Other white and red oaks	59,497	48,323	128,115
Hickory	13,650	12,183	33,024
Yellow birch	--	--	--
Hard maple	1,621	815	2,944
Sweetgum	4,230	3,605	5,093
Ash, walnut, and black cherry	6,041	3,812	8,460
Yellow-poplar	9,861	8,112	21,250
Tupelo and blackgum	2,266	1,249	2,534
Bay and magnolia	387	387	1,330
Other eastern hardwoods	44,085	20,745	48,673
Total hardwoods	169,175	120,758	324,387
All species	227,800	175,903	456,641

[1] Merchantable portion only.

Table 35—Average annual mortality of growing stock and sawtimber on timberland, by ownership class, softwood, and hardwood, Virginia, 1986-1991

Ownership class	Growing stock			Sawtimber		
	All species	Softwood	Hardwood	All species	Softwood	Hardwood
	Thousand cubic feet			*Thousand board feet*		
National forest	20,749	2,179	18,570	56,854	6,302	50,552
Other public	8,053	3,324	4,729	23,187	11,159	12,028
Forest industry	10,089	4,900	5,189	21,376	8,385	12,991
Forest industry-leased	376	285	91	568	568	--
Other private	136,636	44,457	92,179	354,656	105,840	248,816
All ownerships	175,903	55,145	120,758	456,641	132,254	324,387

Table 36—Average annual mortality of growing stock and sawtimber on timberland, by cause of death, softwood, and hardwood, Virginia, 1986-1991

Cause of death	Growing stock			Sawtimber		
	All species	Softwood	Hardwood	All species	Softwood	Hardwood
	Thousand cubic feet			*Thousand board feet*		
Fire	2,507	787	1,720	5,602	594	5,008
Insects	20,893	13,909	6,984	64,339	46,847	17,492
Disease	42,712	7,022	35,690	125,180	24,324	100,856
Weather	36,003	9,115	26,888	120,592	21,985	98,607
Suppression	26,007	12,848	13,159	17,486	6,032	11,454
Animals	2,955	182	2,773	7,589	--	7,569
Undetermined	44,826	11,282	33,544	115,873	32,472	83,401
All causes	175,903	55,145	120,758	456,641	132,254	324,387

Table 37—Average annual output of timber products, by product, species group, and type of material, Virginia, 1986-1991

Product and species group	Standard units	Total output		Roundwood products		Plant byproducts	
		Number of units	Thousand cubic feet	Number of units	Thousand cubic feet	Number of units	Thousand cubic feet
Saw logs							
Softwood	*k fbm**	595,448	108,857	589,453	107,761	5,995	1,096
Hardwood		822,336	134,809	822,335	134,809	--	--
Total		1,417,783	243,666	1,411,788	242,570	5,995	1,096
Veneer logs and bolts							
Softwood	*k fbm**	76,142	12,281	76,142	12,281	--	--
Hardwood		29,769	4,763	29,769	4,763	--	--
Total		105,911	17,044	105,911	17,044	--	--
Pulpwood**							
Softwood	*Cords****	1,735,258	127,125	1,362,299	99,802	372,959	27,323
Hardwood		1,537,556	117,008	1,162,628	88,476	374,928	28,532
Total		3,272,814	244,133	2,524,927	188,278	747,887	55,855
Poles and piling							
Softwood	*h pieces*	1,265	2,338	1,265	2,338	--	--
Hardwood		--	--	--	--	--	--
Total		1,265	2,338	1,265	2,338	--	--
Posts (round and split)							
Softwood	*k pieces*	2,220	1,565	2,220	1,565	--	--
Hardwood		216	194	216	194	--	--
Total		2,436	1,759	2,436	1,759	--	--
Other***,							
Softwood	*k ft³*	21,101	21,101	4,912	4,912	16,189	16,189
Hardwood		28,763	28,763	9,338	9,338	19,425	19,425
Total		49,864	49,864	14,250	14,250	35,614	35,614
Total industrial products							
Softwood		--	273,267	--	228,659	--	44,608
Hardwood		--	285,537	--	237,580	--	47,957
Total		--	558,804	--	466,239	--	92,565
Fuelwood****							
Softwood	*Cords*	154,778	11,338	141,428	10,361	13,350	978
Hardwood		1,256,401	95,536	1,202,208	91,488	53,193	4,048
Total		1,410,179	106,875	1,343,636	101,849	66,543	5,026
All products							
Softwood		--	284,606	--	239,020	--	45,586
Hardwood		--	381,073	--	329,068	--	52,005
Total		--	665,679	--	568,088	--	97,591

* International 1/4-inch rule.

** Roundwood figures include an estimated 12,016,000 cubic feet of roundwood chipped at other primary wood-using plants.

*** Rough-wood basis (includes chips converted to equivalent standard cords).

**** Includes litter, mulch, particleboard, charcoal, and other specialty products.

***** Excludes approximately 32,863,000 cubic feet of wood residues and 24,933,000 cubic feet of bark used for industrial fuel.

Table 38—Average annual output of roundwood products, by product, species group, and source of material, Virginia, 1986-1991

Product and species group	All sources	Growing-stock trees[1]			Cull trees[1]	Salvable dead trees[1]	Other sources[2]
		Total	Sawtimber	Poletimber			
	Thousand cubic feet						
Saw logs							
Softwood	107,761	105,203	101,008	4,195	726	--	1,832
Hardwood	134,809	126,410	119,748	6,662	6,340	365	1,694
Total	242,570	231,613	220,756	10,857	7,066	365	3,526
Veneer logs and bolts							
Softwood	12,281	12,136	11,893	243	--	--	145
Hardwood	4,763	4,722	4,528	194	--	--	41
Total	17,044	16,858	16,421	437	--	--	186
Pulpwood							
Softwood	99,802	89,583	41,208	48,375	506	--	9,713
Hardwood	88,476	78,607	35,373	43,234	4,915	--	4,954
Total	188,278	168,190	76,581	91,609	5,421	--	14,667
Poles and piling							
Softwood	2,338	2,282	2,236	46	--	--	56
Hardwood	--	--	--	--	--	--	--
Total	2,338	2,282	2,236	46	--	--	56
Posts (round and split)							
Softwood	1,565	923	692	231	--	--	642
Hardwood	194	11	7	4	183	--	--
Total	1,759	934	699	235	183	--	642
Other							
Softwood	4,912	4,912	3,508	1,404	--	--	--
Hardwood	9,338	8,495	6,067	2,428	--	--	843
Total	14,250	13,407	9,575	3,832	--	--	843
Total industrial products							
Softwood	228,659	215,039	160,545	54,494	1,232	--	12,388
Hardwood	237,580	218,245	165,723	52,522	11,438	365	7,532
Total	466,239	433,284	326,268	107,016	12,670	365	19,920
Fuelwood							
Softwood	10,361	6,141	4,424	1,717	73	1,157	2,990
Hardwood	91,488	48,175	34,709	13,466	840	11,196	31,277
Total	101,849	54,316	39,133	15,183	913	12,353	34,267
All products							
Softwood	239,020	221,180	164,969	56,211	1,305	1,157	15,378
Hardwood	329,068	266,420	200,432	65,988	12,278	11,561	38,809
Total	568,088	487,600	365,401	122,199	13,583	12,718	54,187

[1] On timberland.

[2] Includes trees less than 5.0 inches in diameter, tree tops and limbs from timberland, or material from other forest land or nonforest land, such as fence rows or suburban areas.

Table 39—Average annual timber removals from growing stock on timberland, by item, softwood, and hardwood, Virginia, 1986-1991

Item	All species	Softwood	Hardwood
		Thousand cubic feet	
Roundwood products			
Saw logs	231,613	105,203	126,410
Veneer logs and bolts	16,858	12,136	4,722
Pulpwood	168,190	89,583	78,607
Poles and piling	2,282	2,282	--
Posts	934	923	11
Other	13,407	4,912	8,495
Fuelwood	54,316	5,141	48,715
All products	487,600	221,180	266,420
Logging residues	51,696	14,390	37,306
Other removals	59,766	17,290	42,476
Total removals	599,062	252,860	346,202

Table 40—Average annual timber removals from live sawtimber on timberland, by item, softwood, and hardwood, Virginia, 1986-1991

Item	All species	Softwood	Hardwood
		Thousand board feet	
Roundwood products			
Saw logs	1,146,104	498,724	647,380
Veneer logs and bolts	98,059	72,101	25,958
Pulpwood	290,442	155,688	134,754
Poles and piling	12,765	12,765	--
Posts	2,640	2,613	27
Other	45,267	16,292	28,975
Fuelwood	214,866	25,443	189,423
All products	1,810,143	783,626	1,026,517
Logging residues	39,912	16,771	23,141
Other removals	169,289	42,115	127,174
Total removals	2,019,344	842,512	1,176,832

Table 41—Disposal of average annual volume of residue at primary wood-using plants, by product, species group, and type of residue, Virginia, 1986-1991

Product and species group	All types	Bark	Coarse[1]	Fine[2]
		Thousand cubic feet		
Fiber products				
Softwood	27,323	--	26,277	1,046
Hardwood	28,532	--	27,710	822
Total	55,855	--	53,987	1,868
Particleboard				
Softwood	7,022	4	1,290	5,728
Hardwood	2,646	2	1,401	1,243
Total	9,668	6	2,691	6,971
Strand/wafer board				
Softwood	--	--	--	--
Hardwood	--	--	--	--
Total	--	--	--	--
Sawn products				
Softwood	1,096	--	1,096	--
Hardwood	--	--	--	--
Total	1,096	--	1,096	--
Industrial fuel				
Softwood	25,723	11,147	491	14,085
Hardwood	32,073	13,786	2,371	15,916
Total	57,796	24,933	2,862	30,001
Domestic fuel				
Softwood	978	144	779	55
Hardwood	4,048	703	3,110	235
Total	5,026	847	3,889	290
Miscellaneous				
Softwood	9,171	6,282	27	2,862
Hardwood	16,781	11,277	902	4,602
Total	25,952	17,559	929	7,464
Not used				
Softwood	2,318	365	1,113	840
Hardwood	6,634	1,412	1,579	3,643
Total	8,952	1,777	2,692	4,483
All products				
Softwood	73,631	17,942	31,073	24,616
Hardwood	90,714	27,180	37,073	26,461
Total	164,345	45,122	68,146	51,077

[1] Material, such as slabs and edgings.

[2] Material, such as sawdust and shavings.

Table 42—Land area, by land use class, major forest type, and survey completion date, Virginia

Land-use class	Survey completion date 1977	1986	1992	Change 1986-1992
	Acres			
Forest land				
Timberland				
Pine and oak–pine types	5,373,812	5,076,570	5,293,958	+217,388
Hardwood types	10,613,320	10,493,118	10,153,592	-339,526
Total	15,987,132	15,569,688	15,447,550	-122,138
Reserved timberland	360,222	471,188	531,980	+60,792
Woodland	70,025	61,417	47,344	-14,073
Total forest land	16,417,379	16,102,293	16,026,874	-75,419
Nonforest land				
Cropland	3,098,823	3,426,068	3,332,421	-93,647
Pasture and range	3,641,844	3,160,322	3,030,334	-129,988
Other	2,138,656	2,560,075	2,883,072	+322,997
Total	8,879,123	9,146,465	9,245,827	+99,362
All land[1]	25,296,502	25,248,758	25,272,701	+23,943

[1] Excludes all water areas.

Table 43—Volume of sawtimber, growing stock, and live timber on timberland, by species group, survey completion date, and diameter class, Virginia

Species group and year	All classes	Diameter class (inches at breast height) 5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0 and larger
					SAWTIMBER (in thousand board feet)					
Softwood										
1977	17,441,454	--	--	4,336,016	4,367,396	3,378,415	2,272,839	1,396,023	736,737	955,028
1986	18,447,172	--	--	4,520,534	4,190,585	3,423,181	2,605,842	1,653,199	925,007	1,228,824
1992	19,880,587	--	--	4,778,084	4,638,768	3,427,866	2,648,769	1,692,221	1,187,593	1,607,298
Hardwood										
1977	45,489,757	--	--	--	8,828,283	9,432,647	8,368,844	6,317,675	4,307,896	8,233,412
1986	54,170,379	--	--	--	9,532,670	10,863,636	10,154,831	8,003,820	5,421,922	10,394,100
1992	60,370,934	--	--	--	10,001,316	11,260,590	10,752,079	8,946,533	6,681,660	12,728,756
					GROWING STOCK (in thousand cubic feet)					
Softwood										
1977	5,928,488	882,268	1,251,760	1,209,088	992,550	674,414	413,037	237,329	119,513	148,531
1986	6,257,948	922,708	1,348,948	1,261,423	955,800	684,833	458,368	283,308	151,139	191,873
1992	6,648,688	961,169	1,425,562	1,325,001	1,053,301	685,138	465,130	289,398	194,166	249,523
Hardwood										
1977	16,875,374	1,530,738	2,218,966	2,611,928	2,589,227	2,353,583	1,881,589	1,321,824	855,860	1,511,651
1986	18,707,447	1,447,270	2,186,394	2,668,693	2,796,887	2,662,610	2,283,409	1,675,686	1,077,045	1,909,653
1992	19,839,406	1,416,568	2,133,022	2,684,802	2,914,519	2,794,682	2,399,628	1,862,764	1,318,368	2,314,065
					LIVE TIMBER[1] (in thousand cubic feet)					
Softwood										
1977	6,023,894	905,242	1,274,714	1,230,814	1,001,771	684,647	416,228	238,420	120,559	161,499
1986	6,360,204	946,214	1,372,485	1,284,099	965,282	695,683	462,297	285,860	152,158	196,166
1992	6,723,490	974,034	1,443,740	1,340,571	1,065,601	690,894	467,113	290,894	195,452	255,191
Hardwood										
1977	19,217,173	2,024,847	2,934,531	2,961,735	2,863,847	2,548,423	2,028,089	1,419,603	952,208	1,783,890
1986	21,228,389	1,911,871	2,597,790	3,024,978	3,095,910	2,887,016	2,460,820	1,800,256	1,195,176	2,254,572
1992	21,889,068	1,805,342	2,445,294	2,964,957	3,155,464	2,973,986	2,537,865	1,974,908	1,400,969	2,830,513

[1] Merchantable volume.

Table 44—Merchantable volume of live timber, by species group, Survey Unit, and survey completion date, Virginia

Species group and Survey Unit	1977	1986	Change 1977-1986	1992	Change 1986-1992
	Thousand cubic feet	*Thousand cubic feet*	*Percent*	*Thousand cubic feet*	*Percent*
Softwood					
Coastal Plain	2,442,447	2,364,313	-3.2	2,491,913	+5.4
Southern Piedmont	1,565,664	1,750,313	+11.8	1,924,520	+10.0
Northern Piedmont	845,216	901,943	+6.7	945,158	+4.8
Northern Mountains	660,861	681,259	+3.1	726,730	+6.7
Southern Mountains	509,706	662,376	+30.0	635,169	-4.1
All units	6,023,894	6,360,204	+5.6	6,723,490	+5.7
Hardwood					
Coastal Plain	3,964,891	4,061,328	+2.4	4,059,486	--
Southern Piedmont	3,624,188	4,177,528	+15.3	4,421,238	+5.8
Northern Piedmont	3,375,341	3,709,882	+9.9	3,999,517	+7.8
Northern Mountains	3,714,351	3,952,785	+6.4	4,030,284	+2.0
Southern Mountains	4,538,402	5,326,866	+17.4	5,378,543	+1.0
All units	18,217,173	21,228,389	+10.5	21,889,068	+3.1

Table 45—Land area and total forest, by county, Virginia, 1992

County	All land[1]	Total forest[2]	
	Acres	*Acres*	*Percent*
Accomack	304,435	96,630	31.74
Albemarle	470,829	293,436	62.32
Alleghany	290,317	254,026	87.50
Amelia	228,410	169,531	74.22
Amherst	306,246	226,454	73.95
Appomattox	215,078	153,357	71.30
Arlington	16,614	--	--
Augusta	643,097	346,217	53.84
Bath	343,851	306,266	89.12
Bedford	482,618	288,607	59.80
Bland	229,446	179,477	78.22
Botetourt	348,550	253,975	72.87
Brunswick	360,460	290,950	80.72
Buchanan	322,355	290,585	90.14
Buckingham	373,401	301,661	80.79
Campbell	355,040	205,236	57.81
Caroline	342,695	261,702	76.37
Carroll	308,777	184,058	59.61
Charles City	116,128	85,042	73.23
Charlotte	304,960	209,194	68.60
Chesapeake	270,655	101,569	37.53
Chesterfield	304,448	189,813	62.35
Clarke	114,138	39,987	35.03
Craig	211,085	179,276	84.93
Culpeper	244,480	114,304	46.75
Cumberland	191,712	133,642	69.71
Dickenson	212,077	175,390	82.70
Dinwiddie	337,213	244,769	72.59
Essex	168,051	98,013	58.32
Fairfax	266,592	92,614	34.74
Fauquier	416,570	175,188	42.05
Floyd	243,981	143,873	58.97
Fluvanna	185,510	137,348	74.04
Franklin	437,248	284,099	64.97
Frederick	271,532	129,262	47.60
Giles	231,654	176,775	76.31
Gloucester	144,122	94,613	65.65
Goochland	180,032	130,505	72.49
Grayson	287,582	175,828	61.14
Greene	100,371	68,858	68.60
Greensville	193,779	135,286	69.81
Halifax	525,818	352,976	67.13
Hampton	32,832	4,342	13.22
Hanover	299,155	178,376	59.63
Henrico	169,210	59,637	35.24
Henry	251,712	179,127	71.16
Highland	266,112	196,294	73.76
Isle of Wight	204,454	114,511	56.01
James City	101,293	64,973	64.14
King and Queen	202,982	152,722	75.24
King George	115,245	72,837	63.20
King William	177,768	111,822	62.90

Continued

Table 45—Land area and total forest, by county, Virginia, 1992--Continued

County	All land[1]	Total forest[2]	
	Acres	*Acres*	*Percent*
Lancaster	85,043	52,501	61.73
Lee	279,974	157,865	56.39
Loudoun	333,498	118,338	35.48
Louisa	317,805	228,537	71.91
Lunenburg	276,627	209,807	75.84
Madison	205,913	120,511	58.53
Mathews	55,776	34,787	62.37
Mecklenburg	394,330	265,852	67.42
Middlesex	85,728	49,882	58.19
Montgomery	254,074	145,464	57.25
Nelson	303,590	233,316	76.85
New Kent	136,258	98,183	72.06
Newport News	41,792	7,934	18.98
Northampton	144,602	30,967	21.42
Northumberland	118,106	67,886	57.48
Nottoway	202,502	137,331	67.82
Orange	218,822	125,848	57.51
Page	200,346	121,531	60.66
Patrick	307,885	220,534	71.63
Pittsylvania	647,731	405,446	62.59
Powhatan	167,162	132,471	79.26
Prince Edward	226,253	166,832	73.74
Prince George	178,537	118,271	66.24
Prince William	223,591	114,923	51.40
Pulaski	203,661	118,971	58.42
Rappahannock	170,870	103,499	60.54
Richmond	123,335	76,279	61.85
Roanoke	197,472	110,833	56.13
Rockbridge	389,382	253,650	65.14
Rockingham	557,376	306,177	54.93
Russell	306,560	174,359	56.88
Scott	342,668	237,082	69.19
Shenandoah	327,833	191,246	58.34
Smyth	289,325	177,224	61.25
Southampton	388,307	240,553	61.95
Spotsylvania	262,471	175,636	66.92
Stafford	173,510	118,956	68.56
Suffolk	261,869	143,645	54.85
Surry	180,058	124,151	68.95
Sussex	314,490	250,668	79.71
Tazewell	332,832	213,914	64.27
Virginia Beach	163,795	40,727	24.86
Warren	139,053	78,281	56.30
Washington	367,366	189,483	51.58
Westmoreland	145,049	75,785	52.25
Wise	263,417	178,535	67.78
Wythe	297,312	144,321	48.54
York	83,277	32,849	39.45
Total	25,409,849	16,026,874	63.07

[1] Excludes inland water.

[2] Includes timberland, reserved timberland, and woodland.

Table 46—Area of timberland, by county and ownership class, Virginia, 1992

County	All ownerships	National forest	Other public	Forest industry[1]	Other private
			Acres		
Accomack	94,507	--	1,833	9,315	83,359
Albemarle	278,205	--	3,036	10,127	265,042
Alleghany	249,199	140,535	2,340	13,427	92,897
Amelia	169,355	--	1,788	42,332	125,235
Amherst	224,549	57,589	1,125	16,326	149,509
Appomattox	151,559	--	9,086	37,709	104,764
Arlington	--	--	--	--	--
Augusta	291,118	148,670	12,389	--	130,059
Bath	287,742	156,860	9,829	440	120,613
Bedford	276,133	13,298	3,644	22,989	236,202
Bland	173,503	65,730	660	4,473	102,640
Botetourt	250,882	76,065	6,909	39,216	128,692
Brunswick	290,950	--	6,350	80,335	204,265
Buchanan	290,585	--	250	3,452	286,883
Buckingham	300,672	--	12,619	79,168	208,885
Campbell	205,236	--	716	24,523	179,997
Caroline	261,702	--	56,720	20,144	184,838
Carroll	182,605	4,038	1,816	7,437	169,314
Charles City	84,737	--	5,011	15,438	64,288
Charlotte	209,194	--	1,846	41,610	165,738
Chesapeake	59,974	--	3,670	6,125	50,179
Chesterfield	187,487	--	7,670	15,814	164,003
Clarke	37,876	--	284	--	37,592
Craig	162,684	97,617	41	397	64,629
Culpeper	114,304	--	829	7,647	105,828
Cumberland	131,624	--	14,134	27,988	89,502
Dickenson	171,650	8,082	6,197	408	156,963
Dinwiddie	244,049	--	9,686	64,864	169,499
Essex	98,013	--	494	16,023	81,496
Fairfax	68,538	--	12,625	--	55,913
Fauquier	174,154	--	12,774	1,855	159,525
Floyd	141,181	--	116	3,891	137,174
Fluvanna	137,348	--	990	18,089	118,269
Franklin	279,864	--	3,377	14,056	262,531
Frederick	128,921	4,297	270	337	124,017
Giles	167,121	52,408	714	5,545	108,454
Gloucester	94,613	--	351	7,886	86,376
Goochland	130,505	--	195	13,063	117,247
Grayson	164,742	22,897	321	3,932	137,592
Greene	53,599	--	1,127	490	51,982
Greensville	135,288	--	143	50,708	84,435
Halifax	351,662	--	10,498	31,059	310,105
Hampton	4,342	--	374	--	3,968
Hanover	178,181	--	1,379	15,246	161,556
Henrico	59,429	--	3,102	128	56,199
Henry	176,780	--	1,740	20,199	154,841
Highland	196,003	57,432	14,014	7,249	117,308
Isle of Wight	114,161	--	995	28,033	85,133
James City	60,221	--	3,148	6,766	50,307
King and Queen	152,722	--	664	55,245	96,823
King George	70,130	--	1,933	698	67,499
King William	111,822	--	789	27,586	83,447

Continued

Table 46—Area of timberland, by county and ownership class, Virginia, 1992--Continued

County	All ownerships	National forest	Other public	Forest industry[1]	Other private
			Acres		
Lancaster	52,501	--	461	7,695	44,345
Lee	150,024	11,229	230	1,380	137,185
Loudoun	117,248	--	7,847	--	109,401
Louisa	228,537	--	795	21,054	206,688
Lunenburg	209,807	--	600	52,726	156,481
Madison	88,259	--	7,685	345	80,229
Mathews	34,787	--	15	7,122	27,650
Mecklenburg	263,242	--	24,254	17,249	221,739
Middlesex	49,882	--	35	4,774	45,073
Montgomery	145,281	18,865	3,617	3,766	119,033
Nelson	231,868	15,507	1,087	24,873	190,401
New Kent	98,183	--	821	24,112	73,250
Newport News	7,934	--	5,700	--	2,234
Northampton	30,351	--	195	150	30,006
Northumberland	67,886	--	210	11,069	56,607
Nottoway	137,331	--	15,401	24,959	96,971
Orange	125,448	--	214	12,523	112,711
Page	81,722	26,803	336	348	54,235
Patrick	212,148	--	11,481	18,664	182,003
Pittsylvania	405,446	--	3,097	47,457	354,892
Powhatan	132,471	--	6,923	14,642	110,906
Prince Edward	165,647	--	9,637	15,182	140,828
Prince George	117,291	--	3,527	29,606	84,158
Prince William	94,125	--	17,766	--	76,359
Pulaski	118,624	19,039	3,819	1,049	94,717
Rappahannock	71,760	--	--	150	71,610
Richmond	76,279	--	110	15,581	60,588
Roanoke	107,085	3,069	13,563	1,892	88,561
Rockbridge	241,345	54,576	24,818	6,804	155,147
Rockingham	253,579	124,722	435	509	127,913
Russell	174,359	--	5,983	155	168,221
Scott	235,375	32,580	174	510	202,111
Shenandoah	184,362	67,209	326	167	116,660
Smyth	172,279	67,941	10,269	528	93,541
Southampton	240,492	--	1,869	62,012	176,611
Spotsylvania	169,148	--	2,522	28,381	138,245
Stafford	118,956	--	23,396	307	95,253
Suffolk	111,147	--	2,913	32,664	75,570
Surry	122,880	--	1,787	35,292	85,801
Sussex	250,649	--	323	94,760	155,566
Tazewell	207,871	3,191	4,817	1,661	198,202
Virginia Beach	36,581	--	3,270	--	33,311
Warren	64,311	5,117	2,700	550	55,944
Washington	189,398	19,481	9,461	--	160,456
Westmoreland	74,248	--	125	5,163	68,960
Wise	178,114	42,830	4,672	150	130,462
Wythe	140,921	50,449	2,183	6,994	81,295
York	28,849	--	21,090	--	7,759
Total	15,447,550	1,468,126	515,160	1,554,763	11,909,501

[1] Includes 17,366 acres of other private land under long-term lease.

Table 47—Area of timberland, by county and broad management class, Virginia, 1992

County	All ownerships	Pine plantation	Natural pine	Oak-pine	Upland hardwood	Lowland hardwood
			Acres			
Accomack	94,507	5,794	39,243	24,617	16,134	8,719
Albemarle	278,205	17,699	26,539	37,864	192,316	3,787
Alleghany	249,199	--	21,895	40,435	186,869	--
Amelia	169,355	52,528	21,856	17,146	70,235	7,590
Amherst	224,549	14,275	21,684	38,462	150,148	--
Appomattox	151,559	34,858	11,810	14,793	90,098	--
Arlington	--	--	--	--	--	--
Augusta	291,118	--	14,504	46,375	230,239	--
Bath	287,742	3,891	16,154	49,642	218,055	--
Bedford	276,133	14,135	42,064	14,132	205,802	--
Bland	173,503	--	10,148	28,258	135,099	--
Botetourt	250,882	--	35,647	27,593	183,204	4,438
Brunswick	290,950	105,577	26,232	45,968	97,459	15,714
Buchanan	290,585	--	--	9,892	280,693	--
Buckingham	300,672	67,968	30,383	37,407	149,121	15,793
Campbell	205,236	27,163	30,637	10,725	132,881	3,830
Caroline	261,702	39,119	55,825	33,976	113,672	19,110
Carroll	182,605	4,837	34,332	55,812	87,624	--
Charles City	84,737	11,688	19,022	21,942	24,034	8,051
Charlotte	209,194	41,037	44,037	39,138	82,384	2,600
Chesapeake	59,974	2,641	10,564	15,995	14,161	16,613
Chesterfield	187,487	40,361	20,873	35,436	83,990	6,827
Clarke	37,876	--	--	--	37,876	--
Craig	162,684	--	33,373	37,990	91,321	--
Culpeper	114,304	10,759	9,347	9,814	78,159	6,225
Cumberland	131,624	36,250	12,207	16,272	61,298	5,597
Dickenson	171,650	--	4,485	8,969	158,196	--
Dinwiddie	244,049	52,134	34,366	69,487	84,130	3,932
Essex	98,013	20,250	13,980	17,117	40,012	6,654
Fairfax	68,538	--	9,867	1,974	48,859	7,838
Fauquier	174,154	1,855	29,620	18,128	119,950	4,601
Floyd	141,181	19,131	25,449	20,392	76,209	--
Fluvanna	137,348	20,820	17,610	38,059	51,198	9,661
Franklin	279,964	4,019	29,774	15,441	230,730	--
Frederick	128,921	--	8,001	24,004	96,916	--
Giles	167,121	--	4,929	10,221	151,971	--
Gloucester	94,613	7,621	24,267	5,081	50,022	7,622
Goochland	130,505	9,980	24,142	24,138	85,339	6,908
Grayson	164,742	6,880	38,214	5,235	114,413	--
Greene	53,599	490	11,215	3,713	38,181	--
Greensville	135,286	20,946	9,523	16,255	48,929	39,633
Halifax	351,662	47,381	70,539	36,918	172,651	24,193
Hampton	4,342	--	--	--	374	3,968
Hanover	178,181	24,768	33,423	34,620	60,785	24,605
Henrico	59,429	128	11,464	11,240	30,977	5,620
Henry	176,780	9,899	53,933	33,251	71,756	7,941
Highland	196,003	4,512	13,442	35,718	142,331	--
Isle of Wight	114,161	9,344	12,341	31,092	45,773	15,611
James City	60,221	10,120	3,928	6,708	39,465	--
King and Queen	152,722	37,315	21,425	33,511	45,952	14,519
King George	70,130	698	5,192	2,596	61,421	223
King William	111,822	39,078	10,771	10,391	43,996	7,586

Continued

Table 47—Area of timberland, by county and broad management class, Virginia, 1992--Continued

County	All ownerships	Pine plantation	Natural pine	Oak-pine	Upland hardwood	Lowland hardwood
			Acres			
Lancaster	52,501	--	13,999	7,000	31,041	461
Lee	150,024	--	9,145	--	140,879	--
Loudoun	117,248	--	16,832	5,993	90,216	4,207
Louisa	228,637	28,361	20,705	16,558	157,972	4,941
Lunenburg	209,807	43,724	57,888	10,781	80,246	17,168
Madison	88,259	345	8,023	16,246	63,645	--
Mathews	34,787	6,326	14,621	5,545	5,530	2,765
Mecklenburg	263,242	31,047	34,991	29,572	163,197	4,435
Middlesex	49,682	9,193	4,595	18,030	18,029	35
Montgomery	145,281	459	36,080	7,533	100,409	800
Nelson	231,868	18,654	13,241	12,153	183,769	4,051
New Kent	98,183	21,424	9,616	20,290	42,045	4,808
Newport News	7,934	--	2,228	1,117	4,589	--
Northampton	30,351	--	12,502	7,712	7,628	2,511
Northumberland	67,886	10,075	5,392	5,391	41,428	5,600
Nottoway	137,331	40,067	14,746	24,477	45,393	12,648
Orange	125,448	11,220	14,741	21,134	71,309	7,044
Page	81,722	--	10,170	3,390	68,162	--
Patrick	212,145	2,667	14,757	20,191	170,818	3,715
Pittsylvania	405,446	29,968	66,642	45,303	244,655	18,878
Powhatan	132,471	11,472	15,298	9,935	88,118	7,648
Prince Edward	165,647	21,156	32,834	41,275	57,837	12,545
Prince George	117,291	39,858	7,791	17,852	44,139	7,651
Prince William	94,125	--	19,244	4,019	66,843	4,019
Pulaski	118,624	--	5,920	12,898	98,402	1,404
Rappahannock	71,780	150	--	6,820	64,790	--
Richmond	76,279	14,426	8,686	2,885	44,512	5,770
Roanoke	107,085	--	19,681	25,603	61,801	--
Rockbridge	241,345	4,548	13,674	36,531	182,029	4,563
Rockingham	253,579	--	18,369	32,002	193,733	9,475
Russell	174,359	--	14,419	--	155,133	4,807
Scott	235,375	--	5,319	11,148	218,908	--
Shenandoah	184,362	--	12,927	22,434	144,514	4,487
Smyth	172,279	--	7,177	17,235	147,867	--
Southampton	240,492	68,956	38,767	34,024	43,690	55,055
Spotsylvania	169,148	33,606	20,948	20,947	72,701	20,946
Stafford	118,956	307	17,555	13,138	87,956	--
Suffolk	111,147	29,422	14,183	14,576	33,365	19,821
Surry	122,880	19,745	24,809	13,516	52,078	12,732
Sussex	250,649	76,820	54,605	40,850	43,622	32,752
Tazewell	207,871	--	--	--	207,871	--
Virginia Beach	38,581	--	11,292	5,632	8,766	10,891
Warren	64,311	--	--	4,662	50,325	9,324
Washington	189,398	--	--	15,528	173,870	--
Westmoreland	74,248	9,383	14,491	7,662	42,712	--
Wise	178,114	4,499	--	--	172,772	843
Wythe	140,921	4,517	4,204	22,154	109,937	109
York	28,849	--	7,086	5,524	15,934	305
Total	15,447,550	1,472,324	1,[illegible],427	1,941,207	9,518,571	635,021

Table 48—Merchantable volume of live timber 5.0 inches d.b.h. and larger on timberland, by county and species group, Virginia, 1992

County	All species	Yellow pine	Other softwood	Soft hardwood	Hard hardwood
	Thousand cubic feet				
Accomack	198,973	114,662	--	52,030	32,281
Albemarle	535,249	77,979	17,157	131,897	308,216
Alleghany	436,373	43,859	19,287	38,474	334,753
Amelia	262,731	127,050	1,629	47,314	86,738
Amherst	439,919	59,112	27,925	128,065	224,817
Appomattox	214,829	68,999	1,189	40,266	104,375
Arlington	--	--	--	--	--
Augusta	484,377	66,078	21,886	42,035	354,378
Bath	564,905	44,360	25,338	61,296	433,911
Bedford	550,823	112,818	8,794	172,032	257,179
Bland	339,501	14,749	31,098	93,710	199,944
Botetourt	457,010	38,207	27,452	111,289	280,062
Brunswick	420,398	208,141	2,431	87,145	122,681
Buchanan	603,005	--	19,721	242,537	340,747
Buckingham	385,474	136,249	1,058	76,629	171,538
Campbell	369,517	100,634	748	90,460	177,675
Caroline	458,971	150,972	312	150,141	157,546
Carroll	278,508	14,366	88,923	45,288	129,931
Charles City	186,542	63,212	8,968	51,428	62,934
Charlotte	346,309	150,904	3,719	73,575	118,111
Chesapeake	139,048	37,966	685	66,272	34,125
Chesterfield	341,835	103,795	--	89,862	148,178
Clarke	101,386	--	--	42,958	58,428
Craig	328,633	86,296	18,625	13,927	229,785
Culpeper	224,718	52,702	1,909	67,765	102,342
Cumberland	185,501	67,223	983	50,298	66,999
Dickenson	333,227	15,579	9,840	102,736	205,072
Dinwiddie	356,461	157,848	1,251	72,333	125,029
Essex	174,111	59,031	--	47,952	67,128
Fairfax	197,711	10,172	2,087	48,715	136,737
Fauquier	355,609	54,030	5,082	102,073	194,424
Floyd	276,144	17,548	74,640	75,012	108,944
Fluvanna	204,926	64,961	467	45,848	93,650
Franklin	584,706	69,330	26,053	240,256	249,067
Frederick	226,208	13,068	12,635	38,932	161,573
Giles	367,575	10,743	10,825	108,165	237,842
Gloucester	215,126	64,728	260	82,060	68,078
Goochland	281,480	79,260	1,517	83,179	117,524
Grayson	347,722	9,264	80,422	76,109	181,927
Greene	136,212	28,807	1,806	43,040	62,559
Greensville	202,215	55,961	2,768	69,089	74,397
Halifax	544,576	193,004	4,098	149,656	197,818
Hampton	14,041	--	--	5,777	8,264
Hanover	298,760	98,111	277	87,632	112,740
Henrico	99,994	28,289	206	26,185	45,314
Henry	244,273	100,723	21,928	43,474	78,148
Highland	424,476	15,291	44,988	70,944	293,253
Isle of Wight	163,109	46,138	--	57,105	59,866
James City	146,104	35,978	402	34,895	74,829
King and Queen	293,926	140,413	4,995	69,656	78,862
King George	172,873	17,497	1,800	92,526	61,050
King William	171,812	68,168	--	44,791	58,853

Continued

Table 48—Merchantable volume of live timber 5.0 inches d.b.h. and larger on timberland, by county and species group, Virginia, 1992--Continued

County	All species	Yellow pine	Other softwood	Soft hardwood	Hard hardwood
			Thousand cubic feet		
Lancaster	98,981	48,207	--	24,870	25,904
Lee	278,580	--	6,818	101,400	170,364
Loudoun	201,153	2,567	2,794	42,804	152,988
Louisa	392,511	97,942	4,928	90,441	199,200
Lunenburg	323,668	138,002	1,838	79,881	103,947
Madison	223,342	15,205	10,316	57,606	140,215
Mathews	75,950	51,448	270	11,809	12,423
Mecklenburg	524,791	118,181	3,551	165,866	237,193
Middlesex	101,787	44,768	183	28,199	28,637
Montgomery	288,429	35,169	46,647	39,488	167,125
Nelson	491,017	35,988	18,421	156,424	280,184
New Kent	202,577	68,282	--	60,905	73,390
Newport News	21,308	9,639	--	6,663	5,007
Northampton	60,587	29,358	--	20,896	10,333
Northumberland	97,056	28,900	--	34,132	34,024
Nottoway	205,037	91,601	--	50,063	63,373
Orange	192,732	35,251	6,976	53,135	97,370
Page	157,599	16,180	6,067	19,110	116,242
Patrick	378,735	41,083	17,214	151,659	168,779
Pittsylvania	766,917	205,716	2,570	256,882	301,749
Powhatan	236,824	38,124	--	82,573	118,127
Prince Edward	221,047	70,542	965	63,284	86,256
Prince George	194,783	68,944	9,115	51,682	65,042
Prince William	230,476	48,882	1,655	53,714	128,225
Pulaski	202,588	9,326	5,798	39,621	147,843
Rappahannock	154,847	4,577	2,083	64,435	83,752
Richmond	162,984	40,832	—	73,605	48,547
Roanoke	190,164	32,912	20,020	21,079	116,153
Rockbridge	432,039	37,503	25,264	69,832	299,640
Rockingham	510,731	26,933	43,501	63,852	376,445
Russell	348,114	--	5,945	125,990	214,179
Scott	532,790	16,025	5,088	215,561	296,118
Shenandoah	344,304	37,730	16,030	43,511	247,033
Smyth	352,470	16,078	15,486	68,449	252,457
Southampton	417,134	181,461	13,062	155,355	87,256
Spotsylvania	366,897	123,578	2,420	103,261	137,638
Stafford	315,876	47,936	666	123,457	143,817
Suffolk	172,340	49,290	5,525	67,023	50,502
Surry	183,348	70,300	2,201	67,001	43,846
Sussex	383,820	215,219	3,958	81,193	83,450
Tazewell	466,047	--	4,023	172,302	289,722
Virginia Beach	69,719	20,069	984	31,202	17,464
Warren	98,809	5,711	1,509	21,028	70,561
Washington	426,634	9,651	7,728	179,688	229,567
Westmoreland	153,763	50,165	265	48,354	54,979
Wise	319,773	1,898	9,237	137,759	171,079
Wythe	254,607	19,191	23,549	22,375	189,492
York	100,962	24,203	--	37,658	39,100
Total	28,612,558	5,730,642	992,848	7,721,709	14,167,359

Table 49—Volume of growing stock on timberland, by county and species group, Virginia, 1992

County	All species	Yellow pine	Other softwood	Soft hardwood	Hard hardwood
			Thousand cubic feet		
Accomack	189,847	114,068	--	47,817	27,962
Albemarle	494,599	76,035	16,416	119,620	282,528
Alleghany	382,121	42,842	18,557	35,098	285,624
Amelia	257,378	125,953	1,629	45,605	84,191
Amherst	400,046	57,478	26,875	120,479	195,214
Appomattox	203,365	68,484	1,189	34,397	99,295
Arlington	--	--	--	--	--
Augusta	421,685	65,632	21,886	31,454	302,713
Bath	521,754	44,360	25,338	54,351	397,705
Bedford	505,405	112,818	8,127	164,036	220,424
Bland	284,218	13,356	31,098	86,735	163,029
Botetourt	403,423	38,207	27,086	99,977	238,173
Brunswick	401,268	207,389	2,239	79,419	112,221
Buchanan	551,581	--	19,721	230,110	301,750
Buckingham	365,041	135,150	1,058	67,938	160,895
Campbell	346,044	100,001	--	84,273	161,770
Caroline	434,440	150,396	312	140,627	143,105
Carroll	251,542	13,911	88,923	37,287	111,421
Charles City	177,075	62,871	8,968	45,412	59,824
Charlotte	331,886	150,238	3,719	70,417	107,512
Chesapeake	132,921	37,966	685	62,141	32,129
Chesterfield	330,227	103,795	--	84,541	141,891
Clarke	93,396	--	--	40,809	52,587
Craig	297,107	64,064	18,625	9,641	204,777
Culpeper	216,041	62,702	1,564	62,174	99,601
Cumberland	175,570	66,605	396	46,833	61,736
Dickenson	283,767	15,579	9,840	93,284	165,064
Dinwiddie	340,407	157,362	1,251	63,829	117,965
Essex	165,553	59,031	--	45,618	60,904
Fairfax	187,033	9,752	2,087	43,305	131,889
Fauquier	321,265	53,650	5,082	88,099	174,434
Floyd	249,027	12,719	73,228	64,823	98,257
Fluvanna	193,777	64,580	467	40,866	87,864
Franklin	550,970	89,330	26,053	232,474	223,113
Frederick	213,952	13,068	12,635	36,925	151,324
Giles	330,477	10,743	10,825	99,084	209,825
Gloucester	208,635	64,728	260	80,083	63,564
Goochland	276,142	78,051	1,517	80,046	116,528
Grayson	286,747	8,172	76,228	55,241	147,106
Greene	128,355	28,301	1,806	41,097	57,151
Greensville	185,353	55,961	2,768	60,433	66,191
Halifax	516,970	191,898	3,868	138,700	182,504
Hampton	11,784	--	--	4,283	7,501
Hanover	290,711	98,111	277	84,047	108,276
Henrico	97,609	28,160	206	25,666	43,577
Henry	231,955	99,644	21,928	39,471	70,912
Highland	389,841	15,291	44,036	63,981	266,533
Isle of Wight	148,556	46,138	--	49,116	53,302
James City	138,394	35,978	402	32,797	69,217
King and Queen	281,876	140,413	4,995	64,508	71,960
King George	154,933	17,497	1,685	84,692	51,059
King William	159,267	67,354	--	40,013	51,900

Continued

Table 49—Volume of growing stock on timberland, by county and species group, Virginia, 1992--Continued

County	All species	Yellow pine	Other softwood	Soft hardwood	Hard hardwood
			Thousand cubic feet		
Lancaster	95,084	48,207	--	24,677	22,200
Lee	245,905	--	6,816	97,182	141,907
Loudoun	181,094	2,567	2,794	32,580	143,153
Louisa	371,099	96,042	4,928	80,684	189,445
Lunenburg	313,426	138,002	1,838	76,631	96,955
Madison	200,218	14,566	10,316	54,056	121,280
Mathews	74,003	51,448	270	11,360	10,925
Mecklenburg	502,474	117,732	2,493	158,860	223,389
Middlesex	98,430	44,768	183	26,114	27,365
Montgomery	270,208	34,223	48,647	36,751	152,587
Nelson	449,610	35,191	18,421	148,809	247,189
New Kent	194,785	68,282	--	58,474	68,029
Newport News	20,979	9,639	--	6,500	4,840
Northampton	57,006	28,607	--	18,774	9,625
Northumberland	89,506	28,336	--	29,521	31,649
Nottoway	198,340	91,601	--	49,064	57,675
Orange	178,427	35,251	6,976	49,898	86,302
Page	140,902	16,180	5,567	15,430	103,725
Patrick	340,996	40,474	17,214	136,738	146,570
Pittsylvania	735,259	203,456	2,570	247,086	282,147
Powhatan	231,934	35,378	--	79,397	117,159
Prince Edward	211,440	70,542	965	59,820	80,113
Prince George	187,235	68,944	8,797	49,857	59,637
Prince William	213,956	45,444	1,855	43,677	123,180
Pulaski	156,621	8,844	5,796	26,501	115,480
Rappahannock	130,294	4,577	2,083	56,200	67,434
Richmond	154,550	39,959	--	68,239	46,342
Roanoke	172,440	32,338	20,020	19,484	100,598
Rockbridge	391,142	35,777	24,721	61,725	268,919
Rockingham	433,406	21,860	42,143	54,324	315,079
Russell	320,486	--	5,097	121,779	193,590
Scott	483,870	16,025	5,086	204,188	258,571
Shenandoah	321,049	36,575	16,030	40,992	227,452
Smyth	333,688	16,078	15,486	66,066	236,058
Southampton	382,178	160,163	12,402	136,474	73,139
Spotsylvania	347,322	122,935	2,203	98,246	123,938
Stafford	303,053	47,473	666	119,725	135,189
Suffolk	157,872	49,064	5,525	60,051	43,232
Surry	171,753	70,099	2,201	60,732	38,721
Sussex	364,651	213,567	3,958	73,371	73,755
Tazewell	419,629	--	2,485	160,065	257,079
Virginia Beach	85,065	19,835	984	27,535	16,711
Warren	95,974	5,711	1,609	19,864	68,890
Washington	397,699	8,651	7,728	171,805	208,515
Westmoreland	144,700	49,461	265	45,323	48,651
Wise	288,051	1,698	9,237	132,582	144,534
Wythe	231,688	18,702	23,161	19,748	170,077
York	96,181	24,203	--	35,718	36,260
Total	26,486,794	5,675,317	973,071	7,126,149	12,712,257

Table 50—Volume of sawtimber on timberland, by county and species group, Virginia, 1992

County	All species	Yellow pine	Other softwood	Soft hardwood	Hard hardwood
			Thousand board feet		
Accomack	670,520	492,202	--	94,557	83,761
Albemarle	1,667,590	169,809	65,502	487,333	944,946
Alleghany	1,080,683	93,235	72,359	104,267	810,822
Amelia	766,373	340,443	5,710	165,177	265,043
Amherst	1,259,387	130,874	117,533	443,145	567,835
Appomattox	461,212	127,926	--	75,567	257,719
Arlington	--	--	--	--	--
Augusta	1,160,740	241,292	66,899	71,547	781,002
Bath	1,534,105	130,710	81,569	119,147	1,202,679
Bedford	1,565,422	330,931	36,088	551,720	646,685
Bland	819,568	44,089	140,990	227,972	406,517
Botetourt	1,347,872	110,502	136,214	408,919	692,037
Brunswick	1,096,193	629,739	--	192,924	273,530
Buchanan	1,723,549	--	91,924	670,431	961,194
Buckingham	801,250	219,548	2,034	168,215	411,453
Campbell	864,759	199,561	--	241,476	423,722
Caroline	1,416,238	480,573	--	507,809	427,856
Carroll	821,265	45,282	363,392	109,610	302,981
Charles City	573,895	213,476	49,196	103,519	207,704
Charlotte	821,854	264,319	2,382	218,317	336,836
Chesapeake	538,161	209,654	3,807	198,350	126,350
Chesterfield	954,455	289,997	--	257,689	406,769
Clarke	364,188	--	--	175,182	189,006
Craig	763,452	219,260	73,797	12,835	457,570
Culpeper	653,732	156,772	2,079	184,649	310,232
Cumberland	412,471	121,874	--	122,365	168,232
Dickenson	979,626	44,856	48,850	328,755	557,165
Dinwiddie	1,016,331	545,831	2,228	167,812	300,460
Essex	519,225	203,392	--	127,926	187,907
Fairfax	741,413	33,955	1,730	169,774	535,954
Fauquier	1,039,338	162,911	6,333	325,194	543,900
Floyd	708,665	30,066	247,386	177,665	253,548
Fluvanna	442,244	156,291	--	86,474	199,479
Franklin	1,574,618	139,768	100,642	720,564	613,644
Frederick	660,288	35,681	46,616	83,836	494,155
Giles	1,013,525	33,634	60,527	339,720	579,644
Gloucester	679,648	243,622	--	233,591	202,435
Goochland	779,303	134,005	--	285,038	360,260
Grayson	1,013,809	36,414	347,180	160,633	469,582
Greene	457,211	55,836	--	184,200	217,175
Greensville	595,907	223,040	11,077	169,611	192,179
Halifax	1,327,747	476,639	2,131	336,124	512,853
Hampton	29,863	--	--	12,409	17,454
Hanover	823,194	261,794	--	203,869	357,531
Henrico	272,730	106,847	--	43,299	122,584
Henry	584,413	236,311	95,105	70,094	182,903
Highland	1,212,280	25,698	188,471	184,520	813,591
Isle of Wight	509,406	172,069	--	124,132	213,205
James City	457,321	104,228	--	111,311	241,782
King and Queen	811,007	404,144	28,884	188,093	209,886
King George	558,728	73,087	5,102	310,017	170,522
King William	404,431	150,933	--	103,452	150,046

Continued

Table 50—Volume of sawtimber on timberland, by county and species group, Virginia, 1992--Continued

County	All species	Yellow pine	Other softwood	Soft hardwood	Hard hardwood
			Thousand board feet		
Lancaster	309,925	154,032	--	85,423	70,470
Lee	746,976	--	2,399	293,535	451,042
Loudoun	648,708	3,179	2,287	148,483	494,759
Louisa	899,612	198,482	9,702	243,923	447,505
Lunenburg	910,432	455,143	1,869	200,537	252,883
Madison	781,140	35,496	53,447	222,197	470,000
Mathews	279,939	206,146	--	19,324	54,470
Mecklenburg	1,410,066	309,632	3,143	440,687	656,604
Middlesex	310,217	135,370	--	80,564	94,283
Montgomery	864,988	97,473	216,381	106,271	444,863
Nelson	1,636,417	63,848	79,275	609,634	883,660
New Kent	584,372	149,398	--	207,553	227,421
Newport News	83,354	36,889	--	25,333	21,132
Northampton	172,583	122,371	--	25,648	24,564
Northumberland	281,120	99,387	--	82,836	98,897
Nottoway	594,942	255,162	--	176,466	163,314
Orange	521,113	34,814	25,328	204,202	256,769
Page	440,413	55,289	26,923	59,209	298,992
Patrick	913,389	92,948	68,706	350,254	401,481
Pittsylvania	2,026,942	492,164	10,013	788,732	736,033
Powhatan	679,742	69,886	--	253,434	356,622
Prince Edward	520,664	87,678	1,736	168,661	262,589
Prince George	624,834	234,869	49,965	154,915	185,085
Prince William	709,457	94,965	--	165,043	449,449
Pulaski	353,831	35,263	28,537	80,403	209,528
Rappahannock	519,667	19,397	13,015	244,830	242,425
Richmond	488,090	73,178	--	243,801	171,111
Roanoke	474,955	75,870	83,887	46,080	268,318
Rockbridge	1,184,042	117,944	90,264	179,085	796,749
Rockingham	1,452,968	70,848	138,547	146,172	1,097,401
Russell	1,040,442	--	14,991	393,625	631,826
Scott	1,627,034	69,213	12,877	699,423	845,521
Shenandoah	932,952	126,226	74,246	90,123	642,357
Smyth	1,131,540	52,257	76,279	197,996	805,008
Southampton	1,261,200	525,485	63,817	417,846	254,052
Spotsylvania	841,444	225,903	8,958	242,012	364,571
Stafford	1,017,342	130,391	--	373,611	513,340
Suffolk	478,291	147,758	28,923	173,291	128,319
Surry	554,607	227,749	11,017	188,365	127,476
Sussex	1,189,378	765,491	22,865	179,798	231,224
Tazewell	1,195,415	--	8,489	470,819	716,107
Virginia Beach	227,605	92,970	4,307	67,044	63,284
Warren	298,465	11,618	5,599	91,052	190,196
Washington	1,246,298	35,377	26,021	588,489	595,411
Westmoreland	418,234	125,182	--	131,200	161,852
Wise	912,666	7,934	42,577	415,673	446,582
Wythe	699,122	79,896	109,016	54,551	455,659
York	395,583	105,166	--	133,608	156,809
Total	80,251,521	15,961,346	3,919,241	22,092,596	38,278,338

Table 51—Net annual change[1] of growing stock on timberland, by county and species group, Virginia, 1992

County	All species	Yellow pine	Other softwood	Soft hardwood	Hard hardwood
			Thousand cubic feet		
Accomack	3,084	1,607	--	1,100	377
Albemarle	6,225	-418	316	1,244	5,083
Alleghany	6,598	661	581	701	4,655
Amelia	-597	3,189	62	-641	-3,207
Amherst	3,383	-477	660	2,427	773
Appomattox	1,529	597	-16	974	-26
Arlington	--	--	--	--	--
Augusta	4,014	472	805	578	2,159
Bath	5,832	544	596	741	3,951
Bedford	7,415	3,565	94	1,872	1,884
Bland	5,326	116	607	1,638	2,965
Botetourt	1,537	-236	278	306	1,189
Brunswick	7,511	5,907	316	-648	1,936
Buchanan	6,301	--	287	2,130	3,884
Buckingham	8,142	3,259	74	1,754	3,055
Campbell	8,537	2,742	--	2,499	3,296
Caroline	3,136	437	6	3,346	-653
Carroll	-4,397	-738	-3,094	1,047	-1,612
Charles City	-327	-549	166	-89	145
Charlotte	6,938	4,859	45	-399	2,433
Chesapeake	-3,994	-573	14	-3,109	-326
Chesterfield	-2,628	-2,353	16	362	-653
Clarke	1,990	--	--	1,087	903
Craig	4,398	-310	447	314	3,947
Culpeper	2,383	-545	-2	1,578	1,352
Cumberland	2,167	-51	-83	441	1,860
Dickenson	-1,882	306	158	-103	-2,243
Dinwiddie	5,309	3,220	42	907	1,140
Essex	-530	1,031	83	-131	-1,513
Fairfax	11	130	-57	176	-238
Fauquier	3,010	-157	211	2,249	707
Floyd	-6,427	-424	-5,705	-803	505
Fluvanna	3,935	564	-64	1,532	1,903
Franklin	8,479	-1,106	-363	6,631	3,317
Frederick	2,306	190	226	1,218	672
Giles	4,582	106	249	1,758	2,469
Gloucester	1,788	2,365	10	-808	221
Goochland	6,775	2,560	56	1,920	2,239
Grayson	2,526	205	2,129	595	-403
Greene	2,913	768	88	998	1,059
Greensville	-78	-2,893	91	2,419	305
Halifax	-953	2,769	229	-3,242	-709
Hampton	-1,569	-1,344	--	-73	-152
Hanover	6,631	2,143	--	1,616	2,872
Henrico	2,053	765	25	575	688
Henry	2,302	1,373	989	-916	856
Highland	5,378	189	1,387	569	3,233
Isle of Wight	-6,860	-2,925	--	-2,471	-1,464
James City	4,546	1,820	--	1,203	1,523
King and Queen	3,544	3,602	74	384	-516
King George	2,815	84	14	1,707	1,010
King William	-3,351	633	-76	-2,078	-1,830

Continued

Table 51—Net annual change[1] of growing stock on timberland, by county and species group, Virginia, 1992--Continued

County	All species	Yellow pine	Other softwood	Soft hardwood	Hard hardwood
			Thousand cubic feet		
Lancaster	616	105	--	255	256
Lee	2,351	--	508	-55	1,898
Loudoun	2,256	-349	169	436	2,000
Louisa	9,668	3,790	274	2,387	3,217
Lunenburg	-59	5,091	142	-3,091	-2,201
Madison	428	-1,709	285	999	853
Mathews	949	1,020	6	293	-370
Mecklenburg	10,154	2,095	-9	4,570	3,498
Middlesex	107	312	44	-1,128	879
Montgomery	3,846	719	1,382	975	770
Nelson	8,049	2,234	476	2,833	2,506
New Kent	-206	-2,268	--	1,045	1,017
Newport News	395	298	--	215	-118
Northampton	686	160	--	416	110
Northumberland	-1,630	-92	--	39	-1,577
Nottoway	-1,462	-4,262	33	1,406	1,371
Orange	2,584	2,555	173	900	-1,044
Page	2,491	239	207	290	1,755
Patrick	8,170	645	-19	3,582	3,962
Pittsylvania	14,383	1,375	114	5,983	6,911
Powhatan	3,487	398	-92	1,845	1,336
Prince Edward	1,884	1,845	92	1,492	-1,545
Prince George	689	-2,215	174	1,458	1,272
Prince William	82	-146	31	353	-156
Pulaski	4,074	170	265	987	2,652
Rappahannock	1,381	-841	52	1,528	642
Richmond	2,171	837	--	1,179	155
Roanoke	2,971	747	456	656	1,112
Rockbridge	3,375	-1,029	832	1,520	2,052
Rockingham	4,226	135	946	1,024	2,121
Russell	4,258	--	250	3,100	908
Scott	5,945	324	117	2,289	3,215
Shenandoah	5,321	341	205	1,347	3,428
Smyth	1,240	-2,341	499	829	2,253
Southampton	-3,893	1,768	141	-1,470	-4,332
Spotsylvania	3,716	28	35	1,541	2,112
Stafford	4,878	-1,984	93	4,203	2,566
Suffolk	260	1,455	153	-1,464	116
Surry	-451	1,571	55	801	-2,878
Sussex	-245	1,082	106	-552	-881
Tazewell	3,926	--	66	1,730	2,130
Virginia Beach	-945	342	21	-1,231	-77
Warren	-1,041	-490	31	301	-883
Washington	5,030	-927	-107	3,879	2,185
Westmoreland	1,813	1,672	71	537	-467
Wise	-5,596	16	260	-2,225	-3,647
Wythe	2,933	-25	942	524	1,492
York	2,313	490	--	1,034	789
Total	249,344	52,860	11,450	86,650	98,384

[1] Average net annual growth minus annual timber removals.

Table 52—Net annual change[1] of sawtimber on timberland, by county and species group, Virginia, 1992

County	All species	Yellow pine	Other softwood	Soft hardwood	Hard hardwood
			Thousand board feet		
Accomack	16,717	10,243	--	3,460	3,014
Albemarle	35,952	-216	1,185	6,372	28,611
Alleghany	23,543	3,220	2,429	2,500	15,394
Amelia	12,037	19,328	114	-1,199	-6,206
Amherst	37,833	8,385	3,358	16,710	9,380
Appomattox	20,990	12,105	-454	7,598	1,741
Arlington	--	--	--	--	--
Augusta	23,876	3,566	3,544	1,881	14,885
Bath	25,273	2,718	4,420	1,041	17,094
Bedford	37,435	12,888	256	14,964	9,327
Bland	19,082	771	3,234	2,465	12,592
Botetourt	14,757	2,082	2,642	799	9,234
Brunswick	26,662	24,724	94	-7,358	9,202
Buchanan	28,863	--	2,328	7,875	18,660
Buckingham	24,601	10,331	163	6,532	7,575
Campbell	36,596	9,193	--	10,923	16,480
Caroline	19,305	433	--	17,580	1,292
Carroll	-58	1,744	-8,038	3,901	2,335
Charles City	1,728	40	995	399	294
Charlotte	16,735	9,630	-40	-3,352	10,497
Chesapeake	-6,202	-2,674	88	-6,103	2,487
Chesterfield	1,571	-4,177	--	2,722	3,026
Clarke	9,272	--	--	5,477	3,795
Craig	16,141	-25	3,523	432	12,211
Culpeper	17,631	3,041	28	6,125	8,437
Cumberland	5,260	-169	-341	2,600	3,170
Dickenson	-2,823	1,690	572	-1,807	-3,278
Dinwiddie	11,795	2,335	68	4,222	5,170
Essex	-433	3,601	--	1,825	-5,859
Fairfax	4,971	732	386	1,852	2,001
Fauquier	20,620	-279	260	12,716	7,923
Floyd	-28,997	-1,389	-22,811	-7,332	2,535
Fluvanna	9,851	-1,799	--	6,050	5,600
Franklin	44,311	-2,630	-2,335	31,914	17,362
Frederick	9,981	996	1,347	3,446	4,192
Giles	22,878	588	1,284	9,867	11,338
Gloucester	4,155	5,679	--	-3,017	1,493
Goochland	31,110	6,638	--	11,877	12,595
Grayson	19,177	289	12,261	3,826	2,791
Greene	15,516	4,274	351	4,650	6,241
Greensville	-2,057	-15,753	409	7,889	5,398
Halifax	19,623	19,118	43	-8,028	8,490
Hampton	-7,629	-6,333	--	-281	-1,015
Hanover	25,711	7,371	--	6,094	12,246
Henrico	7,906	4,488	--	221	3,197
Henry	5,239	3,640	3,909	-4,567	2,257
Highland	20,251	966	3,146	1,156	14,983
Isle of Wight	-30,820	-20,883	--	-5,224	-4,713
James City	18,094	7,010	--	4,754	6,330
King and Queen	14,438	18,573	459	1,410	-4,004
King George	16,154	963	140	10,671	4,380
King William	-12,421	-218	--	-7,650	-4,553

Continued

Table 52—Net annual change[1] of sawtimber on timberland, by county and species group, Virginia, 1992--Continued

County	All species	Yellow pine	Other softwood	Soft hardwood	Hard hardwood
			Thousand board feet		
Lancaster	11,428	5,515	--	2,309	3,604
Lee	9,130	--	498	80	8,554
Loudoun	11,244	-1,187	94	3,395	8,942
Louisa	28,024	3,145	148	12,506	12,225
Lunenburg	5,259	22,168	350	-11,192	-6,067
Madison	12,882	-6,158	1,559	8,924	8,557
Mathews	9,527	8,559	--	317	651
Mecklenburg	47,158	5,929	116	19,949	21,165
Middlesex	2,314	3,241	--	-4,399	3,472
Montgomery	19,564	4,009	7,894	3,737	3,924
Nelson	40,726	2,262	2,315	20,027	16,122
New Kent	-1,379	-10,536	--	3,250	5,907
Newport News	2,381	1,576	--	771	34
Northampton	3,402	1,722	--	609	1,071
Northumberland	-7,133	-1,363	--	-444	-5,326
Nottoway	-14,996	-23,321	--	5,780	2,545
Orange	6,750	3,658	584	5,261	-2,753
Page	12,242	1,496	598	1,787	8,361
Patrick	34,405	5,381	927	13,483	14,614
Pittsylvania	56,401	-5,230	405	26,628	34,598
Powhatan	23,702	53	--	13,008	10,641
Prince Edward	4,348	3,739	13	2,204	-1,608
Prince George	2,390	-5,237	1,035	4,632	4,960
Prince William	5,035	-163	398	3,588	1,212
Pulaski	16,188	660	1,092	3,044	11,392
Rappahannock	8,848	-2,882	310	9,014	2,406
Richmond	12,033	2,618	--	7,656	1,759
Roanoke	14,217	5,100	2,777	-80	6,420
Rockbridge	21,207	-508	3,720	7,757	10,238
Rockingham	15,044	1,060	1,393	2,592	9,999
Russell	17,374	--	-890	12,874	5,390
Scott	27,931	1,885	177	8,840	17,029
Shenandoah	22,326	3,334	1,348	2,751	14,893
Smyth	14,509	-7,972	2,047	5,714	14,720
Southampton	-19,380	-667	1,308	-4,589	-15,432
Spotsylvania	17,463	-226	173	7,961	9,555
Stafford	23,772	-1,541	--	12,542	12,771
Suffolk	-1,709	2,532	917	-7,119	1,961
Surry	-10,114	-642	309	1,034	-10,815
Sussex	-6,118	-7,169	578	-2,033	2,506
Tazewell	13,980	--	107	7,963	5,910
Virginia Beach	-4,136	-271	121	-4,770	784
Warren	-582	-1,152	421	341	-192
Washington	25,597	-4,816	-918	19,621	11,710
Westmoreland	2,868	3,206	--	1,652	-1,990
Wise	-16,596	102	1,016	-2,897	-14,817
Wythe	18,512	-96	7,089	1,161	10,378
York	10,854	2,892	--	3,768	4,194
Total	1,251,073	176,563	59,023	421,685	593,802

[1] Average net annual growth minus annual timber removals.

Table 53—Green weight of forest biomass on timberland, by county and species group, Virginia, 1992

County	All species	Yellow pine	Other softwood	Soft hardwood	Hard hardwood
	Hundred thousand pounds				
Accomack	198,435	98,834	8	58,625	40,968
Albemarle	550,885	75,017	16,909	122,490	336,469
Alleghany	485,008	41,412	16,493	48,080	379,023
Amelia	275,777	121,594	3,113	53,184	97,886
Amherst	438,942	55,858	22,916	118,446	241,692
Appomattox	235,006	88,953	2,698	42,438	120,917
Arlington	--	--	--	--	--
Augusta	529,214	53,423	21,278	53,955	400,558
Bath	604,892	38,660	22,246	73,601	470,185
Bedford	564,852	103,736	8,262	162,351	290,503
Bland	368,237	11,555	25,058	93,419	228,205
Botetourt	480,589	33,265	21,269	107,268	318,787
Brunswick	461,843	195,574	4,938	103,411	157,920
Buchanan	602,645	169	17,299	211,581	373,596
Buckingham	443,358	142,373	2,992	92,176	205,817
Campbell	384,151	98,562	1,823	88,351	195,615
Caroline	470,656	147,755	757	143,098	179,046
Carroll	279,823	13,088	72,462	49,543	144,730
Charles City	193,773	58,500	8,630	55,162	71,481
Charlotte	370,642	148,881	5,585	78,328	137,848
Chesapeake	137,794	32,932	654	65,990	38,218
Chesterfield	360,117	96,296	697	93,910	169,214
Clarke	98,561	--	--	37,746	60,815
Craig	341,190	53,244	16,545	20,803	250,598
Culpeper	221,917	45,032	2,541	62,762	111,582
Cumberland	206,952	68,843	1,889	51,809	84,411
Dickenson	336,822	13,796	9,320	92,764	220,942
Dinwiddie	378,746	145,861	2,566	81,893	148,326
Essex	182,107	53,318	360	49,195	79,234
Fairfax	196,869	9,493	2,914	45,480	138,982
Fauquier	364,655	49,492	7,733	91,885	215,545
Floyd	275,881	18,492	60,921	73,958	122,510
Fluvanna	218,069	63,490	1,188	47,538	105,853
Franklin	589,681	67,199	24,016	217,083	281,383
Frederick	243,651	12,746	10,952	43,573	176,380
Giles	373,602	8,396	9,368	95,500	260,340
Gloucester	219,399	58,658	272	80,215	80,255
Goochland	292,482	73,630	3,734	82,403	132,715
Grayson	345,775	7,359	65,321	74,888	198,207
Greene	133,900	25,912	1,941	38,981	67,066
Greensville	224,223	53,794	2,701	76,942	90,786
Halifax	577,394	184,477	8,794	156,611	227,512
Hampton	13,553	--	--	5,113	8,440
Hanover	329,769	98,370	572	93,796	137,021
Henrico	108,938	25,028	398	28,544	54,970
Henry	277,448	106,909	17,978	50,513	102,048
Highland	450,751	15,652	40,486	69,659	324,954
Isle of Wight	178,281	43,720	--	62,971	71,590
James City	151,774	36,216	359	34,773	80,428
King and Queen	308,004	131,002	5,240	73,278	98,484
King George	169,105	15,541	1,717	82,902	68,945
King William	180,056	66,286	271	47,178	66,321

Continued

Table 53—Green weight of forest biomass on timberland, by county and species group, Virginia, 1992--Continued

County	All species	Yellow pine	Other softwood	Soft hardwood	Hard hardwood
			Hundred thousand pounds		
Lancaster	103,305	45,253	118	25,416	32,519
Lee	286,654	--	8,642	91,367	186,645
Loudoun	213,207	2,641	6,533	43,245	160,788
Louisa	427,013	95,020	6,874	96,502	228,817
Lunenburg	330,339	124,178	3,810	85,863	116,688
Madison	219,799	14,057	8,004	49,016	148,722
Mathews	73,871	44,337	333	13,929	15,272
Mecklenburg	539,928	107,594	6,075	163,270	262,987
Middlesex	105,124	40,641	438	28,340	35,705
Montgomery	292,725	29,538	37,081	38,299	187,809
Nelson	486,467	38,937	16,172	135,389	295,969
New Kent	211,807	64,886	--	59,727	87,194
Newport News	20,526	7,939	27	6,916	5,644
Northampton	61,331	25,914	--	22,178	13,239
Northumberland	103,349	28,089	--	33,939	41,321
Nottoway	208,900	85,898	823	50,469	71,710
Orange	215,636	41,487	7,069	53,208	113,872
Page	161,630	14,158	5,498	19,653	122,321
Patrick	392,837	36,401	13,935	147,067	195,434
Pittsylvania	802,473	201,480	3,698	245,200	352,095
Powhatan	241,986	36,720	1,100	77,728	126,438
Prince Edward	240,375	71,299	2,103	64,247	102,726
Prince George	205,169	66,610	9,359	55,381	73,819
Prince William	230,032	42,390	3,381	51,019	133,242
Pulaski	230,917	8,912	5,049	46,765	170,191
Rappahannock	154,815	3,948	1,623	58,313	90,931
Richmond	163,499	40,470	159	67,160	55,710
Roanoke	210,765	32,529	17,317	23,386	137,533
Rockbridge	466,993	35,822	22,926	71,087	337,158
Rockingham	537,231	21,312	41,405	69,079	405,435
Russell	351,196	606	9,178	112,728	228,684
Scott	541,525	13,490	5,144	196,196	326,695
Shenandoah	364,815	31,406	13,922	51,946	267,541
Smyth	365,309	13,050	13,431	68,296	270,532
Southampton	447,089	152,197	12,842	170,937	111,113
Spotsylvania	382,967	123,462	2,819	101,138	155,548
Stafford	310,794	41,497	1,643	114,051	153,603
Suffolk	182,783	47,565	5,232	70,817	59,169
Surry	198,229	67,393	2,112	70,722	58,002
Sussex	409,618	199,250	4,361	95,574	110,433
Tazewell	479,781	--	4,276	155,920	319,585
Virginia Beach	71,775	19,208	909	33,034	18,624
Warren	102,506	4,511	1,459	20,209	76,327
Washington	420,639	8,322	7,597	157,187	247,533
Westmoreland	160,567	48,545	584	46,484	64,954
Wise	330,133	1,361	9,292	128,594	190,886
Wythe	273,567	15,552	20,021	28,129	209,865
York	94,903	20,202	--	33,132	41,569
Total	29,842,860	5,404,594	920,156	7,634,214	15,883,896

Thompson, Michael T.; Johnson, Tony G. 1994. Virginia's forests, 1992. Resour. Bull. SE-151. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southeastern Forest Experiment Station. 103 p.

Since 1986, area of timberland in Virginia declined by 1 percent and currently totals 15.4 million acres. Nonindustrial private owners control 77 percent of the State's timberland. Volume of softwood growing stock increased 6 percent to 6.6 billion cubic feet, and hardwood growing-stock volume was up by an equal rate to 19.8 billion cubic feet. Softwood net annual growth increased by 38 percent to 317 million cubic feet, and hardwood growth declined 7 percent to 531 million cubic feet. Annual removals of softwood and hardwood growing stock increased 22 and 27 percent, respectively. Annual softwood mortality was down 24 percent, while hardwood mortality increased 33 percent.

KEYWORDS: Timberland, forest ownership, timber volume, timber growth, timber removals, timber mortality.

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