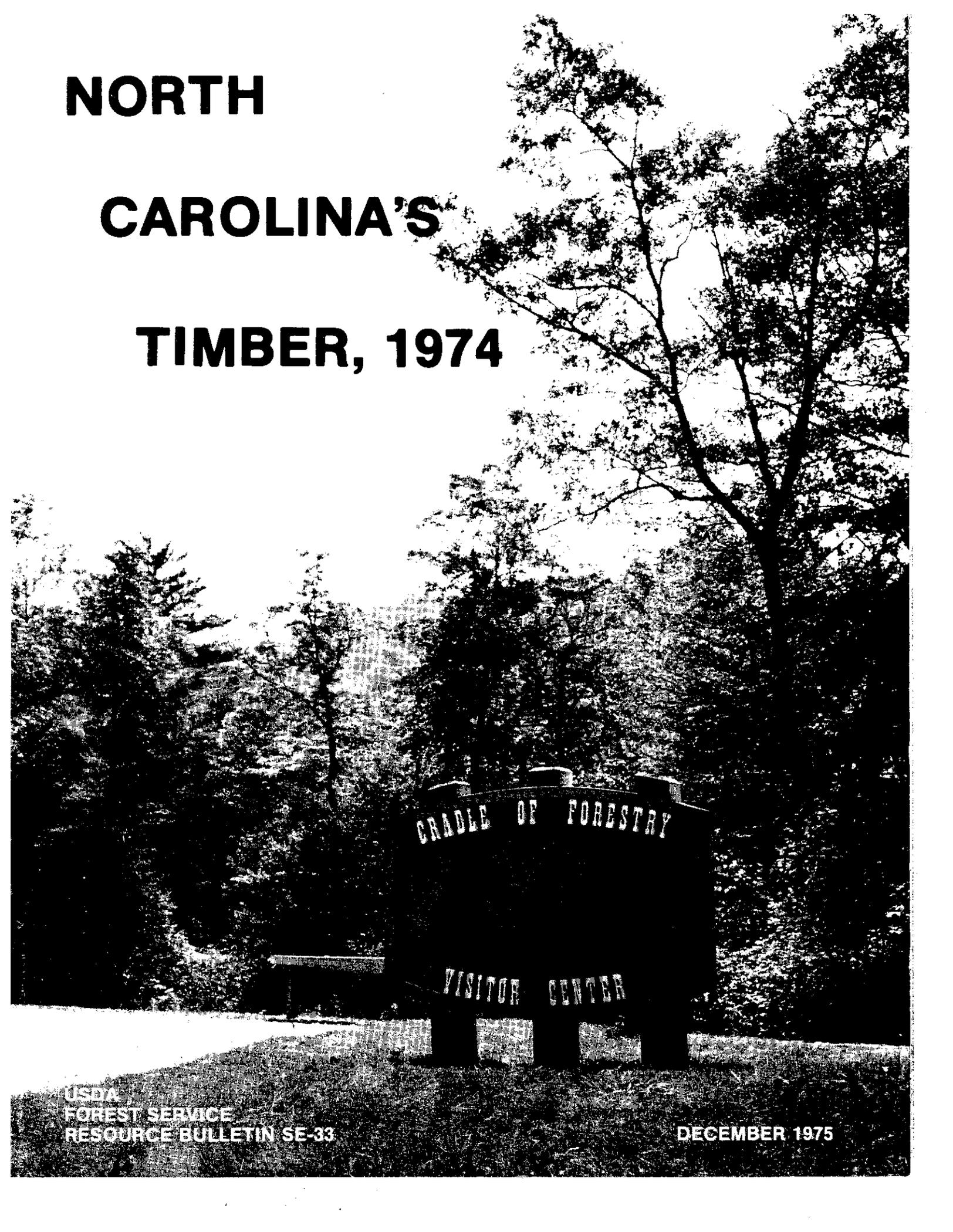


# **NORTH CAROLINA'S TIMBER, 1974**



**CRADLE OF FORESTRY**

**VISITOR CENTER**

**USDA  
FOREST SERVICE  
RESOURCE BULLETIN SE-33**

**DECEMBER 1975**

# Contents

	Page
Highlights .....	3
Timber trends	
Commercial forest acreage decreasing .....	5
Decline in farm woodland slows .....	6
Hardwoods encroach on pine sites .....	7
Regeneration lags behind harvesting .....	8
Volume accumulation accelerates .....	8
Growth rate up 21 percent .....	9
Timber products output	
Saw-log output up .....	13
Pulpwood production continued to increase .....	13
Output of veneer logs soars .....	15
Output of other roundwood products down .....	15
Increase in other removals nullified gains from improved utilization .....	16
Timber supply outlook	
Hardwoods dominate prospective supply .....	18
Prospective supply from plantations .....	19
Prospective supply is well below potential .....	20
Stand-age distribution further describes supply outlook .....	21
Recent rates of forestry activities .....	22
Almost two-thirds of the stands were undisturbed .....	23
Management opportunities	
Adverse sites limit opportunities on 3.4 million acres .....	26
Almost 9.1 million acres suitable for management supported stands in good condition .....	26
Opportunities identified on 7.1 million acres .....	26
Appendix	
Procedure .....	30
Reliability of the data .....	30
Definition of terms .....	30
Conversion factors .....	34
Index to detailed tables .....	35

## Foreword

This report presents the principal findings of the fourth evaluation of North Carolina's forest resources. The field survey was started in November 1972 and completed in January 1975. Three previous surveys, completed in 1938, 1956, and 1964, provide statistics for measuring changes and trends over the past 36 years. In this report, the primary emphasis is on the changes and trends since 1964.

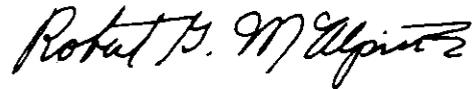
Additional breakdowns of some of the data, including many county tables, are available in four Survey Unit reports issued as the survey progressed through the State. Copies of these reports can be obtained from the Southeastern Forest Experiment Station. A Forest Information Retrieval service is also available at the Southeastern Station; Forest Survey statistics are compiled at cost for any geographic area within the Station territory.

Section 9 of the McSweeney-McNary Forest Research Act of 1928, as amended, and the Forest and Rangeland Renewable Resources Planning Act of 1974 authorize these forest resources evaluations. These evaluations are also guided by Forest Service enabling legislation such as the Multiple-Use Sustained Yield Act of 1960 and the National Environmental Policy Act of 1969. Forest resources evaluation in Florida, Georgia, North Carolina, South Carolina, and Virginia is a research activity of the South-

eastern Forest Experiment Station, which is headquartered at Asheville, North Carolina. The primary objective of these evaluations is to develop and maintain a resource information base, and in cooperation with other research groups, to periodically appraise the levels of output from forest and range lands under alternative management strategies. This information will be used for the formulation of forest and rangeland policy and programs.

The combined efforts of many people have gone into this forest resources evaluation of North Carolina's timberlands. Appreciation is expressed to all Work Unit and Station personnel who participated in the field and office work. Special appreciation is also expressed for the excellent cooperation of the forest industries, other private landowners, and public agencies in providing information and access to the sample locations. The Southeastern Station also gratefully acknowledges the cooperation and assistance provided by the North Carolina Department of Natural and Economic Resources, the Weyerhaeuser Company, the Southern Region of the U. S. Forest Service, and the Tennessee Valley Authority.

Finally, the evaluation of many forest and rangeland values in North Carolina is beyond the scope of this report. The purpose of this publication is to evaluate the timber situation.



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# NORTH CAROLINA'S TIMBER, 1974

by

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## HIGHLIGHTS

*Since the third Forest Survey in North Carolina was completed in 1964—*

*—area of commercial forest land decreased from 20.0 to 19.5 million acres, or by more than 2 percent.* Tree planting and the natural reversion of idle agricultural lands to forest offset the diversion of another 0.7 million acres of commercial forest to other land uses. Renewed agricultural activity, continuing urban encroachment, and other forest withdrawals will likely perpetuate this downward trend in acreage available for commercial timber production.

*—hardwoods replaced pines on more than 370,000 acres.* Unless greater attention is given to the prompt and adequate regeneration of pine stands following harvesting, the trend from pine to hardwood could gain momentum. As retirement and reversion of cropland to pine diminish, forest acreage supporting pine in North Carolina could decline substantially, particularly on private, non-industrial lands.

*—almost 2.9 million acres of commercial forest were harvested.* This total does not include acreage of land-use change or intermediate cutting. Less than 19 percent of the acreage harvested and retained in the commercial timber base was artificially regenerated. Another 36 percent restocked naturally to the extent that a manageable stand was present. Regeneration was lacking on the remaining 45 per-

cent of the acreage harvested. These findings indicate that regeneration efforts failed to keep pace with the rate of harvesting.

*—volume of growing-stock timber increased from 20.9 to 24.8 billion cubic feet, or by 19 percent.* More than 80 percent of the net increase in timber volume occurred in the Piedmont and Mountain regions, reflecting windfall gains from timber stands that developed on extensive acreages of idle farmland. A 3-percent reduction in the volume of softwood growing stock in the Northern Coastal Plain was one highly significant exception to the overall buildup in inventory. This decrease was attributed to a sharp increase in softwood removals, which almost doubled in this region. Statewide, hardwoods accounted for almost two-thirds of the volume increase.

*—rate of net annual growth increased by 21 percent to an average of 58 cubic feet per acre of commercial forest.* Hardwoods accounted for two-thirds of the increase and, for the first time since statewide surveys were begun, hardwood growth exceeded that of softwood. By region, average growth per acre ranged from a high of 70 cubic feet in the Piedmont to a low of 46 cubic feet in the Southern Coastal Plain. Growth in the Piedmont was inflated by an unusually high rate of ingrowth and probably will not be sustained at the level indicated. For example, ingrowth accounted for 23 percent of the gross softwood growth in the Pied-

mont, in contrast to only 14 percent for the other three regions combined.

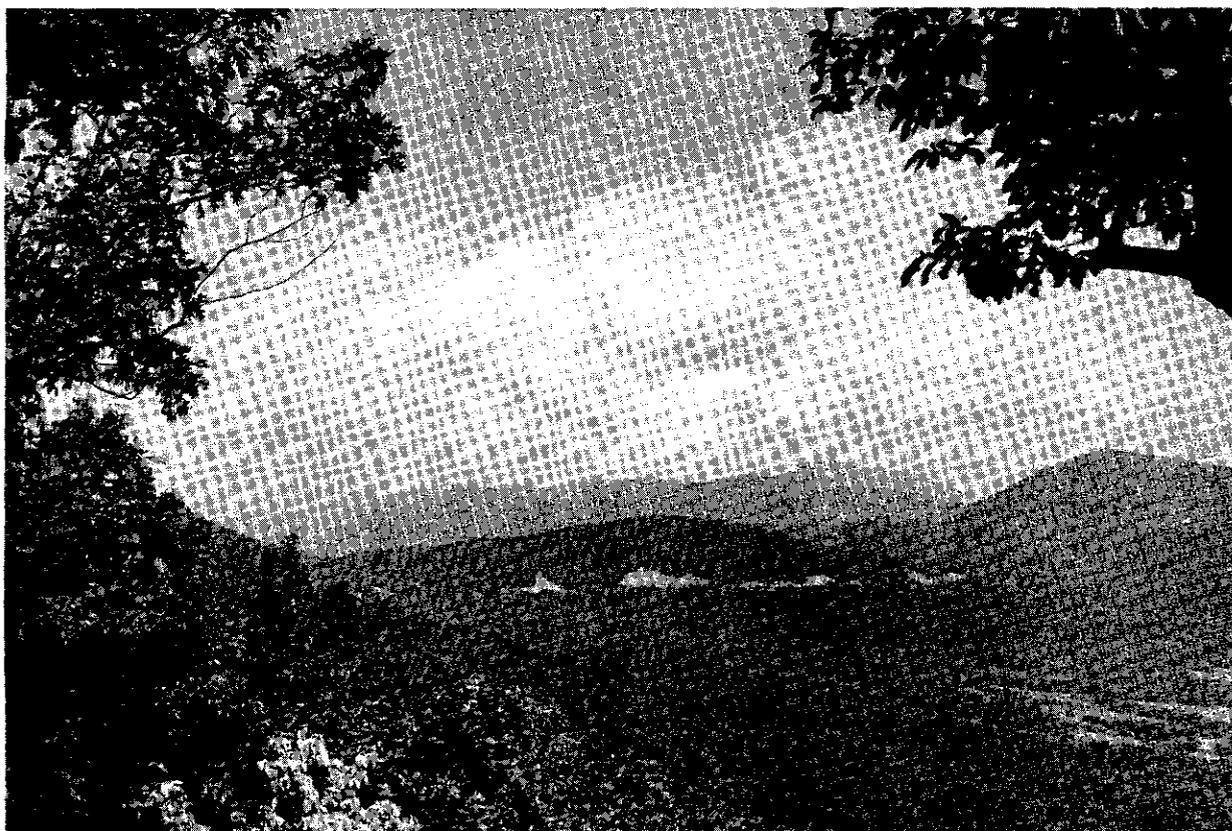
*—annual growth loss to mortality was reduced from 16 to 11 percent.* In 1973, mortality of growing stock totaled 140 million cubic feet and included 317 million board feet of sawtimber. Weather, suppression, and insects were the leading causes of mortality identified. Improved protection and successful control efforts have substantially reduced losses to wildfire. Protected area burned has been held below 100,000 acres annually for the past several years. More than 35 percent of the softwood mortality was attributed to insects, and recent outbreaks of pine bark beetle infestations have created a major forestry concern in North Carolina.

*—timber removals for products or withdrawals from the commercial forest base averaged approximately 635,000 acres per year.* In 1973, removals of growing stock totaled just over 750 million cubic feet and included 2,730 million board feet of sawtimber. About 77 percent of the cubic volume removed was converted into timber products, 9 percent was left in the woods in the form of logging residue, and the remaining 14 percent was lost in silvicultural operations, land clearing, and other withdrawals where the timber was not used. Closer utilization was evident both in the woods and at processing plants; however, an increase in other removals nullified most of the gains from improved utilization.

*—about 840,000 acres were artificially seeded or planted.* Some 64 percent of this reforestation was on acres which had also been harvested during the remeasurement period, and another 9 percent was on old fields. These figures suggest that about 27 percent of the tree planting effort was directed toward the backlog of needed regeneration.

*—there was no significant treatment or disturbance on some 12.6 million acres, or 64 percent of the land classified as commercial forest in 1974.* Almost 23 percent of the undisturbed stands were on sites unfavorable for intensive silvicultural practices either because of steep slopes or year-around water problems. Only 8 percent of the treated or disturbed stands occurred on similar sites.

*—the margin of net annual growth over removals increased to 374 million cubic feet for total growing stock and included 1,238 million board feet of sawtimber.* Hardwoods accounted for well over 70 percent of this surplus. Hardwood growth has already overtaken softwood growth in North Carolina, and if timber utilization follows the trend of prospective supply, hardwood cut should exceed softwood cut within the next 10 to 15 years. Forestry practices have enabled hardwoods to replace pine on sites better suited for pine from the standpoint of timber production. Unless greater control over species composition is exercised through prompt regeneration following harvesting, major adjustments in utilization seem inevitable.



## Timber Trends

North Carolina encompasses more than 31.2 million acres of land and spans three well-defined physiographic regions: Coastal Plain, Piedmont, and Mountain. The Coastal Plain is a broad expanse of level land extending inland from the seacoast an average of 150 miles, with a gradual rise in elevation to about 500 feet along its western margin. Along the seacoast this region is poorly drained and much of its soil is highly organic. Swamps, bays, and pocosins dominate the landscape. Further inland, the Coastal Plain is better drained and the soils are primarily sandy loams, which are easily worked and highly productive when fertilized. Although it is rich in natural resources, the northern half of the Coastal Plain is one of the most sparsely populated sections of the State, with fewer than 700,000 inhabitants distributed over 6.7 million acres of land.

The Piedmont is a rolling to hilly plateau extending across the central part of the State, ranging in elevation from 500 to more than 1,000 feet at the base of the mountains. The soils are predominantly red clay loams somewhat depleted from a long history of agricultural use and serious erosion of topsoil. Cropland retirement, the establishment of pastureland, and urban development have recently altered the landscape of this area. Although this region embraces only a third of the land area, more than half of the State's inhabitants reside in the Piedmont.

The Mountain region in the western part of the State is a high plateau of valleys and basins surrounded and interlaced with some of the highest and most rugged mountains in the Eastern United States. Although the main floor of the plateau ranges from 2,000 to 3,000 feet in elevation, numerous mountain peaks exceed 6,000 feet in height. Soil types range from stiff clays to sandy and stony loams. Although sparsely populated compared to

the Piedmont and Southern Coastal Plain, the region has a climate and esthetic attributes that attract large numbers of seasonal visitors.

This fourth evaluation of North Carolina's forest resources identified significant differences in recent trends in land use, ownership patterns, forest type, and timber production among the three regions. Also, because of important sectional differences, this analysis recognizes and retains the traditional division of the Coastal Plain into a southern and northern section (fig. 1).

### COMMERCIAL FOREST ACREAGE DECREASING

Between 1964 and 1974, acreage classified as commercial forest in North Carolina decreased more than 2 percent from 20.0 to 19.5 million acres (table I). Tree planting and the natural reversion of idle agricultural land to forest offset the diversion of another 0.7 million acres of commercial forest to other land uses. Renewed agricultural activity, continuing urban encroachment, and other forest withdrawals will likely perpetuate this downward trend in commercial forest acreage.

About 95 percent of the net reduction in commercial forest land occurred in the Coastal Plain where large areas are being drained and cleared for agriculture. While these highly organic soils have been used for forestry and wildlife, their planned development will create some of the largest farms in the United States. In addition to the area diverted to agriculture, an even greater acreage of forest land within the Coastal Plain was lost to urban development and other land uses. In total, 540,100 acres of commercial forest were diverted while only 127,500 acres of new forest were added. From the standpoint of future timber production, the impact of this net loss could be rather small in that many of

**Table I. — Changes in area of commercial forest land, by Survey Unit, North Carolina, 1964-1974**

Survey Unit	Area of commercial forest land in:		Net change	Changes							
	1964	1974		Total gain	Additions from:		Total loss	Diversions to:			
					Nonforest	Noncommercial forest		Noncommercial forest	Agriculture	Urban and other	Water
<i>Thousand acres</i>											
Southern Coastal Plain	5,667.0	5,391.9	-275.1	91.7	91.7	—	366.8	3.5	155.2	193.0	15.1
Northern Coastal Plain	4,247.9	4,110.4	-137.5	35.8	35.8	—	173.3	1.1	98.9	68.2	5.1
Piedmont	6,015.9	6,028.0	+ 12.1	472.3	472.3	—	460.2	4.4	187.9	241.1	26.8
Mountains	4,045.1	4,014.5	- 30.6	92.1	92.1	—	122.7	54.3	35.9	32.5	—
State	19,975.9	19,544.8	-431.1	691.9	691.9	—	1,123.0	63.3	477.9	534.8	47.0

the acres involved were of marginal quality for timber growing.

The remaining net reduction in commercial forest acreage occurred in the Mountain region, where almost 80 percent of all land is forested. Urban concentrations are scattered and relatively small in this region and, because of its rugged terrain, only a small proportion of the land is suitable for intensive agriculture. Nonforest areas include substantial acreages of pastureland and orchards. In addition to timber, the mountain forests are extremely important as watersheds and for outdoor recreation, esthetic attraction, and fish and wildlife. More than 400,000 acres of forest have already been withdrawn from timber utilization through statute or administrative designation. Land-use change in the Mountain region, therefore, often centers around social and environmental issues between timber and nontimber uses of the forest, rather than around economic decisions between forest and nonforest uses. This latest evaluation indicated that 122,700 acres of commercial forest were diverted or withdrawn, while 92,100 acres were added. More than 40 percent of the loss is attributed to the reclassification of forest from commercial to noncommercial.

The area of commercial forest has also peaked in the Piedmont, where total acreage remained about the same between surveys. Extensive cropland retirement in this region, and its reversion to forest, accounts for most of the past expansion in North Carolina's forest acreage. During this latest remeasurement period, 460,200 acres of forest were diverted to other uses while 472,300 acres of new forest were added. Most of the diversion is attributed to urban encroachment and the establishment of new pastureland. With less than 300,000 acres

classified as idle farmland, it is unlikely that the region's rapid rate of development can be continued without reductions in forest acreage.

### DECLINE IN FARM WOODLAND SLOWS

The shift in forest ownership from farmers to other miscellaneous private owners continued but at a much slower rate. Between 1955 and 1964, the proportion of total commercial forest land classified as farmer-owned decreased from 69 to 47 percent. This proportion was 43 percent in 1974. By Survey Unit, the proportion of total commercial forest land owned by farmers ranges from a low of 29 percent in the Mountains, to a high of 53 percent in the Piedmont. Collectively, farm woodlands totaled more than 8.4 million acres and remain as the largest source of timber in North Carolina.

About 2.3 million acres of privately owned timberland in North Carolina were classified as either owned or under long-term lease by forest industry. Several major land transactions and associated plant closings reduced the acreage of timberland owned by forest industry. Acreage under long-term lease to industry was up, but was still relatively small in total. By Survey Unit, the proportion of total commercial forest land under control of forest industry ranges from a low of 3 percent in the Mountains to a high of 22 percent in the Northern Coastal Plain.

Commercial forest land owned by other miscellaneous private individuals and corporations totaled more than 7.0 million acres, and remains as the second leading source of timber. An upward trend in acreage in the miscellaneous private owner class continued. By Survey Unit, the proportion of

total commercial forest acreage in this owner class ranges from a low of 28 percent in the Southern Coastal Plain to a high of 44 percent in the Mountains.

Less than 1.8 million acres, or only 9 percent of North Carolina's commercial forest land, were classified as publicly owned. More than half of these publicly owned timberlands are on the Pisgah, Nantahala, Croatan, and Uwharrie National Forests. Other large public holdings include the Fort Bragg and Camp Lejeune military reservations; the Cherokee Indian Reservation; Bladen Lakes State Forest; Sandhill, Holly Shelter, Caswell, Gull Rock, and Angola Bay Game Lands; the Pungo Lake National Wildlife Refuge; and forests around New Hope Lake and the John H. Kerr Reservoir. By Survey Unit, the proportion of total commercial forest land that is publicly owned ranges from a low of 2 percent in the Piedmont to a high of 23 percent in the Mountains. In addition to the commercial timberland, some 430,000 acres of publicly owned forests are withdrawn from timber utilization through statute or administrative designation. Most of these lands are also in the Mountain Unit. State-wide, commercial forest additions just about offset the withdrawals within the public owner class.

Based on the forest ownership pattern described, forest industry is more heavily dependent on open-market sources of timber in North Carolina than in any of the five Southeastern States, with the possible exception of Virginia. With ownership of its private timberland divided among an estimated 245,000 individuals and corporations, North Carolina also has the greatest number of forest owners of any State in the Southeast. These factors, together with the physiographic differences described, take on special significance in the planning and implementation of forestry programs.

## **HARDWOODS ENCROACH ON PINE SITES**

Changes in forest type indicate that hardwoods have replaced pines on more than 370,000 acres. The net changes in acreages of forest types underestimate the extent of hardwood encroachment. For example, the net reduction in acreage of commercial forest land occupied by pine and other softwood types was only about 237,000 acres. However, more than 80 percent of the forest additions were to the pine types, while less than 40 percent of the diversions of commercial forest land to other land uses

were from pine types. If land-use change was the only factor affecting forest type, acreage dominated by pines would have increased by more than 133,000 acres. Thus man's actions or inactions, together with nature's successional change, enabled hardwoods to replace pines on at least 370,000 acres.

Unless greater attention is given to the prompt and adequate regeneration of pine stands following harvesting, the trend from pine to hardwood could gain momentum in North Carolina. As retirement and reversion of cropland to pine diminish, the likelihood of a substantial reduction in pine acreage increases, particularly on private, nonindustrial holdings. This trend is especially likely in the Piedmont region, where forest industry and public agencies together control only 6 percent of the timberland. Without more effective regeneration effort, the trend toward clearcutting and closer utilization could add to the problem of hardwood encroachment.

Up to now the loss in pine acreage has occurred mainly in the shortleaf pine, pond pine, and longleaf pine types. In the 1955 survey, these three types occupied almost 3.9 million acres of commercial forest land. By 1964, their combined acreage had declined to slightly less than 3.0 million acres, and it has now been reduced to 2.4 million acres. Acreage in loblolly pine, the State's most important forest type, has followed a somewhat different trend. After a decline from 3.5 to 3.1 million acres between 1955 and 1964, acreage of loblolly pine was back up to almost 3.3 million acres. Loblolly pine is the species most widely favored in pine management in North Carolina.

A comparison of the 1964 and 1974 acreages in the oak-pine type could lead to the conclusion that this type is shrinking rapidly, but this is not the case. The acreage in this transitional type in the succession from pine to hardwood, where pines comprise 25 to 50 percent of the stocking, was overestimated in the 1964 survey. Procedures were modified to correct this situation in the latest survey. For this reason, an increase in oak-pine acreage from 2.0 to 2.5 million acres between 1955 and 1974 is more indicative of the real change. This increase provides additional evidence that there has been significant hardwood encroachment onto sites which have previously supported pine.

## REGENERATION LAGS BEHIND HARVESTING

Examination of the distribution of acres by stand size suggests that regeneration efforts have failed to keep pace with the rate of harvesting. For example, acreage of nonstocked forest has more than doubled and totals almost 0.5 million acres. A lag in regeneration is further evidenced by reductions in both the acreage of sawtimber and sapling-seedling stand sizes.

Stand histories at sample locations indicate that almost 2.9 million acres were harvested between the third and fourth surveys. Acres that experienced either land-use change or intermediate cutting are excluded. Less than 19 percent of the acreage harvested was artificially regenerated. Another 36 percent had restocked naturally to the extent that a manageable stand was present. Regeneration was lacking on the remaining 45 percent of the acreage harvested. Altogether, the backlog of forest needing regeneration in North Carolina was estimated to total 2.9 million acres exclusive of another 1.2 million acres where stand conversion should be considered because species composition is obviously unsatisfactory for timber production.

## VOLUME ACCUMULATION ACCELERATES

In contrast to the decline in commercial forest acreage, volume of growing-stock timber increased from 20.9 to 24.8 billion cubic feet, or by 19 percent. When compared with the 7-percent increase which occurred between the second and third surveys, this indicates that there has been a sharp acceleration in the rate of inventory buildup. While part of this increase can certainly be attributed to improved forestry practices, better protection, and closer utilization, other significant factors should not be overlooked. For example, more than 80 percent of the net increase occurred in the Piedmont and Mountain regions; much of this change is windfall gain from timber stands that have developed on extensive acreages of idle farmland, particularly in the Piedmont. Many of these stands were in the sapling-seedling stage during the 1964 survey. The new volume and growth statistics reflect their development into merchantable size.

Statewide, hardwoods accounted for almost two-thirds of the volume increase. Oaks, maples, yellow-poplar, and beech registered the largest

percentage gains in volume of all the major hardwood species. Smaller increases occurred in the volumes of sweetgum, hickory, and ash. Volume of blackgum and tupelo decreased. Of all the major softwood species, Virginia pine, pitch pine, white pine, and hemlock made the largest percentage gains; however, the volumes of loblolly pine, pond pine, longleaf pine, and cypress were also up. Shortleaf pine was the only softwood species with a volume loss.

The volume increases extended across the range of diameter classes for both softwoods and hardwoods, but at significantly different rates. Almost 40 percent of the softwood increase was concentrated in the 8- and 10-inch diameter classes (fig. 2). The sharp dropoff in volume beyond the 10-inch class reflects the short rotations used in pine management. Almost half of the hardwood increase was in trees 10 to 14 inches in diameter (fig. 3). The sharp dropoff in hardwood volume occurs beyond the 12-inch class.

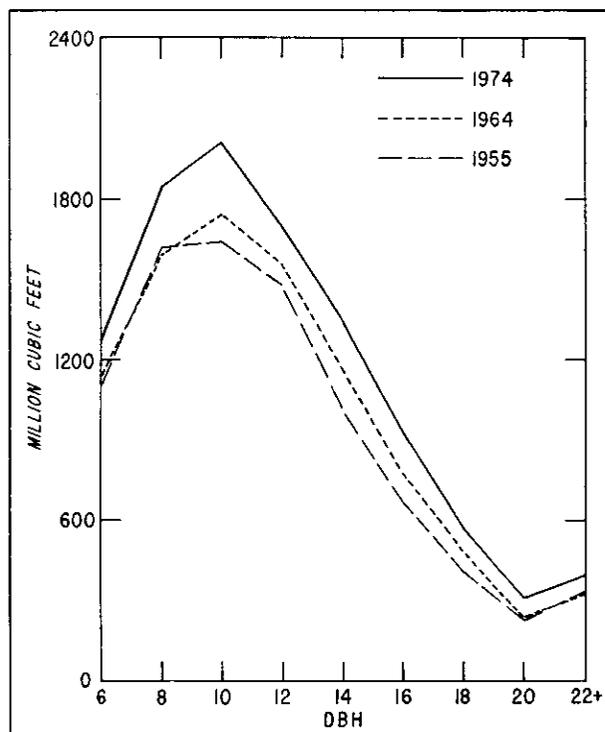
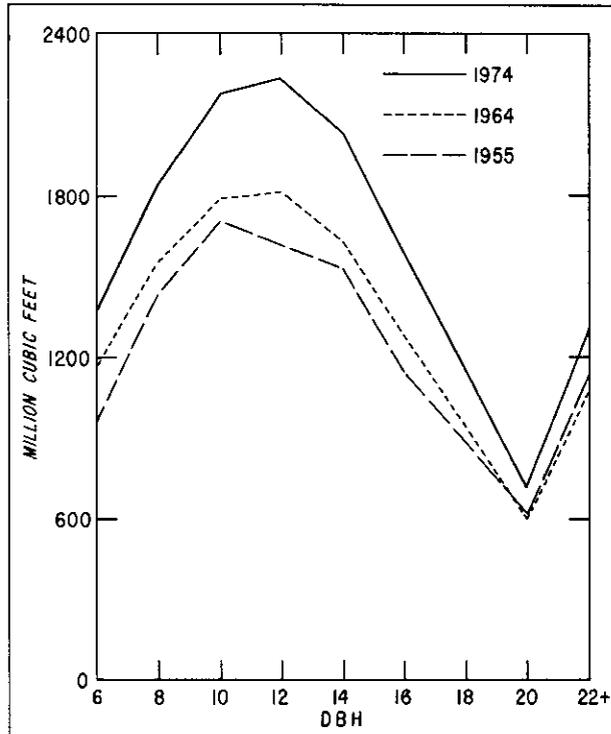


Figure 2. — Volume of softwood growing stock, by tree diameter, 1955, 1964, and 1974.

By ownership class, the largest inventories per acre are carried on National Forests, where cubic volume per acre was 13 percent above the Statewide average. Hardwood stands managed on long rota-

tions for large sawtimber predominate on this ownership class. The smallest inventories were found on forest industry lands where cubic volume per acre was 27 percent below the Statewide average. Pine stands managed on short rotations for pulpwood predominate on this ownership class. The fact that more than 45 percent of the stands owned or leased by forest industry were in the sapling-seedling stage further explains the low inventory volume.



**Figure 3. — Volume of hardwood growing stock, by tree diameter, 1955, 1964, and 1974.**

A 3-percent reduction in the volume of softwood growing stock in the Northern Coastal Plain was one highly significant exception to the overall buildup in inventory. This softwood reduction occurred across most counties, several species, and most diameter classes in the region. Volume of loblolly pine, the region's most important timber species, was down almost 9 percent. Percentage volume reductions in cypress and shortleaf pine were even greater. This decrease was attributed to a sharp increase in softwood removals, which almost doubled in this region. Although the Northern Coastal Plain has a high proportion of the better sites and a timber growth potential well above the Statewide average, the findings suggest that a 20-percent increase in softwood growth must be achieved in the region before it can sustain the rate of timber removals determined in this latest survey.

The total volume of growing stock included 72,870 million board feet of sawtimber. Although acreage supporting sawtimber stands decreased from 10.5 to 8.2 million acres, inventory volume of sawtimber has followed a pattern of change similar to that described for total growing stock.

### GROWTH RATE UP 21 PERCENT

In 1973, net growth of growing-stock timber averaged 58 cubic feet per acre of commercial forest land, or 21 percent above the average determined in the 1964 survey. Hardwoods accounted for two-thirds of the increase, and for the first time, hardwood growth exceeded that of softwood. Trends in growth and removals, by species, point toward a further buildup in inventory volume more heavily dominated by hardwoods (fig. 4).

By region, average growth per acre ranged from a high of 70 cubic feet in the Piedmont to a low of 46 cubic feet in the Southern Coastal Plain. Growth in the Piedmont was inflated by an unusually high rate of softwood ingrowth, and probably will not be sustained at the level indicated. For example, ingrowth accounted for 23 percent of the gross softwood growth in the Piedmont, in contrast to only 14 percent for the other three regions combined. This difference is attributed to the development of pine stands on extensive acreages of retired farmland in the Piedmont.

By ownership class, average growth per acre ranged from a high of 63 cubic feet on farm woodland to a low of 41 cubic feet on public lands outside National Forests. The high average on farmer-owned lands reflects the Piedmont situation described earlier, as well as the fact that this ownership class includes some of the best sites for tree growth. The low average for other public holdings is attributed to the large proportion of poor sites within the class. Growth per acre averaged only 46 cubic feet on lands owned and leased by forest industry; but this is understandable in light of the finding that more than 45 percent of the stands in this owner class were in the sapling-seedling stage of development. As these stands develop, a substantial increase in growth can be expected, particularly in the Coastal Plain, where most of the industry holdings are concentrated.

A detailed breakdown of gross growth into its various components, by Survey Unit and species

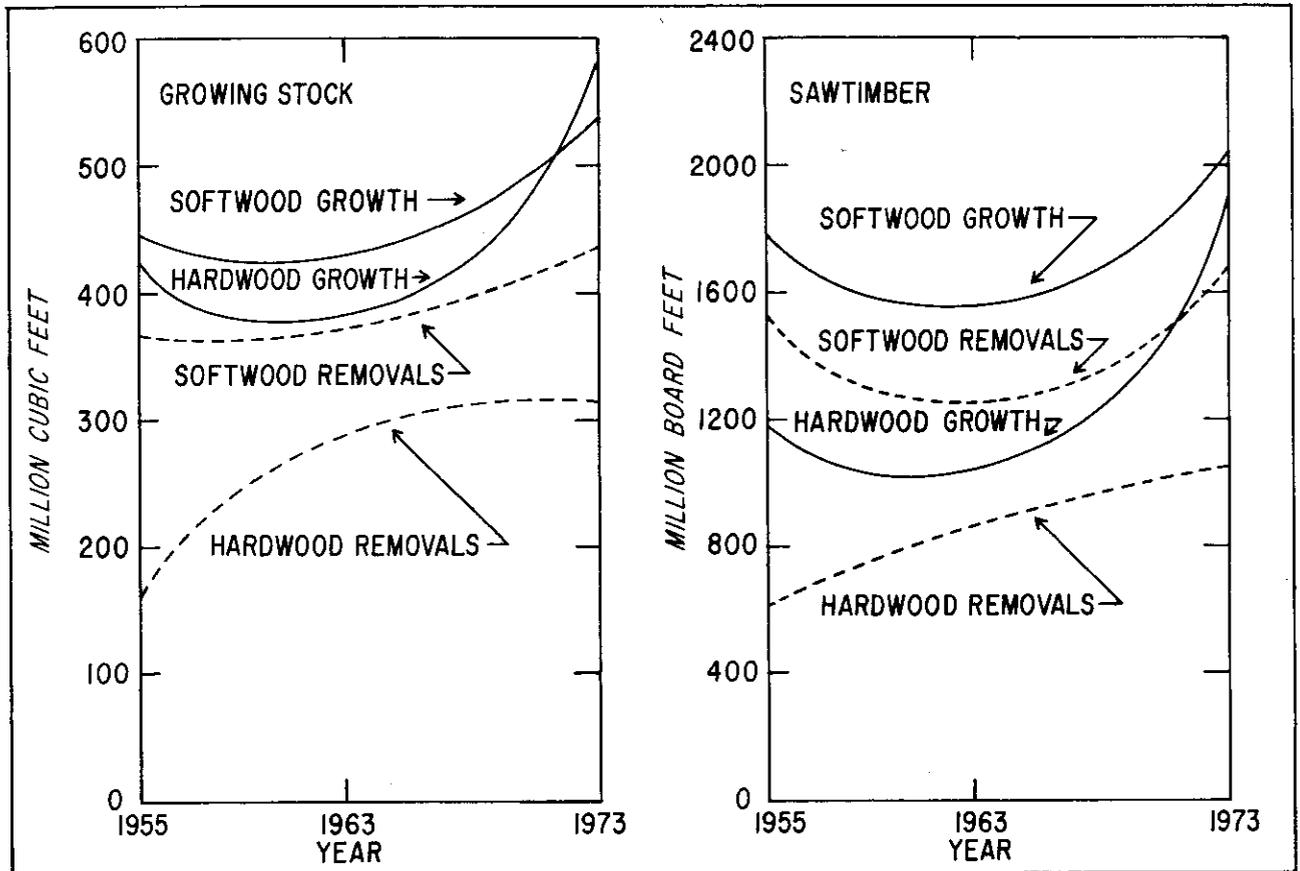


Figure 4. — Trends in net growth and timber removals in North Carolina since 1955.

Table II. — Annual components of change in the volume of growing stock on commercial forest land, by Survey Unit and by softwood and hardwood, North Carolina, 1973

Survey Unit and species group	Gross growth	Components of growth					Mortality	Net growth	Removals	Net change
		Survivor growth	Ingrowth	Growth on ingrowth	Growth on removals	Growth on mortality				
<i>Million cubic feet</i>										
Southern Coastal Plain:										
Softwood	176.5	147.7	23.0	2.1	3.2	0.5	17.9	158.6	138.6	+ 20.0
Hardwood	100.7	83.9	15.0	0.8	0.8	0.2	13.0	87.7	53.8	+ 33.9
Total	277.2	231.6	38.0	2.9	4.0	0.7	30.9	246.3	192.4	+ 53.9
Northern Coastal Plain:										
Softwood	135.3	117.2	13.8	1.2	2.6	0.5	20.4	114.9	136.5	- 21.6
Hardwood	132.7	111.0	18.9	1.1	1.4	0.3	16.2	116.5	91.5	+ 25.0
Total	268.0	228.2	32.7	2.3	4.0	0.8	36.6	231.4	228.0	+ 3.4
Piedmont:										
Softwood	232.3	176.0	48.9	3.8	2.8	0.8	30.3	202.0	128.2	+ 73.8
Hardwood	236.3	199.0	31.8	2.6	2.6	0.3	15.5	220.8	123.2	+ 97.6
Total	468.6	375.0	80.7	6.4	5.4	1.1	45.8	422.8	251.4	+171.4
Mountains:										
Softwood	68.6	55.2	11.6	0.9	0.7	0.2	8.5	60.1	33.4	+ 26.7
Hardwood	182.5	158.6	21.4	1.3	0.8	0.4	18.7	163.8	45.4	+118.4
Total	251.1	213.8	33.0	2.2	1.5	0.6	27.2	223.9	78.8	+145.1
State:										
Softwood	612.7	496.1	97.3	8.0	9.3	2.0	77.1	535.6	436.7	+ 98.9
Hardwood	652.2	552.5	87.1	5.8	5.6	1.2	63.4	588.8	313.9	+274.9
Total	1,264.9	1,048.6	184.4	13.8	14.9	3.2	140.5	1,124.4	750.6	+373.8

group, along with the distribution of mortality and removals, identifies the recent sources of annual change in timber volume (table II). Survivor growth, the volume increment of growing-stock trees 5.0 inches d.b.h. and larger in the inventory at the beginning of the year and surviving to its end, accounted for 83 percent of the gross growth. Ingrowth, the net volume of growing-stock trees reaching 5.0 inches d.b.h. during the year, and the subsequent growth on these trees, accounted for another 16 percent. Growth on removals before removal and growth on mortality before death made up the remaining 1 percent.

In 1973, mortality of growing stock totaled more than 140 million cubic feet and reduced gross growth by 11 percent. Weather, suppression, and insects were the leading causes of death identified, followed in order by disease, fire, and animals. Attention is called to the heavy loss to insects, which accounted for more than 35 percent of the softwood mortality. This large loss is mainly attributed to pine bark beetles, which have created a major for-

estry concern in North Carolina. Improved protection and successful control efforts have substantially reduced losses to wildfire. Protected area burned has been held below 100,000 acres annually for the past 7 years (table III).

**Table III. — Forest area under fire protection, protected area burned, number of fires, and average size of fires, North Carolina, 1964-1974<sup>1</sup>**

Year	Forest area protected		Protected area burned		Fires	
	<i>M acres</i>	<i>Percent</i>	<i>M acres</i>	<i>Percent</i>	<i>Number</i>	<i>Acres</i>
1964	18,816	94.57	38	0.20	3,424	11
1965	18,862	94.76	67	0.35	4,746	14
1966	19,360	95.53	127	0.66	4,696	27
1967	19,362	95.54	101	0.52	5,550	18
1968	19,371	95.55	87	0.45	6,464	13
1969	19,393	95.55	68	0.35	4,262	16
1970	19,388	95.55	82	0.42	4,988	16
1971	21,974	96.05	99	0.45	3,697	27
1972	23,613	96.31	38	0.16	2,451	16
1973	22,382	97.50	31	0.14	3,499	9
1974 <sup>2</sup>	20,867	97.93	35	0.17	3,223	11

<sup>1</sup> Source: U. S. Department of Agriculture, Forest Service, Forest Fire Statistics, 1964-1974.

<sup>2</sup> Figures are preliminary.



## Timber Products Output

The volume of roundwood harvested from North Carolina's forests in 1973 totaled 620 million cubic feet. Plant byproducts pushed the volume of total product output up to 718 million cubic feet, which was 27 percent greater than the 1964 estimate. A canvass of the primary wood-using industries conducted by the North Carolina Department of Natural & Economic Resources showed that 410 mills operated in the State during 1973 (fig. 5). These mills received logs, bolts, and other forms of roundwood from which they manufactured lumber, veneer, plywood, chips, pulp, paper, and other products. In addition, an undetermined number of secondary manufacturing plants located in the State were engaged in the remanufacture of lumber, veneer, plywood, paper, and other products into finished goods such as furniture, fixtures, and containers. Altogether, the timber-based industries employed some 115,000 people and generated an annual payroll estimated at \$775 million.

### SAW-LOG OUTPUT UP

Saw-log production was up by more than 10 percent over 1964, and accounted for 43 percent of the total roundwood output. The number of sawmills continued to decline, and was down to 355 active mills in 1973. New technology, market fluctuation, rising production costs, and environmental restraints led to the closing of many of the old, inefficient mills. The strong lumber demand of the early seventies and the introduction of chipping headrigs sparked a general expansion and modernization within the lumber industry, now temporarily interrupted by the economic recession. The 1973 industry canvass counted 14 sawmills which had already installed chipping headrigs.

Bureau of the Census figures also reflect the strong upturn in lumber demand, particularly soft-

wood, which occurred in the early seventies as the number of housing starts soared to record levels (fig. 6). Even with the increase, lumber production in North Carolina in 1973 was some 6 percent below the estimate for 1964. This apparent inconsistency between saw-log output and lumber production is explained by the diversion of large quantities of saw-log volume to chips at sawmills and the interstate movement of saw logs.

### PULPWOOD PRODUCTION CONTINUED TO INCREASE

Pulpwood was the second leading product in terms of volume, and accounted for 40 percent of the total roundwood output. Volume of round pulpwood in 1973 totaled 251 million cubic feet, 63 percent greater than the estimate for 1964. Sawmills and other wood-using plants provided the pulpmills with another 73 million cubic feet of wood fiber in the form of chips and other plant byproducts. In fact, if the comparison of product output is made on total volume rather than roundwood, volume of pulpwood has now surpassed that of saw logs.

In 1964, five pulpmills operated in North Carolina with a combined pulping capacity of 4,525 tons per day. In 1973, eight pulpmills were in operation with a combined capacity of 6,275 tons per day. Even with this increase in pulping capacity, large quantities of pulpwood harvested in North Carolina are shipped to mills in other States. Based on the 1973 southern pulpwood production study, more than 925,000 cords of roundwood produced in the State were shipped to South Carolina and Virginia. Only about 400,000 cords harvested in these two States were shipped to mills in North Carolina.

Trends in pulpwood production reflect a modest shift in utilization from softwoods to the more

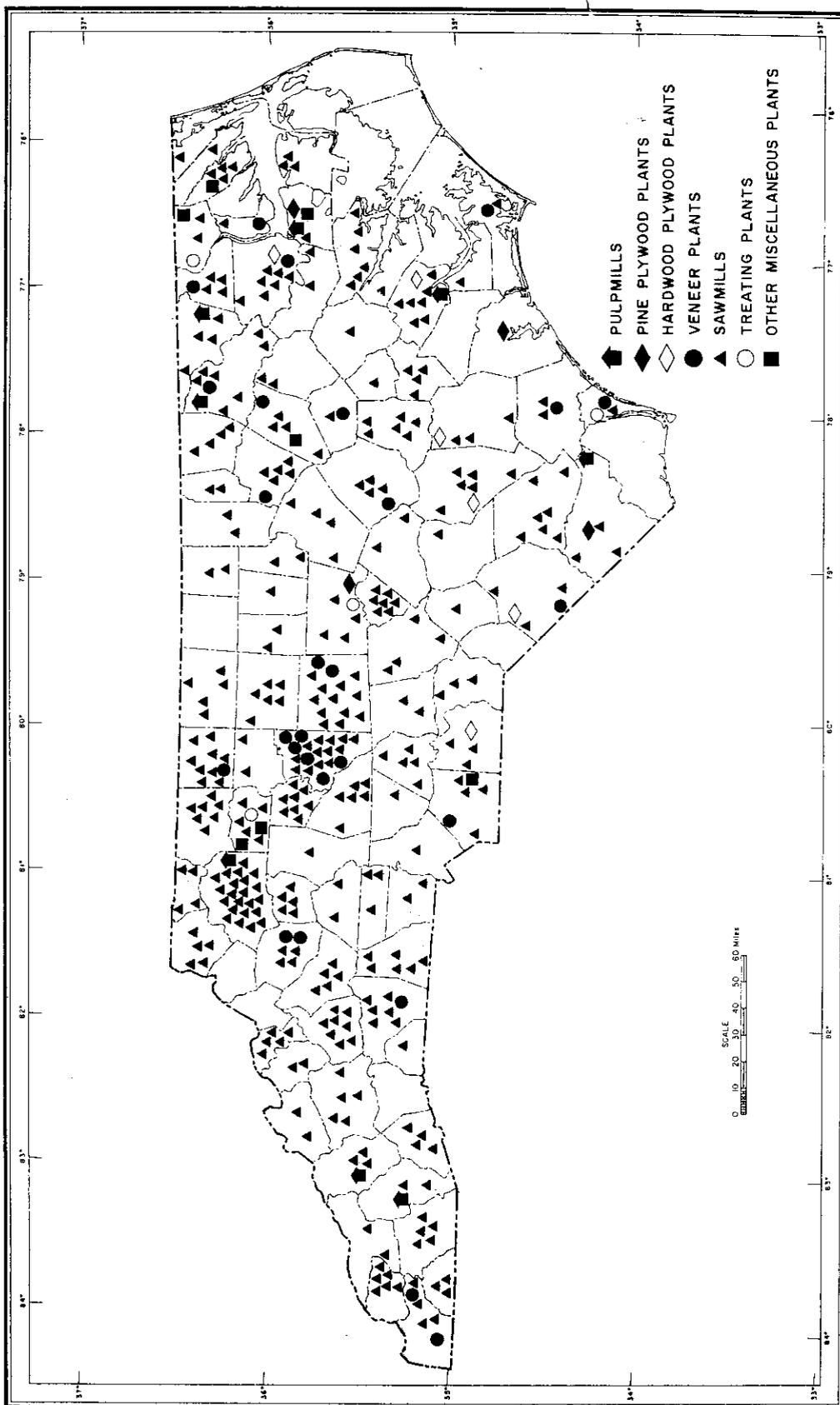
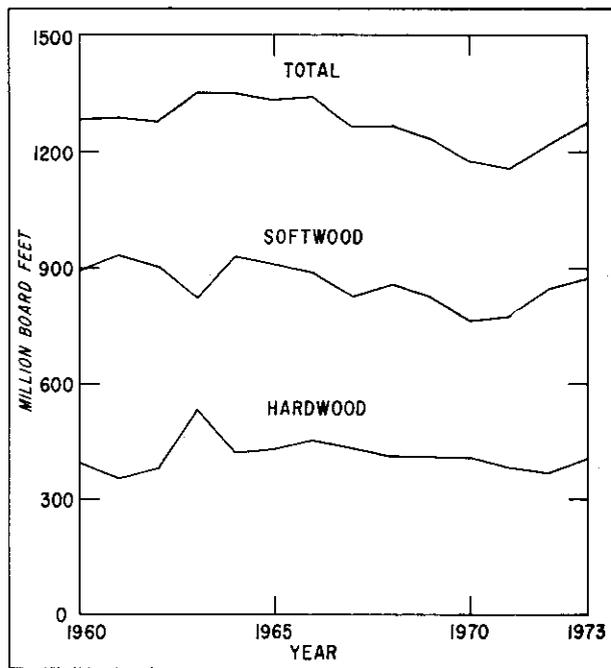


Figure 5. — Location of primary wood-using industries in North Carolina, 1973.



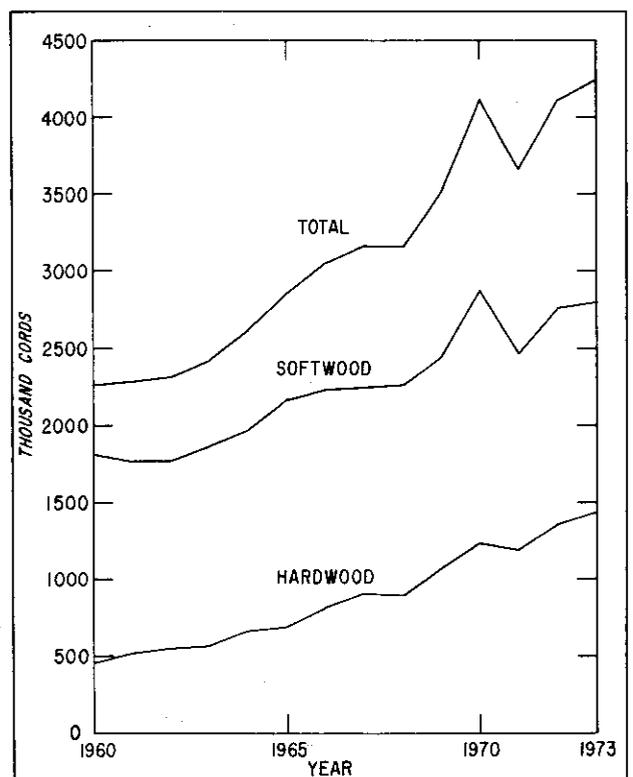
**Figure 6. — Lumber production in North Carolina, 1960 to 1973.**

abundant hardwoods (fig. 7). For example, hardwoods provided 34 percent of the total pulpwood output in 1973, compared to only 25 percent in 1964. Trends in the timber resource in North Carolina suggest that every opportunity for greater utilization of hardwood should be fully explored. The hardwood timber resources in North Carolina could easily accommodate an expansion of fiber-oriented industries.

The heavy use of sawtimber for pulpwood is highly significant. Although the timing of this latest Forest Survey coincided with a strong demand for lumber, some 500 million board feet of sawtimber were cut for pulpwood in 1973. Well over 40 percent of the total softwood output of round pulpwood came from the saw-log portion of sawtimber trees. Seemingly, these findings identify a gross under-utilization of an already scarce resource.

#### **OUTPUT OF VENEER LOGS SOARS**

Of all the major roundwood products, veneer logs registered the largest gain. Because of its furniture industry, North Carolina has long been a major producer of hardwood veneer and plywood. While foreign imports and substitute products have captured a substantial share of the hardwood veneer and plywood markets, development of the pine plywood industry in North Carolina has more than off-



**Figure 7. — Pulpwood production in North Carolina, including byproducts, 1960-1973.**

set these losses in terms of product output and wood use. With all species combined, volume of veneer logs and bolts harvested in 1973 totaled more than 67 million cubic feet and accounted for almost 11 percent of total roundwood output. The comparable figure for 1964 was only 24 million cubic feet.

The first major pine plywood plant in North Carolina was constructed at Plymouth in the Northern Coastal Plain, and started up in 1965. In 1973, four pine plywood plants were in operation with a combined annual capacity of 400 million square feet on a  $\frac{3}{8}$ -inch basis. Active hardwood plywood and veneer plants receiving roundwood in 1973 numbered 32, down from about 60 plants in 1964.

#### **OUTPUT OF OTHER ROUNDWOOD PRODUCTS DOWN**

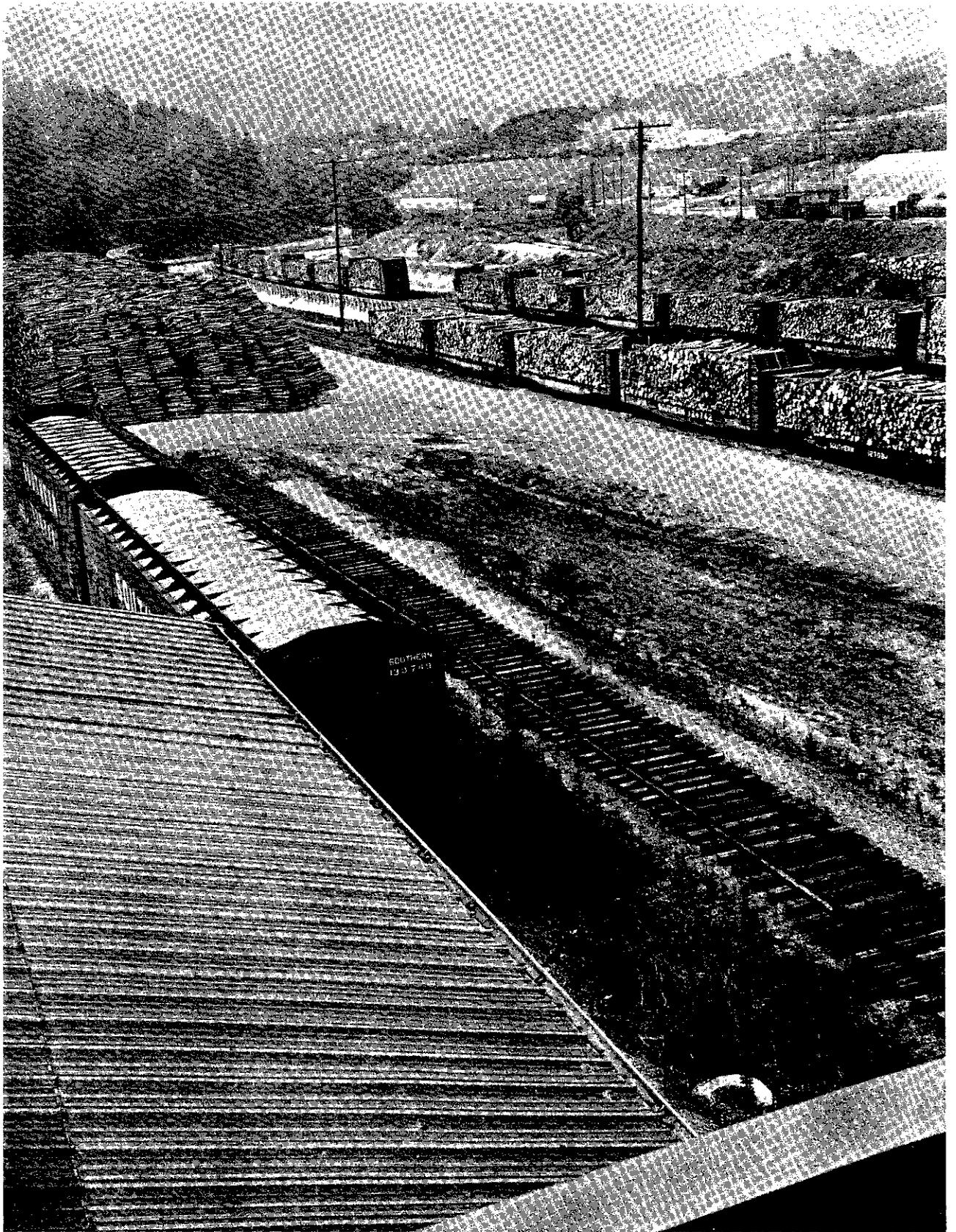
The combined volume of all other roundwood products harvested in 1973 was estimated at 34 million cubic feet, or 50 percent below the 1964 estimate. In terms of volume, fuelwood is the leading product included in this miscellaneous grouping. While the long downward trend in fuelwood continued, a strong possibility exists for an upturn in

fuelwood use in response to the energy shortage. Other products included particleboard, poles, piling, posts, cooperage, and various specialty woods. About two-thirds of the volume in this miscellaneous group of products was hardwood.

**INCREASE  
IN OTHER REMOVALS NULLIFIED  
GAINS FROM IMPROVED UTILIZATION**

Closer utilization was evident, both in the woods and at the plants. For example, output of roundwood products was almost 27 percent greater than the output in 1964; yet, removal of growing

stock during timber harvesting was up only 21 percent. A reduction in the amount of logging residue from 84 to 68 million cubic feet explains most of this difference. Estimated volume of wood residues generated at primary manufacturing plants was reduced from 66 to 30 million cubic feet. Altogether, these figures indicate a net saving of 52 million cubic feet through improved utilization. An increase in the volume of other removals from 59 to 109 million cubic feet nullified most of this gain. These other removals resulted primarily from land clearing and other actions where timber was removed from the inventory, but not used for products. Part of this volume is in trees still standing but on acreage no longer classified as commercial forest.



## Timber Supply Outlook

Unlike many other natural resources, timber is renewable and expandable. Supplies can eventually be increased to the limits established by the growth potential of lands available for timber production. On the other hand, the lag between implementation of timber cultural practices and any significant increase in available supply is much longer than the lag experienced in most other land-based production endeavors. Except for possible gains from improved utilization and protection, the supply of timber that will be available in the next decade or longer has already been determined by actions taken or foregone. If one looks ahead for the next 30 years, much of the time restraint is removed from those opportunities for increasing timber supplies in North Carolina. The primary objective in this chapter of the analysis is to bracket future estimates of timber supplies between prospectively available cut if past trends are extrapolated for 30 years, and a level of available cut that more nearly reflects the inherent growth potential of North Carolina's forests. The results should not be misinterpreted as bold forecasts; they are reasonable estimates of what will likely happen if the stated assumptions hold true.

### **HARDWOODS DOMINATE PROSPECTIVE SUPPLY**

In 1973, the net annual growth of growing-stock timber on commercial forest land in North Carolina totaled 1,124 million cubic feet, and included 3,969 million board feet of sawtimber. Net growth provides one estimate of the cut that could be sustained in the absence of significant change in either acreage or stand conditions. Changes are occurring, however, and to the extent that their results can be determined, refinements can be made in the estimate of prospectively available cut.

Several basic assumptions as to probable change over the next 30 years were made in this

projection. Acreage of commercial forest land was assumed to continue to decline at the rate of 40,000 acres annually, or at about the same rate as the average between 1964 and 1974. Growth and mortality rates by diameter class and species group as determined in the latest survey were retained throughout the projection. Finally, an assumption was made that timber removals will gradually increase and come into balance with growth, by softwood and hardwood, by the end of the projection.

With these assumptions, available cut of total growing stock could reach a little more than 1,200 million cubic feet annually and include some 4,620 million board feet of sawtimber. The growing-stock estimate is 60 percent greater than the level of removals determined for 1973. When the results are examined by species group, one must conclude that hardwoods will increasingly dominate North Carolina's supply of timber if current trends continue (fig. 8). For example, under the assumptions stated, almost 80 percent of the prospective increase in available cut of total growing stock and almost 70 percent of the prospective increase in available sawtimber will be hardwood. Hardwood growth has already overtaken softwood growth in North Carolina, and if timber utilization follows the trend of prospective supply, hardwood cut should exceed softwood cut within the next 10 to 15 years.

The situation described has been brought about by forestry practices which have enabled hardwoods to replace pine on sites better suited for pine from the standpoint of timber production. Unless greater control over species composition is exercised through prompt and improved regeneration following harvesting, major adjustments in utilization seem inevitable. The alternatives all point toward fierce competition among wood-using industries that depend on pine timber while large inventories of low-quality hardwood accumulate.

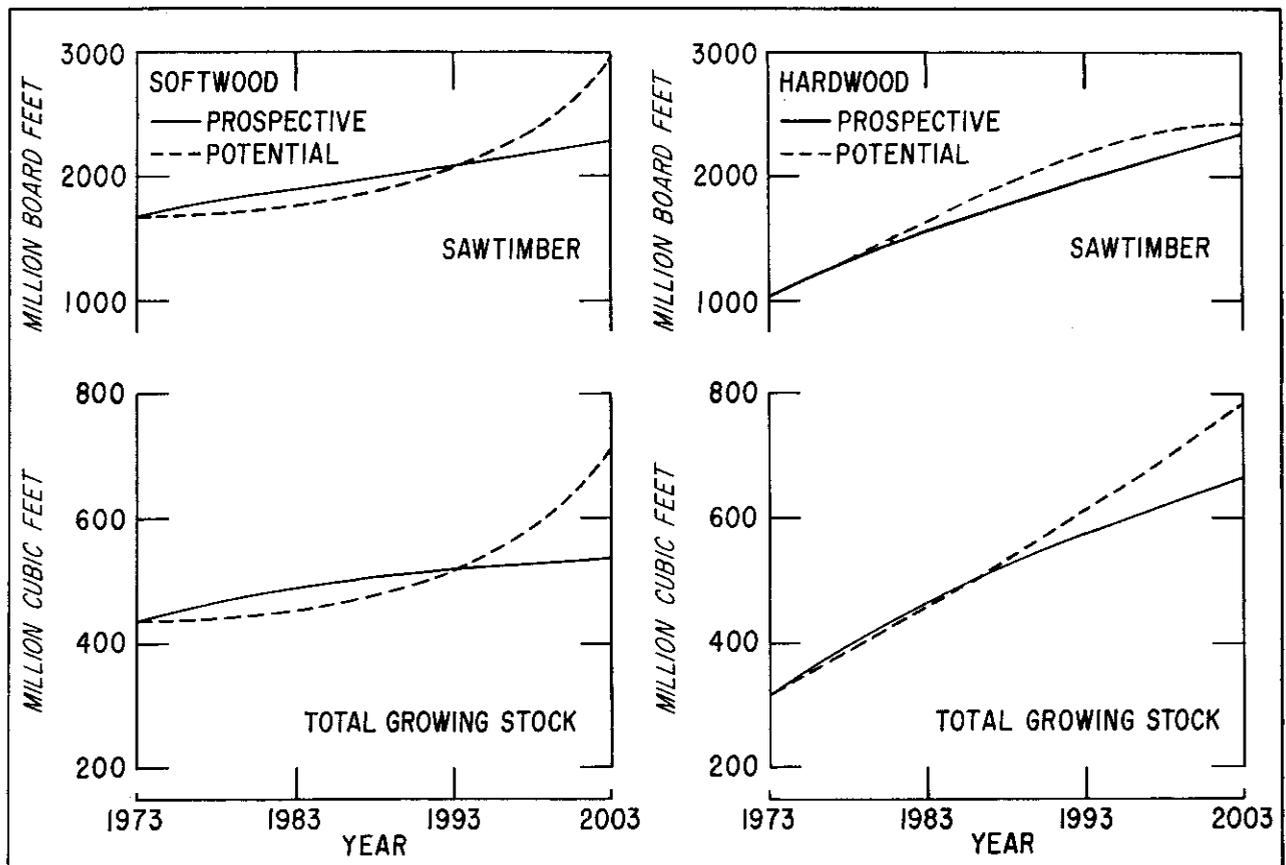


Figure 8. — Prospective and potential available cut, in North Carolina, 1973-2003.

### PROSPECTIVE SUPPLY FROM PLANTATIONS

In the projections, adequate consideration has been given to timber supplies from already established plantations. Two independent estimates of the acreage involved are available. First, there are the annual reports of forest planting and seeding compiled by the USDA, Forest Service. These reports provide estimates of acres planted in North Carolina by ownership class (table IV). Based on this source, some 1.4 million acres had been planted through June 1974. Second, field crews determined the stand origin at each sample location visited in this latest survey. Based on these findings, evidence of tree planting was observed on 1.1 million acres (table V). It would appear that these two estimates are reasonably consistent with one another, and that liquidation over time could easily explain the difference.

During the late fifties, almost 110,000 acres were planted in North Carolina under the Con-

servation Reserve Soil-Bank Program, and planting across all ownerships peaked at about 87,400 acres in fiscal year 1959. Following the expiration

Table IV. — Acres of forest planting,<sup>1</sup> by ownership class, North Carolina, 1964-1974

Fiscal year	Ownership class				All ownerships	Accumulative total
	National Forest	Other public	Forest industry	Other private		
----- Acres -----						
1964	4,208	2,023	30,286	15,619	52,136	654,914
1965	5,106	3,546	20,021	19,077	47,750	707,050
1966	2,695	2,853	27,745	18,585	51,878	806,678
1967	3,049	1,766	27,148	25,323	57,286	863,964
1968	4,008	3,921	42,702	15,312	65,943	929,907
1969	3,379	4,053	35,593	36,150	79,175	1,009,082
1970	4,758	3,672	54,561	18,770	81,761	1,090,843
1971	4,196	3,748	72,575	16,521	97,040	1,187,883
1972	3,493	3,750	27,760	22,155	57,158	1,245,041
1973	3,964	1,272	64,943	17,851	88,030	1,333,071
1974	3,755	6,923	55,044	15,814	81,536	1,414,607

<sup>1</sup> Includes acres of planting by direct seeding. Source: U. S. Department of Agriculture, Forest Service, *Forest and Windbarrier Planting and Seeding in the United States*.

<sup>2</sup> Accumulative total prior to FY 1964.

**Table V. — Area of commercial forest land, by stand origin and Survey Unit, North Carolina, 1974**

Stand origin	State		Survey Unit							
			Southern Coastal Plain		Northern Coastal Plain		Piedmont		Mountains	
	<i>M acres</i>	<i>Percent</i>	<i>M acres</i>	<i>Percent</i>	<i>M acres</i>	<i>Percent</i>	<i>M acres</i>	<i>Percent</i>	<i>M acres</i>	<i>Percent</i>
Natural stands with no evidence of artificial regeneration	18,423.4	94.3	4,840.9	89.8	3,792.3	92.3	5,843.8	96.9	3,946.4	98.3
Stands originating wholly or in part from artificial regeneration since 1964	843.2	4.3	430.8	8.0	262.2	6.4	127.0	2.1	23.2	0.6
Stands originating wholly or in part from artificial regeneration prior to 1964	278.2	1.4	120.2	2.2	55.9	1.3	57.2	1.0	44.9	1.1
All stands	19,544.8	100.0	5,391.9	100.0	4,110.4	100.0	6,028.0	100.0	4,014.5	100.0

of this program, planting dropped off rather sharply to a low of 47,750 in fiscal year 1965. Planting again accelerated as forest industries stepped up the conversion and regeneration of their own lands, and reached an all-time high of 97,000 acres in fiscal year 1971. With this apparent fluctuation in rate of planting, prospective timber supplies from plantations will likely vary considerably over the next 30 years. Based on the Forest Survey classifications, between 60,000 and 70,000 acres of pine plantations should start feeding into the prospective timber supply annually during the latter third of the projection period, assuming a 30-year rotation. Indications are that yields may average around 3,000 cubic feet per acre. These figures suggest a prospective cut of 200 million cubic feet annually from pine plantations. Natural stands will still supply most of the annual wood requirements.

Distribution of the acres planted by ownership class and region indicates that most of the prospective increase in timber supplies from plantations will occur on forest industry lands in the Coastal Plain. For example, 78 percent of the 1.1 million acres where evidence of tree planting was observed occurred in the Coastal Plain. About 16 percent occurred in the Piedmont, and the remaining 6 percent was in the Mountain region. Further examination shows that there were about 605,000 acres of well established pine plantations on lands owned or leased by forest industry in the Coastal Plain.

Statewide, well established pine plantations occupied just under 1 million acres when all ownerships were grouped. Because more than 60 percent of these plantations were less than 10 years old at time of measurement, the softwood growth rates determined and used in the projections might not

fully reflect the prospective growth of these stands. As pointed out earlier, however, softwood growth rates in the Piedmont were inflated by unusually high ingrowth in natural stands, which will not likely be sustained. On balance, the growth rates used in the projection should provide a reasonable estimate of prospective timber supply.

#### **PROSPECTIVE SUPPLY IS WELL BELOW POTENTIAL**

Over the years, the substitution of other materials for wood has been widely promoted with varying degrees of success, but the demand for wood and timber products continues to increase. Supplies of some of these substitute materials are not renewable, and if they are exhausted, demands for wood could rise more quickly. It is important, therefore, that this analysis provides a reasonable estimate of the inherent growth potential of land available for timber production in North Carolina.

One quick and simple approach would be to weight the acreage of commercial forest land by site class. This calculation indicates a potential annual growth of 1,460 million cubic feet, and assumes that sites were accurately classified based on their growth capacity when fully stocked with natural stands. Surprising as it may seem, a more sophisticated approach produced an estimate only 2 percent greater. Furthermore, these estimates were only 6 and 8 percent below the potential estimated in the 1964 analysis where no reduction was assumed in forest acreage.

The aim of this latest projection was to establish a realistic maximum level of available cut which could be reached and sustained through improved

timber management over the next 30 years. The same assumption was made with regard to the decline in commercial forest area as was made in the prospective projection—a net loss of 40,000 acres annually. Management goals were expressed in terms of basal area per acre and a stand-structure quotient for both softwoods and hardwoods. The goals selected for projection control would allow average stand densities of growing-stock trees 5.0 inches d.b.h. and larger to increase from 56 to almost 80 square feet per acre. Although this goal calls for only a 15-percent gain over the prospective increase when all species are grouped, it would require a gain of almost 25 percent for softwoods through prompt and improved regeneration. The stand-structure quotient is the quotient of the number of trees in any 2-inch diameter class divided by the number in the next larger class and, in even-aged management, reflects the age distribution of the stands. The management goals assumed a stand-structure quotient of 1.7 for both softwoods and hardwoods. This quotient would require a rather large increase in the inventory of softwoods 15.0 inches d.b.h. and larger. Finally, it was assumed that mortality rates could be gradually reduced by 50 percent through better control over stocking and species composition. If all these conditions were met, net annual growth could be increased from 58 to 81 cubic feet per acre.

Results from this projection indicate a potential cut of 1,485 million cubic feet by year 2003, or almost double the 1973 level of removals. Available cut of sawtimber climbs to 5,340 million board feet. The most significant increase over prospective supplies would occur in the volume of softwood (fig. 8). A shift in utilization from softwood to hardwood early in the projection period along with improved regeneration of pine following harvesting would be required to achieve and sustain these levels of cut. Any further gains would have to be accomplished through some combination of site improvement, forest fertilization, genetic improvement, or acreage expansion.

### **STAND-AGE DISTRIBUTION FURTHER DESCRIBES SUPPLY OUTLOOK**

The distribution of commercial forest acreage by stand-age class and major forest type reflects the history of forestry practices in North Carolina, and appears to support the stated conclusions about

timber supply outlook (fig. 9). The profile of acreage supporting pine types reflects the accomplishments made in pine reforestation in the two youngest age classes—less than 10, and 10-19. Whatever increase in volume that results from this pine reforestation effort must come from increased yields and shorter rotations, in that no prospective increase in pine acreage of merchantable age is indicated over the next 30 years. The relatively small acreage of pine stands in the 20- to 29-year age class supports the widely voiced concern over a prospective gap in the pine supply prior to the time the plantations come of age.

The profile of hardwood acreage clearly shows a large accumulation of stands 40 years of age and older. Although many of these stands occur on either wet sites or steep, mountain slopes, hardwood stands collectively offer the greatest opportunity for increasing timber cut over the next 30 years. A sharp dropoff in the acreage of young, well-stocked hardwood stands reflects deficiencies in hardwood management which will have to be corrected before the full growth potential can be realized and sustained. Hardwoods dominated more than 2.2 million acres so poorly stocked that a manageable stand did not exist. About 46 percent of these acres had not experienced any significant treatment or disturbance during the past 10 years; therefore, their condition is not likely to improve significantly without some intervention. The poor stocking conditions on the remaining 54 percent were attributed to harvesting or other disturbance during the preceding 10 years. Perhaps the condition of some of these acres will improve over time, but hardwoods will dominate whatever stands develop unless there is further intervention. Many of these acres are pine sites that were harvested and left without regeneration.

Back on the pine side of the profile, 655,000 acres were so poorly stocked that a manageable stand did not exist. Half of these acres had not experienced any significant treatment or disturbance during the preceding 10 years. Most of these acres were on the Coastal Plain. Here again, the likelihood of improvement without treatment is remote.

The average volume per acre for each stand-age class provides a crude measure of minimum yields which can be expected from reasonably, well-stocked natural stands across the range of sites. These averages do not reflect actual performance in that the

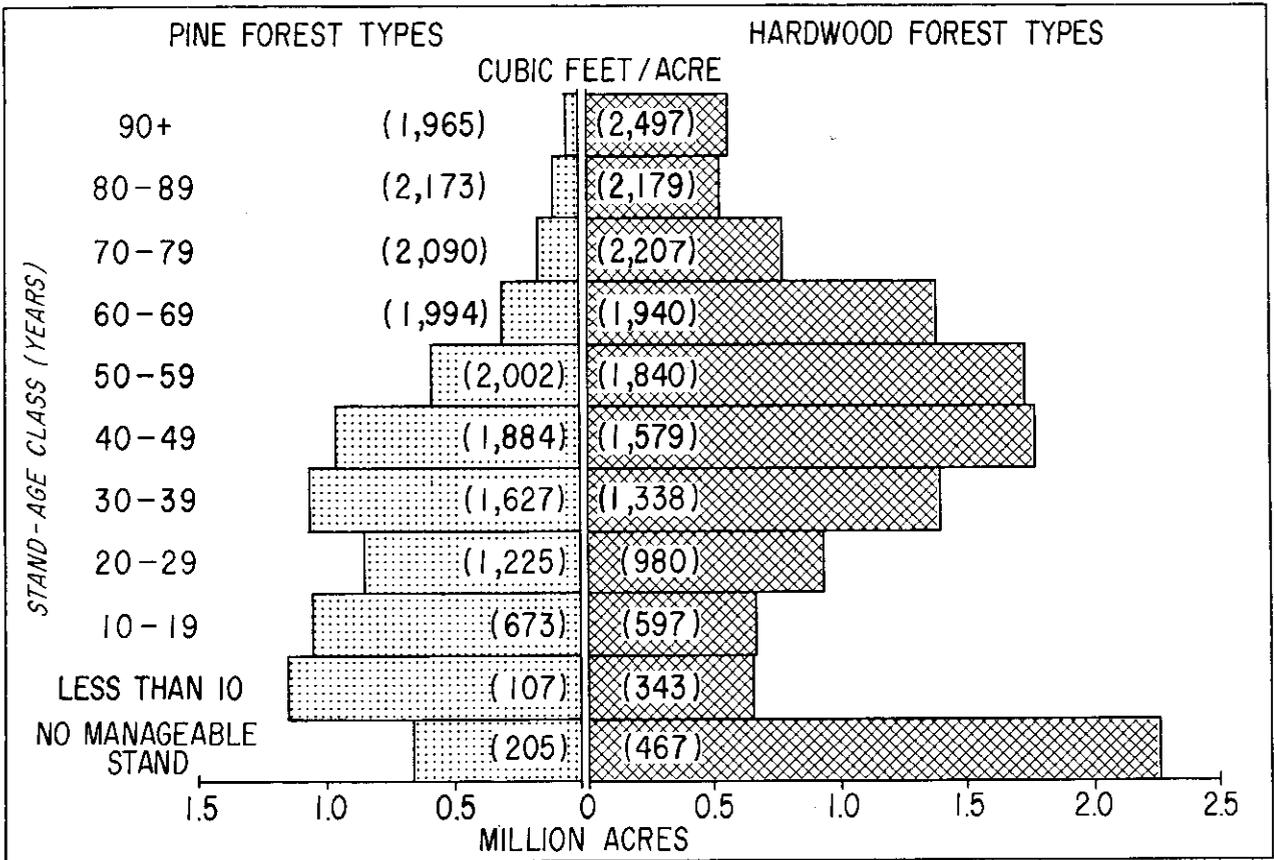


Figure 9. — Profile of area of commercial forest land, by stand-age class, by pine and hardwood forest types, with average cubic volume of growing stock per acre (in parentheses), North Carolina, 1974.

volumes removed through thinning and other intermediate cutting are not included. The strong correlations between average volume and stand age, and the low averages for acres classified as having no manageable stand, lends considerable credibility to the classification.

### RECENT RATES OF FORESTRY ACTIVITIES

Before the management opportunities available for closing the gap between prospective and potential supply are discussed, recent rates of various forestry practices and activities should be examined. In this latest North Carolina survey, evidence of treatment or disturbance during the 10-year remeasurement period was noted at each sample location. A summary of this treatment and disturbance information by broad management and ownership classes provides a measure of recent forestry activities (table VI).

Timber harvesting was the most common forest activity observed. Of the 19.5 million acres classi-

fied as commercial forest in this latest survey, almost 2.9 million acres had been harvested since the 1964 survey. This means that almost 290,000 acres were harvested annually during the remeasurement period and retained in the commercial timber base. These figures exclude more than 1.1 million acres withdrawn or diverted to other land uses during the 10 years. Timber was also harvested and utilized on some of this acreage. Evidence of thinning or other types of intermediate cutting was observed on another 2.3 million acres. When the estimates of harvesting, intermediate cutting, and diversions are grouped, timber removals occurred on an average of 635,000 acres annually over the remeasurement period.

Observations of recent past treatment and disturbance indicated that 840,000 acres had either been artificially regenerated or planted. A breakdown of this reforestation effort shows that 64 percent was on forest acres that had also been harvested during the remeasurement period, and another 9 percent was on old fields. The remaining 27 percent

**Table VI. — Area of commercial forest land, by broad management, ownership, and past treatment or disturbance classes, North Carolina, 1974**

Broad management and ownership classes <sup>1</sup>	Total area	Primary treatment or disturbance between 1964 and 1974							
		Harvesting with artificial regeneration	Harvesting with natural regeneration	Other harvesting	Intermediate cutting	Artificial planting	Other treatment <sup>2</sup>	Natural disturbance	None
----- <i>Thousand acres</i> -----									
Nonstocked forest:									
Public	69.2	—	6.4	17.0	3.5	—	8.3	3.3	30.7
Forest industry	92.2	3.9	7.6	38.3	—	—	2.6	5.2	34.6
Other private	326.4	—	17.2	117.4	3.1	—	35.0	34.5	119.2
Total	487.8	3.9	31.2	172.7	6.6	—	45.9	43.0	184.5
Pine plantations:									
Public	49.7	27.9	—	—	—	3.6	0.6	0.4	17.2
Forest industry	669.3	389.0	—	—	7.3	162.5	5.4	—	105.1
Other private	279.0	58.6	—	—	31.4	106.1	—	3.7	79.2
Total	998.0	475.5	—	—	38.7	272.2	6.0	4.1	201.5
Natural pine stands:									
Public	513.3	—	18.5	7.4	98.5	6.8	29.1	45.8	307.2
Forest industry	673.2	—	35.7	33.7	46.1	—	29.0	68.3	460.4
Other private	4,544.5	—	206.2	78.3	576.1	—	164.2	335.7	3,184.0
Total	5,731.0	—	260.4	119.4	720.7	6.8	222.3	449.8	3,951.6
Oak-pine stands:									
Public	158.1	5.7	11.9	—	29.1	—	15.1	7.7	88.6
Forest industry	266.9	38.0	24.2	20.4	16.9	9.1	—	17.8	140.5
Other private	2,058.9	—	102.7	98.0	324.7	—	82.8	88.4	1,362.3
Total	2,483.9	43.7	138.8	118.4	370.7	9.1	97.9	113.9	1,591.4
Upland hardwood stands:									
Public	865.1	1.4	8.2	15.7	74.6	1.9	—	27.4	735.9
Forest industry	237.6	8.2	27.2	17.5	19.7	2.3	—	1.8	160.9
Other private	6,146.1	3.8	446.0	555.4	768.3	5.5	194.9	78.4	4,093.8
Total	7,248.8	13.4	481.4	588.6	862.6	9.7	194.9	107.6	4,990.6
Bottomland hardwood stands:									
Public	90.0	—	3.7	22.2	10.4	—	2.1	13.5	38.1
Forest industry	376.4	2.6	15.1	22.5	19.5	3.7	13.5	3.0	296.5
Other private	2,128.9	—	124.6	240.4	318.2	—	74.1	45.0	1,326.6
Total	2,595.3	2.6	143.4	285.1	348.1	3.7	89.7	61.5	1,661.2
All classes:									
Public	1,745.4	35.0	48.7	62.3	216.1	12.3	55.2	98.1	1,217.7
Forest industry	2,315.6	441.7	109.8	132.4	109.5	177.6	50.5	96.1	1,198.0
Other private	15,483.8	62.4	896.7	1,089.5	2,021.8	111.6	551.0	585.7	10,165.1
Total	19,544.8	539.1	1,055.2	1,284.2	2,347.4	301.5	656.7	779.9	12,580.8

<sup>1</sup> Forest industry includes lands under long-term lease.

<sup>2</sup> Includes grazing, draining, prescribed burning, site preparation, and other miscellaneous treatments.

of the tree planting effort apparently was directed toward the backlog of acreage needing regeneration.

Other significant treatments or disturbances by man were observed on 657,000 acres. Such disturbances include forest grazing, drainage efforts, prescribed burning, site preparation, and other miscellaneous actions. An additional 780,000 acres experienced significant natural disturbance from insect infestations, wildfire, disease, and weather, such as wind and ice storms. These estimates do not fully reflect the extent of these treatments and disturbances in that they also occurred on acres

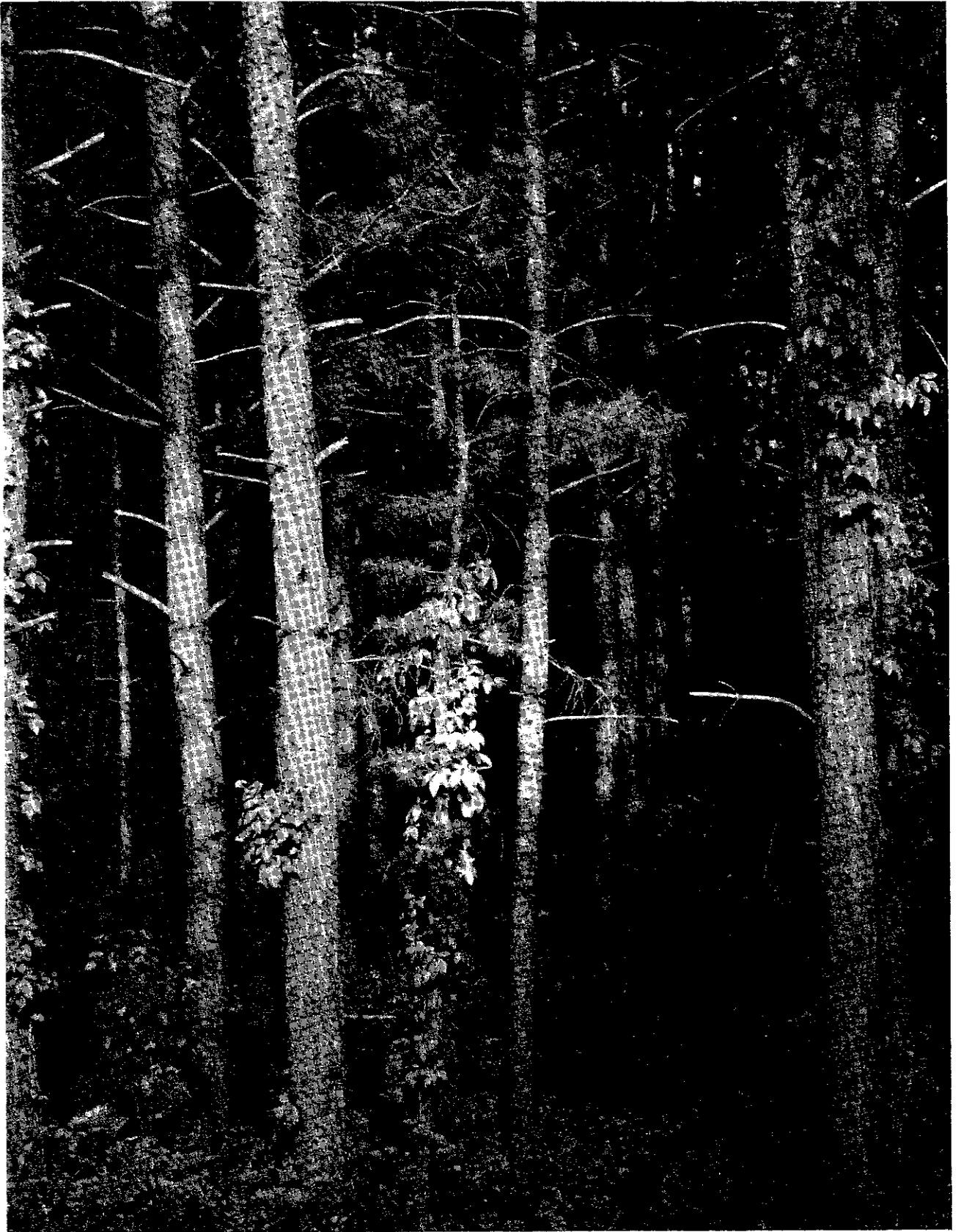
where other practices had a greater impact on existing stand conditions.

### ALMOST TWO-THIRDS OF THE STANDS WERE UNDISTURBED

On some 12.6 million acres, or 64 percent of the land classified as commercial forest, there was no evidence of significant treatment or disturbance during the 10-year remeasurement period. By region, the proportion of undisturbed stands ranged from a high of 78 percent in the Mountains to a low of 56 percent in the Coastal Plain. By ownership class,

the proportion of undisturbed stands ranged from a high of 70 percent for publicly owned lands to a low of 52 percent for lands owned or leased by forest industries. By broad management class, the proportion undisturbed ranged from a high of 69 percent for both natural pine and upland hardwood stands to a low of 20 percent for pine plantations.

Almost 23 percent of the undisturbed stands were on sites unfavorable for intensive silvicultural practices either because of steep slopes or year-around water problems. Only 8 percent of the treated or disturbed stands occurred on similar sites.



## Management Opportunities

It is instructive to divide commercial forest land into condition classes that reflect prospective growth. Stand condition was estimated at each sample location based on volume, stocking, species composition, stand age, mortality, and site. From this information, it was possible to estimate acreages on which there were treatment opportunities for broad management and ownership classes (table VII).

### **ADVERSE SITES LIMIT OPPORTUNITIES ON 3.4 MILLION ACRES**

Our first step in estimating acreages that present timber management opportunities in North Carolina was to eliminate the areas where steep slopes or year-around water problems preclude intensive forestry. Areas on slopes of 40 percent or steeper were eliminated, and the severity of the water problem was based on the survey crew's judgment on the ground. Based on these criteria, the timber management opportunities are severely limited on 3.4 million acres, or almost 18 percent of the commercial forest land. The logic applied in this analysis assumed that limited funds and resources probably will not be expended on these adverse sites so long as more promising opportunities are available for attracting silvicultural investments. The rate of recent treatment of these adverse sites tends to support this assumption. For example, 84 percent of this acreage was not significantly treated or disturbed over the past 10 years.

By region, the proportion of total acreage of commercial forest land classified as adverse ranged from a high of 57 percent in the Mountains to a low of 4 percent in the Piedmont. Adverse sites limited management opportunities on about 10 percent of the acreage in the Coastal Plain. By ownership class, the proportion of adverse sites ranged from a high of 44 percent of publicly owned timberland to

a low of 11 percent of lands owned or leased by forest industries. About 15 percent of the commercial forest land owned by other private owners was classified as adverse. Statewide, hardwoods predominated the stocking on almost 90 percent of the acreage classified as adverse.

### **ALMOST 9.1 MILLION ACRES SUITABLE FOR MANAGEMENT SUPPORTED STANDS IN GOOD CONDITION**

In estimating opportunity acreages, we also eliminated stands that were already in relatively good condition. To qualify for elimination, these stands had to be immature, adequately stocked with trees of acceptable quality, free from significant competition, and located on manageable sites. Statewide, these conditions were met on almost 9.1 million acres, or 46 percent of the commercial forest land.

By region, the proportion of acreage suitable for timber management which supported stands in good condition ranged from a high of 68 percent in the Mountains to a low of 52 percent in the Coastal Plain. By ownership class, the proportion ranged from a high of 64 percent on lands owned or leased by forest industry to a low of 52 percent for other private owners.

### **OPPORTUNITIES IDENTIFIED ON 7.1 MILLION ACRES**

The deductive process described assumes that timber growth could be significantly enhanced on the remaining 7.1 million acres, or 36 percent of the commercial forest. Conditions on these acres ranged from serious damage or overmaturity to deficiencies in stocking. The approximate acreages for various treatment opportunities are summarized below.

**Table VII. — Area of idle cropland and commercial forest land, by broad management, ownership, and treatment opportunity classes, North Carolina, 1974**

Broad management and ownership classes <sup>1</sup>	Total area	Broad treatment opportunity classes							
		Salvage	Harvest	Commercial thinning	Other stand improvement	Stand conversion <sup>2</sup>	Regeneration	Stands in relatively good condition	Adverse sites or conditions <sup>3</sup>
----- <i>Thousand acres</i> -----									
<b>Idle cropland:</b>									
Public	—	—	—	—	—	—	—	—	—
Forest industry	—	—	—	—	—	—	—	—	—
Other private	563.0	—	—	—	—	—	563.0	—	—
<b>Total</b>	<b>563.0</b>	<b>—</b>	<b>—</b>	<b>—</b>	<b>—</b>	<b>—</b>	<b>563.0</b>	<b>—</b>	<b>—</b>
<b>Nonstocked forest:</b>									
Public	69.2	—	—	—	—	—	52.0	—	17.2
Forest industry	92.2	—	—	—	—	—	82.9	—	9.3
Other private	326.4	—	—	—	—	—	275.4	—	51.0
<b>Total</b>	<b>487.8</b>	<b>—</b>	<b>—</b>	<b>—</b>	<b>—</b>	<b>—</b>	<b>410.3</b>	<b>—</b>	<b>77.5</b>
<b>Pine plantations:</b>									
Public	49.7	—	—	4.0	—	—	4.0	34.9	6.8
Forest industry	669.3	—	—	26.1	32.5	2.5	6.4	601.8	—
Other private	279.0	—	—	68.5	18.5	—	7.9	164.5	19.6
<b>Total</b>	<b>998.0</b>	<b>—</b>	<b>—</b>	<b>98.6</b>	<b>51.0</b>	<b>2.5</b>	<b>18.3</b>	<b>801.2</b>	<b>26.4</b>
<b>Natural pine stands:</b>									
Public	513.3	0.2	58.2	13.0	12.4	3.3	57.3	303.4	65.5
Forest industry	673.2	8.9	69.6	34.0	57.6	10.1	96.0	365.6	31.4
Other private	4,544.5	120.5	321.7	477.2	351.8	220.0	263.5	2,599.5	190.3
<b>Total</b>	<b>5,731.0</b>	<b>129.6</b>	<b>449.5</b>	<b>524.2</b>	<b>421.8</b>	<b>233.4</b>	<b>416.8</b>	<b>3,268.5</b>	<b>287.2</b>
<b>Oak-pine stands:</b>									
Public	158.1	—	14.4	—	2.1	3.4	22.8	84.0	31.4
Forest industry	266.9	0.1	26.9	4.1	34.7	2.4	46.0	144.7	8.0
Other private	2,058.9	24.7	198.8	22.7	199.4	164.6	189.5	1,137.5	121.7
<b>Total</b>	<b>2,483.9</b>	<b>24.8</b>	<b>240.1</b>	<b>26.8</b>	<b>236.2</b>	<b>170.4</b>	<b>258.3</b>	<b>1,366.2</b>	<b>161.1</b>
<b>Upland hardwood stands:</b>									
Public	865.1	—	42.9	—	8.9	—	43.4	138.0	631.9
Forest industry	237.6	—	11.8	—	18.6	14.8	33.4	107.4	51.6
Other private	6,146.1	7.2	464.4	11.9	385.0	624.2	672.6	2,510.8	1,470.0
<b>Total</b>	<b>7,248.8</b>	<b>7.2</b>	<b>519.1</b>	<b>11.9</b>	<b>412.5</b>	<b>639.0</b>	<b>749.4</b>	<b>2,756.2</b>	<b>2,153.5</b>
<b>Bottomland hardwood stands:</b>									
Public	90.0	3.0	1.5	—	3.7	3.4	22.3	43.5	12.6
Forest industry	376.4	—	48.6	2.6	17.8	5.1	48.6	89.2	164.5
Other private	2,128.9	2.7	269.8	36.9	101.5	73.8	386.3	726.6	531.3
<b>Total</b>	<b>2,595.3</b>	<b>5.7</b>	<b>319.9</b>	<b>39.5</b>	<b>123.0</b>	<b>82.3</b>	<b>457.2</b>	<b>859.3</b>	<b>708.4</b>
<b>All classes:</b>									
Public	1,745.4	3.2	117.0	17.0	27.1	10.1	201.8	603.8	765.4
Forest industry	2,315.6	9.0	156.9	66.8	161.2	34.9	313.3	1,308.7	264.8
Other private	16,046.8	155.1	1,254.7	617.2	1,056.2	1,082.6	2,358.2	7,138.9	2,383.9
<b>Total</b>	<b>20,107.8</b>	<b>167.3</b>	<b>1,528.6</b>	<b>701.0</b>	<b>1,244.5</b>	<b>1,127.6</b>	<b>2,873.3</b>	<b>9,051.4</b>	<b>3,414.1</b>

<sup>1</sup> Forest industry includes lands under long-term lease.

<sup>2</sup> Areas occupied with species unsuitable for the site from the standpoint of timber productions.

<sup>3</sup> Areas where management opportunities are severely limited because of steep slopes or poor drainage.

One of the most feasible opportunities for increasing timber supplies is to liquidate and regenerate merchantable stands that have either reached maturity or been damaged to the extent that salvage should be considered. Almost 1.7 million acres supported such stands. A large share of the State's mortality occurred in these high-risk stands, and continued loss is inevitable unless these stands are liquidated and regenerated. Volume per acre aver-

aged 1,790 cubic feet for the damaged stands and almost 2,190 cubic feet for the mature stands. Average age was 44 years for the damaged stands and 73 years for the mature stands. More than half of the salvage opportunities were in the Piedmont region.

Commercial thinning opportunities were identified on 0.7 million acres. These were immature

stands averaging 31 years of age and supporting an average of 2,260 cubic feet of growing-stock volume per acre. Pre-commercial thinning, cleaning, release, or other stand improvement practices would enhance growth on another 1.2 million acres where volume per acre averaged 1,040 cubic feet and stand age averaged 22 years. Altogether, more than 1.9 million acres present intermediate treatment opportunities.

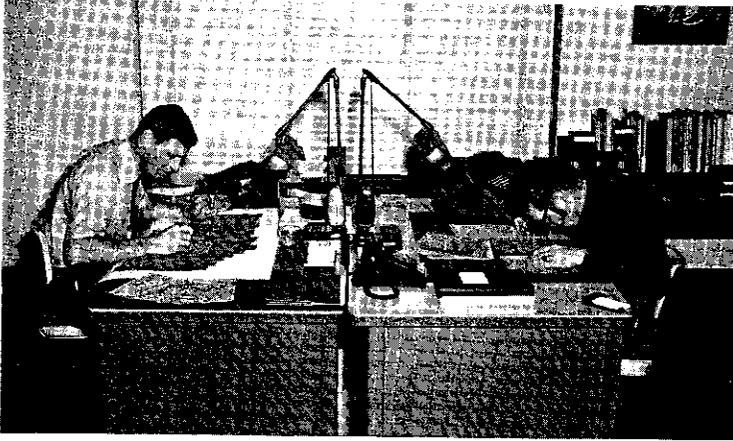
On 1.1 million acres, the existing species composition was obviously incompatible with the site from the standpoint of timber production. For the most part, these were pine sites supporting low-quality hardwood stands. On the average, these stands were 80 percent stocked with trees that met the minimum standards for growing stock. Volume per acre averaged less than 680 cubic feet, and stand age averaged 27 years. There will be substantial growth loss on these acres until they are converted to more suitable species. Almost 60 percent of these stands are in the Piedmont region.

Some 2.3 million acres of commercial forest land suitable for management were so poorly stocked that manageable stands did not exist. On the average, these acres were less than 40 percent stocked with trees that met the minimum standards for growing stock, and merchantable volume averaged only 380 cubic feet per acre. These stands were almost 50 percent stocked with rough trees, rotten trees, and other inhibiting vegetation, which means that the conditions probably will not improve significantly without site preparation and regeneration.

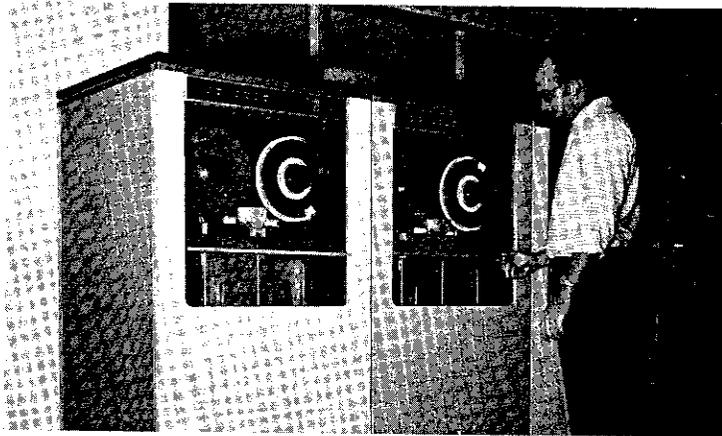
In addition to the treatment opportunities identified on 7.1 million acres of commercial forest land, almost 0.6 million acres were classified as idle cropland and included as part of the regeneration opportunity in table VII. Owners that are receptive should be encouraged to plant trees on these idle lands. Site preparation and planting costs would average considerably less on these acres than would normally be required on cut-over or poorly stocked forest land.

This analysis is deliberately focused on existing deficiencies and prospective problems facing forestry in North Carolina. The orientation of this report should not be interpreted to mean that no progress is being made. The sizable buildup in inventory volume and the increase in growth rate over the past decade show that there has been great progress. Most of the deficiencies and problems described can be corrected through well-planned and coordinated programs and actions.

Any action program that is considered should concentrate on regeneration efforts immediately after harvesting, because regeneration failures after timber cutting are the major cause for poorly stocked stands in North Carolina. Site preparation for natural seeding or for planting is cheapest if it is done immediately after a harvest. Delays permit competing vegetation of low value to get firmly established and raise costs considerably. Furthermore, the landowner is most likely to have cash to invest in regeneration right after a timber harvest. Because the trend in natural succession is from pines to hardwoods, pine stands cannot be maintained in North Carolina without effort. The effort required is least if it is done in conjunction with timber harvesting.



## HOW THE SURVEY WAS MADE



- A. CHECKING AERIAL PHOTOS
- B. USE OF COMPUTER
- C. FIELD CHECKING INDIVIDUAL STANDS.



# Appendix

## PROCEDURE

The basic steps of the procedure used in the fourth forest resources evaluation of North Carolina's timberlands were:

1. Initial estimates of forest and nonforest areas were based on the classification of 108,579 sample clusters systematically spaced on the latest aerial photographs available. A subsample of 8,171 of these 16-point clusters was checked on the ground, and a linear regression was fitted to the data to develop the relationship between the photo and ground classification of the subsample. This procedure provided a means for adjusting the initial estimates of area for change in land use since date of photography and for photo misclassifications.

2. Estimates of timber volume and forest classifications were based on measurements recorded at 4,882 ground sample locations systematically distributed within the commercial forest land. A 10-point cluster of plots, measured with a basal area factor of 37.5 square feet per acre, was systematically spaced on an acre at each of these locations. Trees less than 5.0 inches d.b.h. were tallied on fixed-radius plots around the point centers.

3. Equations developed from detailed measurements collected on trees tallied at 303 sample locations were used to compute the volumes of individual tally trees of the major species. Similar measurements taken throughout the Southeast were used to supplement the North Carolina data in the development of volume prediction equations for the minor species. A mirror caliper and sectional aluminum poles were used to obtain the additional measurements on standing trees required to construct the volume equations. Felled trees were measured at 91 active cutting operations to provide utilization factors for product and species groups, and to supplement the standing-tree volume study.

4. Estimates of growth, removals, and mortality were determined from the remeasurement of 4,895 permanent sample locations which were established in the third survey. A 1973 survey of timber products output, conducted by the North Carolina Department of Natural & Economic Resources, along with the annual pulpwood production study in the South, provided additional information for breakdowns of removals by product.

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

6. All field data were sent to Asheville for editing and were punched on cards and stored on magnetic tape for computer processing, sorting, and tabulation. Final estimates were based on statistical summaries of the data.

7. As each of the four survey units in North Carolina was completed, special summaries of the information were added to a master data bank of forest resource statistics maintained for the entire Southeast in Asheville. A Forest Information Retrieval (FIR) program is available for compiling the information for any area of interest as a cooperative service.

## RELIABILITY OF THE DATA

Statistical analysis of the data indicates a sampling error of  $\pm 0.24$  percent for the estimate of total commercial forest area, 1.11 percent for total cubic-foot volume, 1.20 percent for total cubic-foot volume growth, and 2.78 percent for total cubic-foot removals. As the totals are broken down by forest type, species, tree diameter, and other subdivisions, the sampling error increases. If homogeneity of variances is assumed the order of this increase is suggested in the following tabulation, which shows the sampling error to which the estimates are liable, in terms of one standard error, or two chances out of three.

Sampling error <sup>1</sup>	Commercial forest area	Volume of growing stock		
		Inventory	Net growth	Removals
	<i>Thousand acres</i>	<i>----- Million cubic feet-----</i>		
<i>Percent</i>				
1	1,107.1	—	—	—
2	276.8	7,655.1	404.8	—
3	123.0	3,402.3	179.9	—
4	69.2	1,913.8	101.2	483.4
5	44.3	1,224.8	64.8	309.4
10	11.1	306.2	16.2	77.3
15	4.9	136.1	7.2	34.4
20	2.8	76.6	4.0	19.3
25	1.8	49.0	2.6	12.4

<sup>1</sup>By random-sampling formula.

## DEFINITIONS OF TERMS

*Acceptable trees.*—Growing-stock trees of commercial species that meet specified standards of size and quality, but not qualifying as desirable trees.

*Available cut.*—The volume of timber that would be available for cutting on commercial forest land during a given period under specified assumptions concerning growth, cut, mortality, and forest management practices.

*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 as square feet of basal area per acre.

*Commercial forest land.*—Forest land producing or capable of producing crops of industrial wood and not withdrawn from timber utilization.

*Commercial species.*—Tree species suitable for industrial wood products.

*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.

*Desirable trees.*—Growing-stock trees of commercial species having no serious defects in quality that limit present or prospective use for timber products, of relatively high vigor, and containing no pathogens that may result in death or serious deterioration before rotation age.

*Diameter class.*—A classification of trees based on diameter outside bark (d.o.b.), measured at breast height (4½ feet above the ground). D.b.h. is the common abbreviation for “diameter at breast height.” Two-inch diameter classes are commonly used in Forest Survey, with the even inch the approximate midpoint for a class. For example, the 6-inch class includes trees 5.00 through 6.99 inches d.b.h., inclusive.

*Farm.*—Either a place operated as a unit of 10 or more acres from which the sale of agricultural products totaled \$50 or more annually, or a place operated as a unit of less than 10 acres from which the sale of agricultural products for the year amounted to at least \$250.

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

*Farmer-owned lands.*—Lands owned by farm operators.

*Forest industry lands.*—Lands owned by companies or individuals operating wood-using plants.

*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 upon the species forming a plurality of live-tree stocking.

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

*Spruce-fir.*—Forests in which spruce or true firs, singly or in combination, comprise a plurality of the stocking. (Common associates include white cedar, tamarack, maple, birch, and hemlock.)

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

*Oak-pine.*—Forests in which hardwoods (usually upland oaks) comprise a plurality of the stocking but in which pines comprise 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, comprise a plurality of the stocking, except where pines comprise 25 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.*—Bottomland forests in which tupelo, blackgum, sweetgum, oaks, or southern cypress, singly or in combination, comprise a plurality of the stocking, except where pines comprise 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, comprise 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, comprise a plurality of the stocking. (Common associates include hemlock, elm, basswood, and white pine.)

*Gross growth.*—Annual increase in net volume of trees in the absence of cutting and mortality.

*Growing-stock trees.*—Live trees of commercial species qualifying as desirable or acceptable trees.

*Growing-stock volume.*—Net volume in cubic feet of growing-stock trees 5.0 inches d.b.h. and over from a 1-foot stump to a minimum 4.0-inch top diameter outside bark of the central stem, or to the point where the central stem breaks into limbs. (Net volume in primary forks is included.)

*Hardwoods.*—Dicotyledonous trees, usually broad-leaved and deciduous.

*Soft hardwoods.*—Soft-textured hardwoods, such as boxelder, red and silver maple, 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.*—Includes former croplands, orchards, improved pastures and farm sites not tended within the past 2 years, and presently less than 16.7 percent stocked with 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.

*Inhibiting vegetation.*—Cover sufficiently dense to prevent the establishment of tree seedlings.

*Land area.*—The area of dry land and land temporarily or partly covered by water such as marshes, swamps, and river flood plains (omitting tidal flats below mean high tide), streams, sloughs, estuaries, and canals less than  $\frac{1}{8}$  of a statute mile in width, and lakes, reservoirs, and ponds less than 40 acres in area.

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

*Logging residues.*—The unused portions of trees cut or killed by logging.

*Miscellaneous Federal lands.*—Federal lands other than National Forests, lands administered by the Bureau of Land Management, and Indian lands.

*Miscellaneous private lands—corporate.*—Lands owned by private corporations other than forest industry.

*Miscellaneous private lands—individual.*—Privately owned lands other than forest industry, farmer-owned, or corporate lands.

*Mortality.*—Number or sound-wood volume of live trees dying from natural causes during a specified period.

*National Forest land.*—Federal lands which have been legally designated as National Forests or purchase units, and other lands under the administration of the Forest Service, including experimental areas and Bankhead-Jones Title III lands.

*Net annual growth.*—The increase in volume for a specific year.

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

*Noncommercial forest land.*—(a) Unproductive forest land incapable of yielding crops of industrial wood because of adverse site conditions, and (b) productive-reserved forest land.

*Noncommercial species.*—Tree species of typically small size, poor form, or inferior quality which 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.

*Nonstocked land.*—Commercial forest land less than 16.7 percent stocked with growing-stock trees.

*Other Federal lands.*—Federal lands other than National Forests, including lands administered by the Bureau of Land Management, Bureau of Indian Affairs, and other Federal agencies.

*Other public lands.*—Publicly owned lands other than National Forests.

*Other removals.*—The net volume of growing-stock 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 the commercial forest.

*Overstocked areas.*—Areas where growth of trees is significantly reduced by excessive numbers of trees.

*Plant byproducts.*—Wood products such as pulp chips, obtained incidental to production of other manufactured products.

*Plant residues.*—Wood materials from manufacturing plants not utilized for some product.

*Poletimber trees.*—Growing-stock trees of commercial species at least 5.0 inches in d.b.h. but smaller than sawtimber size.

*Productive-reserved forest land.*—Forest land sufficiently productive to qualify as commercial forest land, but withdrawn from timber utilization through statute or administrative designation.

*Quality class.*—A classification of sawtimber volumes by log or tree grades.

*Rangeland.*—Land on which the natural plant cover is composed principally of native grasses, forbs, or shrubs valuable for forage.

*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 tree volume in sound material.

*Rough trees.*—(a) 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 tree volume in sound material; and (b) all live trees of noncommercial species.

*Roundwood products.*—Logs, bolts, or other round sections cut from trees for industrial or consumer uses.

*Salvable dead trees.*—Standing or down dead trees that are considered merchantable by Forest Survey standards.

*Saplings.*—Live trees 1.0 inch to 5.0 inches in diameter at breast height.

*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 the stump and the saw-log top.

*Saw-log top.*—The point on the bole of sawtimber trees above which a saw log cannot be produced. The minimum saw-log top is 7.0 inches d.o.b. for softwoods and 9.0 inches d.o.b. for hardwoods.

*Sawtimber trees.*—Live trees of commercial species containing at least a 12-foot saw log, or two contiguous saw logs, each 8 feet or longer, and with at least one-third of the gross board-foot volume between the 1-foot stump and minimum saw-log top being sound. Softwoods must be at least 9.0 inches and hardwoods at least 11.0 inches in diameter at breast height.

*Sawtimber volume.*—Net volume of the saw-log portion of live sawtimber in board-foot International ¼-inch rule.

*Seedlings.*—Live trees less than 1.0 inch in diameter at breast height that are expected to survive and develop.

*Site class.*—A classification of forest land in terms of inherent capacity to grow crops of industrial wood based on fully stocked natural stands.

*Class 1.*—Sites capable of producing 165 or more cubic feet per acre annually.

*Class 2.*—Sites capable of producing 120 to 165 cubic feet per acre annually.

*Class 3.*—Sites capable of producing 85 to 120 cubic feet per acre annually.

*Class 4.*—Sites capable of producing 50 to 85 cubic feet per acre annually.

*Class 5.*—Sites incapable of producing 50 cubic feet per acre annually, but excluding unproductive sites.

*Softwoods.*—Coniferous trees, usually evergreen, having needles or scale-like leaves.

*Pines.*—Yellow pine species which include loblolly, longleaf, slash, pond, shortleaf, pitch, Virginia, and Table-Mountain pine.

*Other softwoods.*—Cypress, eastern redcedar, white cedar, eastern white pine, eastern hemlock, spruce, and fir.

*Stand-size class.*—A classification of forest land based on the diameter class of growing-stock trees on the area.

*Sawtimber stands.*—Stands at least 16.7 percent stocked with growing-stock 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 growing-stock trees of which half or more of this 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 growing-stock trees of which more than half of the stocking is saplings and seedlings.

*State, county, and municipal lands.*—Lands owned by States, counties, and local public agencies or municipalities, or lands 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 to a minimum standard, depending on tree size, to fully utilize the growth potential of the land. (See table at end of definitions.)

*Fully stocked.*—100 percent or more stocking

*Medium stocked.*—60 to 100 percent stocking

*Poorly stocked.*—Less than 60 percent stocking

*Survivor growth.*—The increase in volume of growing-stock trees that survive cutting and mortality for a specified year.

*Timber products.*—Roundwood products and plant by-products.

*Timber removals.*—The net volume of growing-stock trees removed from the inventory by harvesting; cultural operations, such as stand improvement; land clearing, or changes in land use.

*Unproductive forest land.*—Forest land incapable of producing 20 cubic feet per acre of industrial wood under natural conditions, because of adverse site conditions.

*Upper-stem portion.*—That part of the main stem or fork of sawtimber trees above the saw-log top to a 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 within the legal boundaries of cities and towns, suburban 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.

### Stocking Standard

D.b.h. class	Minimum number trees per acre for full stocking	Minimum basal area per acre for full stocking	Percent stocking assigned each tally tree <sup>1</sup>
Seedlings	600	—	5.0
2	560	—	5.4
4	460	—	6.5
6	340	67	5.8
8	240	84	4.8
10	155	85	4.3
12	115	90	4.0
14	90	96	3.8
16	72	101	3.7
18	60	106	3.5
20	51	111	3.5

<sup>1</sup>Trees less than 5.0 inches d.b.h. were tallied on a 10-point cluster of circular, 1/300-acre plots at each sample location. Trees 5.0 inches d.b.h. and larger were tallied on a 10-point cluster of variable plots using a basal area factor of 37.5 at each sample location.

Overstocked — over 130 percent  
 Fully stocked — 100-130 percent  
 Medium stocked — 60-99 percent  
 Poorly stocked — 16.7-59 percent  
 Nonstocked — less than 16.7 percent

### CONVERSION FACTORS Cubic feet of wood per average cord (excluding bark)

D.b.h.	Pine	Other softwoods	Hardwood
6	61.0	68.2	59.9
8	68.1	76.1	68.4
10	73.1	81.4	73.4
12	76.7	85.2	76.4
14	79.4	88.1	78.4
16	81.6	90.4	79.8
18	83.3	92.4	80.8
20	84.8	93.7	81.5
22	86.0	95.0	82.1
24+	87.9	98.0	83.1
Average	73.8	85.9	74.5

Rough cords per M cubic feet (without bark) =

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

Where	<i>Pine</i>	<i>Other softwoods</i>	<i>Hardwood</i>
a =	10.01850	9.15960	11.68410
b =	34.42135	28.75793	3.74431
c =	22.73994	25.54418	157.39417

# Index to Detailed Tables

## Area

1. Area by land classes
2. Area of commercial forest land, by ownership classes
3. Area of commercial forest land, by stand-size and ownership classes
4. Area of commercial forest land, by stand-volume and ownership classes
5. Area of commercial forest land, by stocking classes based on selected stand components
6. Area of commercial forest land, by ownership and stocking classes, with percent occupancy by selected stand components
7. Area of commercial forest land, by site and ownership classes
8. Area of commercial forest land, by forest types and ownership classes
9. Area of noncommercial forest land, by forest types

## Volume

10. Number of growing-stock trees on commercial forest land, by species and diameter classes
11. Volume of timber on commercial forest land, by class of timber and by softwood and hardwood
12. Volume of growing stock and sawtimber on commercial forest land, by ownership classes and by softwood and hardwood
13. Volume of growing stock on commercial forest land, by species and diameter classes
14. Volume of sawtimber on commercial forest land, by species and diameter classes
15. Volume of sawtimber on commercial forest land, by species and quality classes

## Growth, Removals, and Mortality

16. Net annual growth and removals of growing stock on commercial forest land, by species
17. Net annual growth and removals of growing stock on commercial forest land, by ownership classes and by softwood and hardwood
18. Net annual growth and removals of sawtimber on commercial forest land, by species
19. Net annual growth and removals of sawtimber on commercial forest land, by ownership classes and by softwood and hardwood

20. Mortality of growing stock and sawtimber on commercial forest land, by species
21. Mortality of growing stock and sawtimber on commercial forest land, by ownership classes and by softwood and hardwood
22. Mortality of growing stock and sawtimber on commercial forest land, by causes and by softwood and hardwood

## Utilization

23. Output of timber products, by product, by source of material, and by softwood and hardwood
24. Output of roundwood products, by product, by source, and by softwood and hardwood
25. Annual timber removals from growing stock on commercial forest land, by items and by softwood and hardwood
26. Annual timber removals from live sawtimber on commercial forest land, by items and by softwood and hardwood
27. Volume of unused residues at primary manufacturing plants, by industry and type of residue, and by softwood and hardwood

## Projections

28. Projections of net annual growth, available cut and inventory of sawtimber and growing stock on commercial forest land, by softwood and hardwood

## Supplemental Tables

29. Basal area per acre of growing stock and rough and rotten trees 5.0 inches d.b.h. and larger, by forest type and Survey Unit
30. Number of growing stock and rough and rotten trees 1.0-4.9 inches d.b.h. per acre by forest type and Survey Unit.
31. Area of commercial forest land, by stand volume (board feet) and ownership classes, by physiographic classes
32. Area of commercial forest land, by stand-volume (cubic feet) and ownership classes, by physiographic classes
33. Average net volume and growth per acre on commercial forest land, by physiographic class, tree class, and species group
34. Land area, by class, major forest type, and survey completion date, 1955, 1964, and 1974
35. Volume of sawtimber, growing stock, and all live timber on commercial forest land, by species group, diameter class, and survey completion date, 1955, 1964, and 1974
36. Volume of all live timber, by species group and Survey Unit, 1955, 1964, and 1974

**Table 1. — Area by land classes, North Carolina, 1974**

Land class	Area Acres
Forest land:	
Commercial	19,544,835
Productive-reserved	433,792
Unproductive	46,230
Total	20,024,857
Nonforest land:	
Cropland	6,402,053
Pasture and range	1,808,363
Other <sup>1</sup>	3,052,268
Total	11,262,684
All land <sup>2</sup>	31,287,541

<sup>1</sup> Includes swampland, industrial and urban areas, other nonforest land, and 232,428 acres classed as water by Forest Survey standards but defined by Bureau of Census as land.

<sup>2</sup> From U. S. Bureau of the Census, Land and Water Area of the United States, 1970.

**Table 2. — Area of commercial forest land, by ownership classes, North Carolina, 1974**

Ownership class	Area Acres
National Forest	1,011,434
Other Federal:	
Bureau of Land Management	—
Indian	52,418
Miscellaneous Federal	283,327
Total other Federal	335,745
State	320,385
County and municipal	77,886
Forest industry <sup>1</sup>	2,134,793
Farmer-owned	8,452,435
Miscellaneous private:	
Individual	5,970,136
Corporate	1,242,021
Total miscellaneous private	7,212,157
All ownerships	19,544,835

<sup>1</sup> Not including 180,775 acres of farmer-owned and miscellaneous private lands leased to forest industry.

**Table 3. — Area of commercial forest land, by stand-size and ownership classes, North Carolina, 1974**

Stand-size class	All ownerships	National Forest	Other public	Forest industry	Farmer and misc. private
	Acres				
Sawtimber	8,211,834	619,796	315,549	546,356	6,730,133
Poletimber	6,292,195	279,042	214,149	548,540	5,250,464
Sapling and seedling	4,552,997	85,328	162,344	953,572	3,351,753
Nonstocked	487,809	27,268	41,974	86,325	332,242
All classes	19,544,835	1,011,434	734,016	2,134,793	15,664,592

**Table 4. — Area of commercial forest land, by stand volume and ownership classes, North Carolina, 1974**

Stand volume per acre <sup>1</sup>	All ownerships	National Forest	Other public	Forest industry	Farmer and misc. private
	Acres				
Less than 1,500 board feet	7,436,245	220,773	387,376	1,265,690	5,562,406
1,500 to 5,000 board feet	6,621,002	396,379	247,178	478,474	5,498,971
More than 5,000 board feet	5,487,588	394,282	99,462	390,629	4,603,215
All classes	19,544,835	1,011,434	734,016	2,134,793	15,664,592

<sup>1</sup> International ¼-inch rule.

**Table 5. — Area of commercial forest land, by stocking classes based on selected stand components, North Carolina, 1974**

Stocking percentage	Stocking classified in terms of:					
	All live trees	Growing-stock trees			Rough and rotten trees	Inhibiting vegetation
		Total	Desirable	Acceptable		
	Acres					
160	6,973	884	—	—	—	
150-159	131,608	47,959	—	9,954	—	
140-149	317,604	138,004	—	43,872	—	
130-139	2,541,094	490,873	23,596	106,656	—	
120-129	2,256,414	994,066	32,435	177,201	3,125	
110-119	2,827,153	1,432,409	75,931	375,688	25,444	
100-109	4,974,138	2,540,304	502,653	510,657	67,698	
90-99	2,163,007	2,537,677	234,665	757,466	93,642	
80-89	1,645,104	2,710,932	449,298	1,176,432	138,364	
70-79	905,727	2,547,348	778,421	1,490,534	339,167	
60-69	598,047	1,817,511	1,139,614	1,989,957	487,885	
50-59	392,127	1,441,919	1,543,346	2,214,721	787,458	
40-49	222,279	1,103,204	2,084,744	2,616,028	1,499,045	
30-39	207,608	645,758	2,489,815	2,548,023	2,157,877	
20-29	128,829	497,388	2,547,972	1,976,375	3,134,004	
10-19	57,463	265,494	2,971,311	1,448,576	4,185,609	
Less than 10	169,660	332,905	4,671,034	2,102,695	6,625,517	
Total	19,544,835	19,544,835	19,544,835	19,544,835	19,544,835	

**Table 6. — Area of commercial forest land, by ownership and stocking classes,<sup>1</sup> with percent occupancy by selected stand components, North Carolina, 1974**

Ownership and stocking class	Area	Stand components					
		Growing-stock trees			Rough and rotten trees	Inhibiting vegetation	Nonstocked
		Total	Desirable	Acceptable			
	<i>Acres</i>	<i>Percent of area</i>					
<b>National Forest:</b>							
Fully stocked stands	225,250	94.0	18.1	75.9	6.0	—	—
Medium stocked stands	571,285	75.9	13.4	62.5	19.4	2.1	2.6
Poorly stocked stands	214,899	34.9	6.2	28.7	23.5	31.1	10.5
All stands	1,011,434	71.7	13.1	58.6	16.8	7.8	3.7
<b>Other public:</b>							
Fully stocked stands	137,426	94.0	42.8	51.2	6.0	—	—
Medium stocked stands	279,483	77.5	30.3	47.2	16.1	1.9	4.5
Poorly stocked stands	317,107	38.8	16.6	22.2	29.5	13.9	17.8
All stands	734,016	71.9	30.5	41.4	16.6	4.7	6.8
<b>Forest industry:</b>							
Fully stocked stands	835,286	95.3	54.7	40.6	4.7	—	—
Medium stocked stands	874,001	74.5	36.7	37.8	20.8	2.1	2.6
Poorly stocked stands	425,506	31.4	12.2	19.2	30.8	16.8	21.0
All stands	2,134,793	74.9	39.5	35.4	16.1	4.0	5.0
<b>Farmer &amp; misc. private:</b>							
Fully stocked stands	4,446,537	93.0	37.8	55.2	7.0	—	—
Medium stocked stands	7,888,899	74.8	32.1	42.7	21.2	1.5	2.5
Poorly stocked stands	3,329,156	38.3	15.5	22.8	39.4	9.9	12.4
All stands	15,664,592	73.5	30.6	42.9	20.1	2.7	3.7
<b>All ownerships:</b>							
Fully stocked stands	5,644,499	93.5	40.5	53.0	6.5	—	—
Medium stocked stands	9,613,668	75.0	31.7	43.3	20.8	1.6	2.6
Poorly stocked stands	4,286,668	37.2	14.6	22.6	36.7	12.1	14.0
All stands	19,544,835	73.6	31.2	42.4	19.2	3.2	4.0

<sup>1</sup> Based on degree of growing-stock stocking.

**Table 7. — Area of commercial forest land, by site and ownership classes, North Carolina, 1974**

Site class	All ownerships	National Forest	Other public	Forest industry	Farmer and misc. private
	<i>Acres</i>				
165 cu. ft. or more	96,375	11,356	—	9,182	75,837
120 to 165 cu. ft.	293,555	49,543	5,560	27,037	211,415
85 to 120 cu. ft.	3,273,037	114,138	38,346	339,383	2,781,170
50 to 85 cu. ft.	12,134,194	542,802	324,733	1,319,953	9,946,706
Less than 50 cu. ft.	3,747,674	293,595	365,377	439,238	2,649,464
All classes	19,544,835	1,011,434	734,016	2,134,793	15,664,592

**Table 8. — Area of commercial forest land, by forest types and ownership classes, North Carolina, 1974**

Type	All ownerships	Public	Private
	<i>Acres</i>		
<b>Softwood types:</b>			
White pine-hemlock	142,841	11,877	130,964
Spruce-fir	12,714	4,811	7,903
Longleaf pine	460,972	151,226	309,746
Slash pine	94,002	—	94,002
Loblolly pine	3,265,216	126,120	3,139,096
Shortleaf pine	763,066	16,019	747,047
Virginia pine	878,777	23,777	855,000
Eastern redcedar	28,430	6,822	21,608
Pond pine	1,196,885	217,604	979,281
Pitch pine	61,685	43,824	17,861
Total	6,904,588	602,080	6,302,508
<b>Hardwood types:</b>			
Oak-pine	2,483,865	158,075	2,325,790
Oak-hickory	6,870,097	719,178	6,150,919
Chestnut oak	215,378	102,423	112,955
Southern scrub oak	163,394	27,277	136,117
Oak-gum-cypress	2,237,447	63,495	2,173,952
Elm-ash-cottonwood	440,426	26,569	413,857
Maple-beech-birch	229,640	46,353	183,287
Total	12,640,247	1,143,370	11,496,877
All types	19,544,835	1,745,450	17,799,385

**Table 9. — Area of noncommercial forest land, by forest types, North Carolina, 1974**

Type	All areas	Productive-reserved areas	Unproductive areas
----- Acres -----			
White pine-hemlock	3,865	3,865	—
Spruce-fir	5,885	4,660	1,225
Longleaf-slash pine	603	603	—
Loblolly-shortleaf pine	50,996	24,714	26,282
Oak-pine	10,564	10,023	541
Oak-hickory	393,993	383,701	10,292
Oak-gum-cypress	9,116	1,226	7,890
Maple-beech-birch	5,000	5,000	—
All types	480,022	433,792	46,230

**Table 10. — Number of growing-stock trees on commercial forest land, by species and diameter classes, North Carolina, 1974**

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 trees -----											
<b>Softwood:</b>											
Longleaf pines	48,285	16,204	13,011	8,739	5,950	2,813	1,044	397	80	47	—
Slash pine	8,401	6,610	1,683	98	—	—	10	—	—	—	—
Shortleaf pine	201,780	85,297	59,083	34,816	14,492	5,629	1,628	567	174	94	—
Loblolly pine	452,723	180,975	108,131	64,689	43,756	27,397	15,441	7,336	2,914	2,023	61
Pond pine	138,379	62,129	36,505	21,949	9,627	4,993	2,069	721	302	84	—
Virginia pine	166,046	83,466	48,194	23,149	7,908	2,476	643	169	41	—	—
Pitch pine	23,486	8,504	6,926	4,327	1,998	933	520	166	95	17	—
Table-Mountain pine	3,077	1,422	838	215	343	180	57	—	—	22	—
Spruce pine	—	—	—	—	—	—	—	—	—	—	—
Sand pine	—	—	—	—	—	—	—	—	—	—	—
Eastern white pine	27,820	7,102	7,974	4,382	2,765	2,101	1,440	979	409	563	105
Eastern hemlock	12,243	5,910	1,977	1,535	578	951	424	164	309	308	87
Spruce and fir	2,373	467	900	687	181	84	38	16	—	—	—
Baldcypress	12,343	2,621	2,149	2,414	1,639	1,391	750	580	324	452	23
Pondcypress	4,149	1,090	903	894	696	222	182	43	63	50	6
Cedars	22,289	12,942	4,770	2,636	1,130	503	136	93	57	22	—
Total softwoods	1,123,394	474,739	293,044	170,530	91,063	49,673	24,382	11,231	4,768	3,682	282
<b>Hardwood:</b>											
Select white oaks <sup>1</sup>	130,843	50,070	28,082	20,142	13,315	8,105	5,202	2,700	1,506	1,538	183
Select red oaks <sup>2</sup>	40,566	12,010	8,388	6,610	4,354	2,771	2,304	1,373	1,134	1,405	217
Chestnut oak	65,336	22,690	14,131	10,598	6,334	4,832	3,035	1,322	991	1,256	147
Other white oaks	32,905	12,132	8,212	5,932	3,044	1,779	898	445	141	280	42
Other red oaks	194,280	76,004	45,762	29,056	18,637	10,985	6,355	3,686	1,669	1,900	226
Hickory	69,551	25,373	15,986	10,734	6,938	5,077	2,576	1,610	644	595	18
Yellow birch	5,978	4,143	669	505	95	255	194	30	32	55	—
Hard maple	6,949	3,495	1,056	743	596	487	158	212	74	123	5
Soft maple	128,707	58,184	30,374	18,042	10,545	5,693	2,758	1,537	846	696	32
Beech	16,616	6,542	2,681	2,147	1,858	1,577	706	539	167	373	26
Sweetgum	153,967	67,255	38,477	21,092	12,130	6,826	4,315	2,115	922	793	42
Tupelo and blackgum	120,477	37,340	29,428	19,448	13,767	9,404	5,188	3,147	1,409	1,281	65
Ash	28,388	11,300	7,281	3,948	2,432	1,485	992	583	179	183	5
Cottonwood	1,375	457	211	250	147	174	53	29	34	20	—
Basswood	4,790	1,171	1,262	684	841	350	322	83	49	22	6
Yellow-popular	151,876	50,300	34,694	24,458	17,772	11,775	6,256	3,355	1,620	1,595	51
Bay and magnolia	7,244	2,969	1,732	1,135	554	545	166	74	35	29	5
Black cherry	5,833	2,939	1,322	767	322	314	64	65	28	12	—
Black walnut	2,574	661	679	503	447	191	36	38	8	11	—
Sycamore	3,761	771	1,063	674	530	183	174	95	102	152	17
Black locust	17,423	5,136	4,392	3,649	2,410	1,086	345	249	69	84	3
Elm	18,242	6,578	5,607	2,727	1,553	841	521	209	87	112	7
Other eastern hardwoods	54,707	25,323	14,489	6,926	3,439	2,000	1,123	718	357	320	12
Total hardwoods	1,262,388	482,843	295,978	190,770	122,060	76,735	43,741	24,214	12,103	12,835	1,109
All species	2,385,782	957,582	589,022	361,300	213,123	126,408	68,123	35,445	16,871	16,517	1,391

<sup>1</sup> Includes white and swamp chestnut oaks.

<sup>2</sup> Includes cherrybark and northern red oaks.

**Table 11. — Volume of timber on commercial forest land, by class of timber and by softwood and hardwood, North Carolina, 1974**

Class of timber	All species	Softwood	Hardwood
--- Thousand cubic feet ---			
Sawtimber trees:			
Saw-log portion	14,175,548	6,541,514	7,634,034
Upper-stem portion	2,138,827	740,462	1,398,365
Total	16,314,375	7,281,976	9,032,399
Poletimber trees	8,493,246	3,101,838	5,391,408
All growing-stock trees	24,807,621	10,383,814	14,423,807
Rough trees:			
Sawtimber-size trees	721,522	62,774	658,748
Poletimber-size trees	1,468,531	88,592	1,379,939
Total	2,190,053	151,366	2,038,687
Rotten trees:			
Sawtimber-size trees	555,431	37,296	518,135
Poletimber-size trees	94,643	1,200	93,443
Total	650,074	38,496	611,578
Salvable dead trees:			
Sawtimber-size trees	15,047	12,696	2,351
Poletimber-size trees	20,636	18,914	1,722
Total	35,683	31,610	4,073
Total, all timber	27,683,431	10,605,286	17,078,145

**Table 12. — Volume of growing stock and sawtimber on commercial forest land, by ownership classes, and by softwood and hardwood, North Carolina, 1974**

Ownership class	Growing stock			Sawtimber		
	All species	Softwood	Hardwood	All species	Softwood	Hardwood
--- Thousand cubic feet ---      --- Thousand board feet <sup>1</sup> ---						
National Forest	1,637,422	446,319	1,191,103	5,194,383	1,651,663	3,542,720
Other public	674,899	364,111	310,788	1,976,370	1,143,422	832,948
Forest industry	2,184,576	1,042,168	1,142,408	6,184,675	3,172,162	3,012,513
Farmer and misc. private	20,310,724	8,531,216	11,779,508	59,514,585	27,716,712	31,797,873
All ownerships	24,807,621	10,383,814	14,423,807	72,870,013	33,683,959	39,186,054

<sup>1</sup> International 1/4-inch rule

**Table 13. — Volume of growing stock on commercial forest land, by species and diameter classes, North Carolina, 1974**

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
<i>Thousand cubic feet</i>											
<b>Softwood:</b>											
Longleaf pine	451,275	40,811	82,713	97,346	102,570	68,262	34,870	17,225	3,826	3,652	—
Slash pine	19,602	11,919	6,814	621	—	—	248	—	—	—	—
Shortleaf pine	1,586,169	229,811	385,839	421,104	278,733	157,737	63,467	30,066	12,370	7,042	—
Loblolly pine	4,993,564	461,914	683,604	785,068	853,423	784,998	618,068	392,123	203,896	198,835	11,635
Pond pine	980,850	141,890	194,756	236,097	163,955	118,939	69,025	31,750	17,773	6,665	—
Virginia pine	1,100,523	260,019	328,006	276,242	142,891	61,615	21,694	7,511	2,545	—	—
Pitch pine	187,377	21,287	37,136	44,162	32,077	21,129	17,864	7,134	5,387	1,201	—
Table-Mountain pine	23,165	4,132	4,799	1,888	5,860	3,406	2,064	—	—	1,016	—
Spruce pine	—	—	—	—	—	—	—	—	—	—	—
Sand pine	—	—	—	—	—	—	—	—	—	—	—
Eastern white pine	421,945	23,749	51,993	52,074	49,807	53,876	50,434	43,922	22,753	55,349	17,988
Eastern hemlock	151,453	12,641	9,088	14,936	8,486	22,561	13,992	7,120	18,874	26,717	17,038
Spruce and fir	19,452	1,194	5,118	7,250	2,539	1,649	1,206	496	—	—	—
Baldcypress	251,260	9,235	18,380	33,557	32,248	37,172	28,208	29,030	20,593	39,284	3,553
Pondcypress	56,211	3,754	6,987	10,901	11,481	5,985	6,149	1,936	3,538	3,805	1,675
Cedars	140,968	34,693	29,556	31,328	19,445	12,652	4,589	4,049	3,072	1,584	—
<b>Total softwoods</b>	<b>10,383,814</b>	<b>1,257,049</b>	<b>1,844,789</b>	<b>2,012,574</b>	<b>1,703,515</b>	<b>1,349,961</b>	<b>931,878</b>	<b>572,362</b>	<b>314,627</b>	<b>345,150</b>	<b>51,889</b>
<b>Hardwood:</b>											
Select white oaks <sup>1</sup>	1,556,551	137,217	168,184	227,403	242,228	213,079	187,007	125,895	90,749	132,616	32,173
Select red oaks <sup>2</sup>	696,446	38,968	55,126	77,221	76,600	71,590	81,501	67,041	65,781	123,368	39,250
Chestnut oak	807,854	58,038	81,703	115,272	107,837	123,180	100,685	56,258	49,774	94,472	20,635
Other white oaks	324,373	32,538	46,098	58,393	50,572	42,870	29,709	20,541	7,368	26,467	9,817
Other red oaks	2,079,830	212,091	272,479	314,067	316,784	275,067	221,976	170,307	96,763	160,998	39,298
Hickory	820,396	67,208	95,781	115,258	126,083	135,771	99,623	79,602	41,040	55,055	4,975
Yellow birch	42,902	12,346	4,104	4,063	1,321	5,569	6,282	1,287	2,319	5,611	—
Hard maple	87,157	11,315	6,524	8,415	11,659	14,086	7,089	11,161	4,811	11,088	1,009
Soft maple	1,178,162	182,547	197,316	207,128	183,630	142,835	91,786	66,877	46,976	54,979	4,088
Beech	243,087	21,606	17,371	26,302	34,801	42,083	26,464	25,668	9,625	34,840	4,327
Sweetgum	1,526,304	164,321	240,962	256,253	242,427	196,836	171,586	111,172	59,698	74,575	8,474
Tupelo and blackgum	1,591,999	113,042	194,836	235,214	253,377	250,020	188,897	149,657	83,095	109,015	14,846
Ash	309,117	32,736	46,756	46,121	47,395	43,545	37,933	28,434	10,775	14,590	832
Cottonwood	21,797	1,318	1,430	3,258	3,391	4,943	1,904	1,737	2,264	1,552	—
Basswood	71,305	2,564	7,992	9,199	18,191	10,490	12,501	4,373	2,987	2,155	853
Yellow-popular	2,011,048	154,676	226,295	290,528	353,444	331,553	238,712	163,539	102,889	142,337	7,075
Bay and magnolia	71,372	8,649	10,910	12,627	9,883	14,255	6,882	3,141	2,086	2,229	710
Black cherry	47,698	9,018	8,578	7,987	6,167	7,720	2,488	3,358	1,574	808	—
Black walnut	27,421	1,989	3,754	5,285	7,308	4,954	1,231	1,663	490	747	—
Sycamore	66,998	2,981	7,388	8,631	10,460	4,995	6,316	4,725	5,514	13,606	2,382
Black locust	176,639	15,265	25,397	36,051	39,644	25,899	12,327	10,673	4,293	6,603	487
Elm	182,332	16,735	33,743	32,222	28,399	22,286	19,448	11,322	5,599	10,300	2,278
Other eastern hardwoods	483,019	70,638	90,871	83,106	63,841	53,083	38,097	33,815	20,571	25,949	3,048
<b>Total hardwoods</b>	<b>14,423,807</b>	<b>1,367,806</b>	<b>1,843,598</b>	<b>2,180,004</b>	<b>2,235,442</b>	<b>2,036,709</b>	<b>1,590,444</b>	<b>1,152,246</b>	<b>717,041</b>	<b>1,103,960</b>	<b>196,557</b>
<b>All species</b>	<b>24,807,621</b>	<b>2,624,855</b>	<b>3,688,387</b>	<b>4,192,578</b>	<b>3,938,957</b>	<b>3,386,690</b>	<b>2,522,322</b>	<b>1,724,608</b>	<b>1,031,668</b>	<b>1,449,110</b>	<b>248,446</b>

<sup>1</sup> Includes white and swamp chestnut oaks.

<sup>2</sup> Includes cherrybark and northern red oaks.

**Table 14. — Volume of sawtimber on commercial forest land, by species and diameter classes, North Carolina, 1974**

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	21.0-29.9	29.0 and larger
----- <i>Thousand board feet</i> -----									
<b>Softwood:</b>									
Longleaf pine	1,606,814	393,762	494,361	365,088	200,550	104,645	24,003	24,405	—
Slash pine	3,450	2,087	—	—	1,363	—	—	—	—
Shortleaf pine	4,161,782	1,509,182	1,228,717	785,377	345,222	174,042	74,993	44,249	—
Loblolly Pine	18,774,018	2,753,969	3,747,753	3,936,251	3,395,409	2,299,680	1,256,889	1,300,708	83,359
Pond pine	2,481,720	719,654	615,406	512,949	337,003	166,086	90,438	40,184	—
Virginia pine	1,948,631	935,469	577,688	277,333	105,910	38,534	13,697	—	—
Pitch pine	557,339	139,803	133,716	102,896	97,727	41,788	33,576	7,833	—
Table-Mountain pine	70,451	6,861	27,880	17,488	11,822	—	—	6,400	—
Spruce pine	—	—	—	—	—	—	—	—	—
Sand pine	—	—	—	—	—	—	—	—	—
Eastern white pine	1,761,520	188,001	215,906	261,464	263,848	242,511	130,607	341,918	117,265
Eastern hemlock	688,869	50,062	35,507	106,649	71,804	38,896	106,731	164,574	114,646
Spruce and fir	53,972	25,392	11,043	8,055	6,627	2,855	—	—	—
Baldcypress	1,025,271	97,999	120,228	160,214	134,903	149,310	111,653	228,231	22,733
Pondcypress	199,359	34,994	44,888	26,613	30,427	10,098	19,355	21,854	11,130
Cedars	350,763	121,615	88,445	64,253	24,985	23,377	18,226	9,862	—
Total softwoods	33,683,959	6,978,850	7,341,538	6,624,630	5,027,600	3,291,822	1,880,168	2,190,218	349,133
<b>Hardwood:</b>									
Select white oaks <sup>1</sup>	4,384,975	—	788,686	822,875	807,959	589,244	455,424	720,311	200,476
Select red oaks <sup>2</sup>	2,275,779	—	245,605	265,735	333,336	294,809	302,945	614,627	218,722
Chestnut oak	2,306,079	—	339,641	461,254	416,302	251,545	235,623	485,077	116,637
Other white oaks	1,152,946	—	273,479	266,489	179,279	142,498	47,785	176,981	66,435
Other red oaks	5,601,720	—	1,071,630	1,100,015	983,746	821,685	493,630	888,664	242,350
Hickory	2,373,494	—	427,832	548,148	452,265	389,862	213,655	310,135	31,597
Yellow birch	92,167	—	4,951	21,745	25,406	5,359	9,903	24,803	—
Hard maple	264,006	—	43,353	56,696	30,598	50,513	22,637	54,881	5,328
Soft maple	2,268,670	—	564,974	521,836	372,546	293,508	218,099	275,383	22,324
Beech	655,954	—	121,554	152,447	96,483	95,782	37,504	134,130	18,054
Sweetgum	3,935,213	—	853,161	836,086	823,511	582,482	332,207	450,520	57,246
Tupelo and blackgum	4,524,389	—	820,445	988,021	843,549	731,690	430,536	613,669	96,479
Ash	747,722	—	152,510	167,696	161,580	131,229	52,748	77,031	4,928
Cottonwood	73,656	—	12,633	21,035	9,034	9,233	12,545	9,176	—
Basswood	207,244	—	62,404	41,334	53,429	19,695	14,373	11,386	4,623
Yellow-poplar	6,059,593	—	1,231,497	1,388,379	1,132,535	844,516	566,816	849,274	46,576
Bay and magnolia	181,876	—	32,681	61,217	36,707	17,302	12,790	15,505	5,674
Black cherry	89,298	—	21,843	29,451	10,742	15,615	7,606	4,041	—
Black walnut	56,507	—	24,751	16,982	4,437	5,938	1,788	2,611	—
Sycamore	219,590	—	33,157	18,881	27,585	22,344	27,710	75,589	14,324
Black locust	363,826	—	139,245	93,970	45,794	40,409	16,527	25,917	1,964
Elm	407,115	—	96,092	85,633	82,332	51,432	26,658	52,090	12,878
Other eastern hardwoods	944,235	—	214,130	197,966	154,475	145,248	92,238	123,702	16,476
Total hardwoods	39,186,054	—	7,576,254	8,163,891	7,083,630	5,551,938	3,631,747	5,995,503	1,183,091
All species	72,870,013	6,978,850	14,917,792	14,788,521	12,111,230	8,843,760	5,511,915	8,185,721	1,532,224

<sup>1</sup> Includes white and swamp chestnut oaks.

<sup>2</sup> Includes cherrybark and northern red oaks.

**Table 15. — Volume of sawtimber on commercial forest land, by species and quality classes, North Carolina, 1974**

Species	All grades	Log grade			
		1	2	3	4
----- Thousand board feet -----					
<b>Softwood:</b>					
Yellow pines <sup>1</sup>	29,604,205	10,659,352	3,145,766	15,799,087	( <sup>2</sup> )
Eastern white pine <sup>3</sup>	1,761,520	50,123	31,839	1,130,704	548,854
Cypress <sup>3</sup>	1,224,630	316,249	605,075	303,306	—
Spruce and fir <sup>3</sup>	53,972	2,956	7,344	39,115	4,557
Other eastern softwoods <sup>3</sup>	1,039,632	150,347	195,913	522,508	170,864
Total	33,683,959	11,179,027	3,985,937	17,794,720	724,275
<b>Hardwood:<sup>4</sup></b>					
Select white and red oaks	6,660,754	1,564,592	1,636,592	2,890,973	568,597
Other white and red oaks	9,060,745	1,236,588	2,155,954	3,905,867	1,762,336
Hickory	2,373,494	284,129	548,164	1,062,476	478,725
Yellow birch	92,167	12,513	26,492	40,699	12,463
Hard maple	264,006	35,725	78,590	98,995	50,696
Sweetgum	3,935,213	819,710	856,692	2,017,853	240,958
Ash, walnut, and black cherry	893,527	171,562	241,440	433,094	47,431
Yellow-poplar	6,059,593	1,110,467	1,486,503	2,658,097	804,526
Other hardwoods	9,846,555	1,052,166	2,409,740	5,016,895	1,367,754
Total	39,186,054	6,287,452	9,440,167	18,124,949	5,333,486
All species	72,870,013	17,466,479	13,426,104	35,919,669	6,057,761

<sup>1</sup> Based on *Southern Pine Log Grades for Yard and Structural Lumber*, Research Paper SE-39, published by the Southeastern Forest Experiment Station in 1968.

<sup>2</sup> Not applicable.

<sup>3</sup> Based on *Trial Log Grades for Eastern White Pine* prepared by the Northeastern Forest Experiment Station in 1960.

<sup>4</sup> Graded according to *Hardwood Log Grades for Standard Lumber* published by the U. S. Forest Products Laboratory in 1953. Specifications for the grade 4 tie and timber logs are based chiefly on knot size and log soundness.

**Table 16. — Net annual growth and removals of growing stock on commercial forest land, by species, North Carolina, 1973**

Species	Net annual growth	Annual timber removals
----- Thousand cubic feet -----		
<b>Softwood:</b>		
Yellow pines	489,904	413,689
Eastern white pine	24,723	10,707
Spruce and fir	537	—
Cypress	7,815	7,292
Other eastern softwoods	12,587	5,030
Total softwoods	535,566	436,718
<b>Hardwood:</b>		
Select white and red oaks	89,544	58,774
Other white and red oaks	125,229	69,693
Hickory	23,988	12,968
Yellow birch	1,776	766
Hard maple	5,214	—
Sweetgum	62,135	44,046
Ash, walnut, and black cherry	16,135	8,478
Yellow-poplar	133,882	39,885
Tupelo and blackgum	29,154	38,906
Bay and magnolia	1,953	1,579
Other eastern hardwoods	99,864	38,741
Total hardwoods	588,874	313,836
All species	1,124,440	750,554

**Table 17. — Net annual growth and removals of growing stock on commercial forest land, by ownership classes and by softwood and hardwood, North Carolina, 1973**

Ownership class	Net annual growth			Annual timber removals		
	All species	Softwood	Hardwood	All species	Softwood	Hardwood
----- Thousand cubic feet -----						
National Forest	58,230	17,853	40,377	14,130	7,838	6,292
Other public	30,294	17,669	12,625	25,966	18,134	7,832
Forest industry	100,999	60,657	40,342	132,435	93,405	39,030
Farmer and misc. private	934,917	439,387	495,530	578,023	317,341	260,682
All ownerships	1,124,440	535,566	588,874	750,554	436,718	313,836

**Table 18. — Net annual growth and removals of sawtimber on commercial forest land, by species, North Carolina, 1973**

Species	Net annual growth	Annual timber removals
	<i>Thousand board feet</i>	
<b>Softwood:</b>		
Yellow pines	1,849,362	1,593,003
Eastern white pine	104,743	46,291
Spruce and fir	2,421	—
Cypress	44,686	34,488
Other eastern softwoods	39,465	11,651
<b>Total softwoods</b>	<b>2,040,677</b>	<b>1,685,433</b>
<b>Hardwood:</b>		
Select white and red oaks	322,113	190,435
Other white and red oaks	413,338	232,514
Hickory	82,078	40,370
Yellow birch	1,525	3,382
Hard maple	12,498	—
Sweetgum	188,808	150,367
Ash, walnut, and black cherry	43,042	25,396
Yellow-poplar	508,337	150,688
Tupelo and blackgum	109,676	146,133
Bay and magnolia	5,528	414
Other eastern hardwoods	241,196	105,246
<b>Total hardwoods</b>	<b>1,928,139</b>	<b>1,044,945</b>
<b>All species</b>	<b>3,968,816</b>	<b>2,730,378</b>

**Table 20. — Mortality of growing stock and sawtimber on commercial forest land, by species, North Carolina, 1973**

Species	Growing stock	Sawtimber
	<i>Thousand cu. ft.</i>	<i>Thousand bd. ft.</i>
<b>Softwood:</b>		
Yellow pines	73,824	134,275
Eastern white pine	1,515	4,915
Spruce and fir	204	—
Cypress	667	1,759
Other eastern softwoods	857	1,902
<b>Total softwoods</b>	<b>77,067</b>	<b>142,851</b>
<b>Hardwood:</b>		
Select white and red oaks	5,684	21,203
Other white and red oaks	16,954	44,221
Hickory	4,455	17,417
Yellow birch	—	—
Hard maple	—	—
Sweetgum	6,691	23,788
Yellow-poplar	3,838	12,557
Tupelo and blackgum	4,858	14,427
Bay and magnolia	153	248
Other eastern hardwoods	16,335	33,431
<b>Total hardwoods</b>	<b>63,396</b>	<b>174,275</b>
<b>All species</b>	<b>140,463</b>	<b>317,126</b>

**Table 19. — Net annual growth and removals of sawtimber on commercial forest land, by ownership classes, and by softwood and hardwood, North Carolina, 1973**

Ownership class	Net annual growth			Annual timber removals		
	All species	Soft-wood	Hard-wood	All species	Soft-wood	Hard-wood
<i>Thousand board feet</i>						
National Forest	222,666	80,358	142,308	54,436	32,185	22,251
Other public	112,036	74,660	37,376	90,647	67,105	23,542
Forest industry	310,600	185,512	125,088	513,323	384,818	128,505
Farmer and misc. private	3,323,514	1,700,147	1,623,367	2,071,972	1,201,325	870,647
<b>All ownerships</b>	<b>3,968,816</b>	<b>2,040,677</b>	<b>1,928,139</b>	<b>2,730,378</b>	<b>1,685,433</b>	<b>1,044,945</b>

**Table 21. — Mortality of growing stock and sawtimber on commercial forest land, by ownership classes, and by softwood and hardwood, North Carolina, 1973**

Ownership class	Growing stock			Sawtimber		
	All species	Soft-wood	Hard-wood	All species	Soft-wood	Hard-wood
<i>Thousand cubic feet</i> <i>Thousand board feet</i>						
National Forest	11,224	2,232	8,992	34,527	5,677	28,850
Other public	4,078	2,221	1,857	11,656	4,469	7,187
Forest industry	13,745	7,910	5,835	35,837	17,055	18,782
Farmer and misc. private	111,416	64,704	46,712	235,106	115,650	119,456
<b>All ownerships</b>	<b>140,463</b>	<b>77,067</b>	<b>63,396</b>	<b>317,126</b>	<b>142,851</b>	<b>174,275</b>

**Table 22. — Mortality of growing stock and sawtimber on commercial forest land, by causes and by softwood and hardwood, North Carolina, 1973**

Cause of death	Growing stock			Sawtimber		
	All species	Soft-wood	Hard-wood	All species	Soft-wood	Hard-wood
<i>Thousand cubic feet</i> <i>Thousand board feet</i>						
Fire	3,733	2,573	1,160	5,377	3,441	1,936
Insects	27,464	27,397	67	74,301	74,039	262
Disease	9,532	5,197	4,335	15,307	12,168	3,139
Weather	29,242	13,051	16,191	85,783	23,258	62,525
Suppression	27,693	19,318	8,375	12,994	9,044	3,950
Animals	173	—	173	694	—	694
Undetermined	42,626	9,531	33,095	122,670	20,901	101,769
<b>All causes</b>	<b>140,463</b>	<b>77,067</b>	<b>63,396</b>	<b>317,126</b>	<b>142,851</b>	<b>174,275</b>

**Table 23. — Output of timber products, by product, by source of material, and by softwood and hardwood, North Carolina, 1973**

Product and species group	Standard units	Total output		Roundwood products		Plant byproducts	
		Number of units	Thousand cu. ft.	Number of units	Thousand cu. ft.	Number of units	Thousand cu. ft.
<b>Saw logs:</b>							
Softwood	M bd. ft. <sup>1</sup>	1,065,765	182,201	1,041,911	178,126	23,854	4,075
Hardwood	M bd. ft. <sup>1</sup>	534,225	90,240	532,447	89,940	1,778	300
Total	M bd. ft. <sup>1</sup>	1,599,990	272,441	1,574,358	268,066	25,632	4,375
<b>Veneer logs and bolts:</b>							
Softwood	M bd. ft. <sup>1</sup>	300,093	49,799	300,093	49,799	—	—
Hardwood	M bd. ft. <sup>1</sup>	106,413	17,629	106,413	17,629	—	—
Total	M bd. ft. <sup>1</sup>	406,506	67,428	406,506	67,428	—	—
<b>Pulpwood:<sup>2</sup></b>							
Softwood	Std. cords <sup>3</sup>	2,798,162	214,576	2,028,548	155,547	769,614	59,029
Hardwood	Std. cords <sup>3</sup>	1,434,432	109,543	1,247,319	95,248	187,113	14,295
Total	Std. cords <sup>3</sup>	4,232,594	324,119	3,275,867	250,795	956,727	73,324
<b>Cooperage logs and bolts:</b>							
Softwood	M bd. ft. <sup>1</sup>	—	—	—	—	—	—
Hardwood	M bd. ft. <sup>1</sup>	1,011	157	1,011	157	—	—
Total	M bd. ft. <sup>1</sup>	1,011	157	1,011	157	—	—
<b>Poles and piling:</b>							
Softwood	M pieces	84	1,033	84	1,033	—	—
Hardwood	M pieces	—	—	—	—	—	—
Total	M pieces	84	1,033	84	1,033	—	—
<b>Posts (round and split):</b>							
Softwood	M pieces	2,393	3,180	435	145	1,958	3,035
Hardwood	M pieces	22	14	22	14	—	—
Total	M pieces	2,415	3,194	457	159	1,958	3,035
<b>Other:<sup>4</sup></b>							
Softwood	M cu. ft.	10,690	10,690	721	721	9,969	9,969
Hardwood	M cu. ft.	5,930	5,930	2,320	2,320	3,610	3,610
Total	M cu. ft.	16,620	16,620	3,041	3,041	13,579	13,579
<b>Total industrial products:</b>							
Softwood		—	461,479	—	385,371	—	76,108
Hardwood		—	223,513	—	105,308	—	18,205
Total		—	684,992	—	590,679	—	94,313
<b>Fuelwood:<sup>5</sup></b>							
Softwood	Std. cords	148,058	11,356	119,570	9,171	28,488	2,185
Hardwood	Std. cords	284,607	21,744	262,500	20,055	22,107	1,689
Total	Std. cords	432,665	33,100	382,070	29,226	50,595	3,874
<b>All products:<sup>6</sup></b>							
Softwood		—	472,835	—	394,542	—	78,293
Hardwood		—	245,257	—	225,363	—	19,894
Total		—	718,092	—	619,905	—	98,187

<sup>1</sup> International ¼-inch rule.

<sup>2</sup> Roundwood figures include 193,821 cords of roundwood chipped at other primary wood-using plants.

<sup>3</sup> Rough-wood basis (includes chips converted to equivalent standard cords).

<sup>4</sup> Includes particleboard, handle stock, and various specialty products.

<sup>5</sup> Excludes approximately 18,099 thousand cubic feet of plant byproducts used for industrial fuel.

<sup>6</sup> Excludes approximately 6,393 thousand cubic feet of plant byproducts used for litter and mulch.

**Table 24. — Output of roundwood products, by product, by source, and by softwood and hardwood, North Carolina, 1973**

Product and species group	All sources	Growing stock trees <sup>1</sup>			Cull trees <sup>1</sup>	Salvable dead trees <sup>1</sup>	Other sources <sup>2</sup>
		Total	Sawtimber	Poletimber			
----- <i>Thousand cubic feet</i> -----							
Saw logs:							
Softwood	178,126	172,465	166,951	5,514	1,760	—	3,901
Hardwood	89,940	85,694	81,032	4,662	3,680	—	566
Total	268,066	258,159	247,983	10,176	5,440	—	4,467
Veneer logs and bolts:							
Softwood	49,799	47,082	47,082	—	—	—	2,717
Hardwood	17,629	16,681	16,515	166	820	—	128
Total	67,428	63,763	63,597	166	820	—	2,845
Pulpwood:							
Softwood	155,547	143,251	94,395	48,856	3,549	786	7,961
Hardwood	95,248	83,062	38,480	44,582	10,465	—	1,721
Total	250,795	226,313	132,875	93,438	14,014	786	9,682
Cooperage logs and bolts:							
Softwood	—	—	—	—	—	—	—
Hardwood	157	157	157	—	—	—	—
Total	157	157	157	—	—	—	—
Poles and piling:							
Softwood	1,033	1,033	1,033	—	—	—	—
Hardwood	—	—	—	—	—	—	—
Total	1,033	1,033	1,033	—	—	—	—
Posts (round and split):							
Softwood	145	46	—	46	—	—	99
Hardwood	14	13	9	4	—	—	1
Total	159	59	9	50	—	—	100
Other:							
Softwood	721	635	97	538	—	—	86
Hardwood	2,320	2,152	1,264	888	164	—	4
Total	3,041	2,787	1,361	1,426	164	—	90
Total industrial products:							
Softwood	385,371	364,512	308,558	54,954	5,309	786	14,764
Hardwood	205,308	187,759	137,457	50,302	15,129	—	2,420
Total	590,679	552,271	447,015	105,256	20,438	786	17,184
Fuelwood:							
Softwood	9,171	4,772	2,402	2,370	181	1,571	2,647
Hardwood	20,055	16,836	8,724	8,112	1,320	—	1,899
Total	29,226	21,608	11,126	10,482	1,501	1,571	4,546
All products:							
Softwood	394,542	369,284	311,960	57,324	5,490	2,357	17,411
Hardwood	225,363	204,595	146,181	58,114	16,449	—	4,319
Total	619,905	573,879	458,141	115,738	21,939	2,357	21,730

<sup>1</sup> On commercial forest land.

<sup>2</sup> Includes trees less than 5.0 inches in diameter, tree tops and limbs from commercial forest areas, or material from noncommercial forest land or nonforest land such as fence rows or suburban areas.

**Table 25. — Annual timber removals from growing stock on commercial forest land, by items, and by softwood and hardwood, North Carolina, 1973**

Item	All species	Softwood	Hardwood
<i>Thousand cubic feet</i>			
Roundwood products:			
Saw logs	258,159	172,465	85,694
Veneer logs and bolts	63,763	47,082	16,681
Pulpwood	226,313	143,251	83,062
Cooperage logs and bolts	157	—	157
Poles and piling	1,033	1,033	—
Posts	59	46	13
Other	2,787	635	2,152
Fuelwood	21,608	4,772	16,836
All products	573,879	369,284	204,595
Logging residues	68,115	23,985	44,130
Other removals	108,560	43,449	65,111
Total removals	750,554	436,718	313,836

**Table 26. — Annual timber removals from live sawtimber on commercial forest land, by items, and by softwood and hardwood, North Carolina, 1973**

Item	All species	Softwood	Hardwood
<i>Thousand board feet</i>			
Roundwood products:			
Saw logs	1,456,546	906,476	550,070
Veneer logs and bolts	375,169	261,146	114,023
Pulpwood	499,998	372,276	127,722
Cooperage logs and bolts	1,125	—	1,125
Poles and piling	5,004	5,004	—
Posts	50	—	50
Other	8,861	553	8,308
Fuelwood	38,430	9,473	28,957
All products	2,385,183	1,554,928	830,255
Logging residues	84,784	23,984	60,800
Other removals	260,411	106,521	153,890
Total removals	2,730,378	1,685,433	1,044,945

**Table 27. — Volume of unused residues at primary manufacturing plants, by industry and type of residue, and by softwood and hardwood, North Carolina, 1973**

Species group and type of residues	All industries	Lumber	Veneer and plywood	Other
<i>Thousand cubic feet</i>				
Softwoods:				
Coarse <sup>1</sup>	3,514	3,428	70	16
Fine <sup>2</sup>	14,849	14,771	78	—
Total	18,363	18,199	148	16
Hardwoods:				
Coarse <sup>1</sup>	3,088	2,345	732	11
Fine <sup>2</sup>	8,776	8,276	496	4
Total	11,864	10,621	1,228	15
All species:				
Coarse <sup>1</sup>	6,602	5,773	802	27
Fine <sup>2</sup>	23,625	23,047	574	4
Total	30,227	28,820	1,376	31

<sup>1</sup> Material such as slabs, edgings, and veneer cores.

<sup>2</sup> Material such as sawdust and shavings.

**Table 28. — Projection of net annual growth, available cut, and inventory of sawtimber and growing stock on commercial forest land, by softwood and hardwood, North Carolina, 1973 to 2003<sup>1</sup>**

Species group	1973	Projected to:		
		1983	1993	2003
<i>GROWING STOCK (In thousand cubic feet)</i>				
Softwood:				
Cut	436,718	484,400	517,400	535,500
Growth	535,566	548,900	549,100	535,500
Inventory <sup>2</sup>	10,383,814	10,961,400	11,190,900	11,091,700
Hardwood:				
Cut	313,836	460,500	579,400	665,900
Growth	588,874	640,100	667,400	665,900
Inventory <sup>2</sup>	14,423,807	16,328,100	17,262,800	17,283,100
Total:				
Cut	750,554	944,900	1,096,800	1,201,400
Growth	1,124,440	1,189,000	1,216,500	1,201,400
Inventory <sup>2</sup>	24,807,621	27,289,500	28,453,700	28,374,800
<i>SAWTIMBER (In thousand board feet)</i>				
Softwood:				
Cut	1,685,433	1,907,200	2,094,600	2,287,400
Growth	2,040,677	2,276,400	2,315,200	2,287,400
Inventory <sup>2</sup>	33,683,959	37,295,800	39,360,200	39,913,100
Hardwood:				
Cut	1,044,945	1,553,500	1,989,100	2,334,300
Growth	1,928,139	2,180,400	2,325,700	2,334,300
Inventory <sup>2</sup>	39,186,054	45,763,800	49,452,400	50,054,700
Total:				
Cut	2,730,378	3,460,700	4,083,700	4,621,700
Growth	3,968,816	4,456,800	4,640,900	4,621,700
Inventory <sup>2</sup>	72,870,013	83,059,600	88,812,600	89,967,800

<sup>1</sup> Assumptions:

1. Area of commercial forest land will decline at the rate of 40,000 acres each year.
2. Forestry progress will continue at the rate indicated by recent trends.
3. Cut starting at the 1973 level will gradually increase and come into balance with growth by year 2003.

<sup>2</sup> Inventory as of January 1 of the following year.

**Table 29. — Basal area per acre of growing stock and rough and rotten trees 5.0 inches d.b.h. and larger, by forest type and Survey Unit, North Carolina, 1974**

Forest type	State	Southern Coastal Plain	Northern Coastal Plain	Piedmont	Mountain
----- Square feet -----					
White pine-hemlock:					
Growing stock	80.4	—	—	37.5	82.9
Rough and rotten trees	9.0	—	—	—	9.5
All trees	89.4	—	—	37.5	92.4
Spruce-fir:					
Growing stock	48.8	—	—	—	48.8
Rough and rotten trees	13.2	—	—	—	13.2
All trees	62.0	—	—	—	62.0
Longleaf-slash pine:					
Growing stock	38.5	36.9	55.5	—	—
Rough and rotten trees	1.6	1.5	1.9	—	—
All trees	40.1	38.4	57.4	—	—
Loblolly-shortleaf pine:					
Growing stock	54.7	42.8	58.0	66.7	68.3
Rough and rotten trees	4.0	4.1	3.9	3.5	6.4
All trees	58.7	46.9	61.9	70.2	74.7
Oak-pine:					
Growing stock	53.0	49.1	50.8	58.2	61.6
Rough and rotten trees	7.9	9.0	7.2	7.0	9.2
All trees	60.9	58.1	58.0	65.2	70.8
Oak-hickory:					
Growing stock	54.2	37.6	54.0	55.3	63.2
Rough and rotten trees	12.4	11.4	10.8	11.0	15.9
All trees	66.6	49.0	64.8	66.3	79.1
Oak-gum-cypress:					
Growing stock	70.0	62.7	76.7	61.5	—
Rough and rotten trees	25.0	24.0	26.7	15.9	—
All trees	95.0	86.7	103.4	77.4	—
Elm-ash-cottonwood:					
Growing stock	59.2	57.6	64.1	57.9	28.1
Rough and rotten trees	22.2	30.2	20.6	19.0	—
All trees	81.4	87.8	84.7	76.9	28.1
Maple-beech-birch:					
Growing stock	77.2	—	—	—	77.2
Rough and rotten trees	23.0	—	—	—	23.0
All trees	100.2	—	—	—	100.2
All types:					
Growing stock	56.4	46.4	61.1	59.9	64.8
Rough and rotten trees	10.7	10.0	11.7	8.3	14.7
All trees	67.1	56.4	72.8	68.2	79.5

**Table 30. — Number of growing-stock and rough and rotten trees 1.0-4.9 inches d.b.h. per acre, by forest type and Survey Unit, North Carolina, 1974**

Forest type	State	Southern Coastal Plain	Northern Coastal Plain	Piedmont	Mountain
----- Number of trees -----					
White pine-hemlock:					
Growing stock	378	—	—	1,599	306
Rough and rotten trees	194	—	—	200	194
All trees	572	—	—	1,799	500
Spruce-fir:					
Growing stock	901	—	—	—	901
Rough and rotten trees	100	—	—	—	100
All trees	1,001	—	—	—	1,001
Longleaf-slash pine:					
Growing stock	188	186	214	—	—
Rough and rotten trees	208	221	64	—	—
All trees	396	407	278	—	—
Loblolly-shortleaf pine:					
Growing stock	408	325	403	540	391
Rough and rotten trees	338	329	394	267	400
All trees	746	654	797	807	791
Oak-pine:					
Growing stock	343	238	415	391	294
Rough and rotten trees	516	567	549	436	439
All trees	859	805	964	827	733
Oak-hickory:					
Growing stock	215	173	247	233	198
Rough and rotten trees	431	532	448	443	343
All trees	646	705	695	676	541
Oak-gum-cypress:					
Growing stock	223	199	247	173	—
Rough and rotten trees	556	573	568	303	—
All trees	779	772	815	476	—
Elm-ash-cottonwood:					
Growing stock	131	104	110	162	—
Rough and rotten trees	371	386	403	338	600
All trees	502	490	513	500	600
Maple-beech-birch:					
Growing stock	172	—	—	—	172
Rough and rotten trees	163	—	—	—	163
All trees	335	—	—	—	335
All types:					
Growing stock	298	248	329	358	226
Rough and rotten trees	417	431	468	372	341
All trees	715	679	797	730	567

**Table 31. — Area of commercial forest land, by stand volume (board feet) and ownership classes, by physiographic classes, North Carolina, 1974**

Ownership class and stand volume per acre <sup>1</sup> (Bd. ft.)	All classes	Physiographic class								
		Deep swamps	Broad stream margins	Narrow stream margins	Mountain tops and slopes	Flatwoods and dry pocosins	Bays and wet pocosins	Rolling uplands	Sandhills	Other misc. classes
----- Acres -----										
<b>National Forest:</b>										
Less than 1,500	220,773	—	—	—	127,330	9,901	67,827	9,323	—	6,392
1,500 to 5,000	396,379	—	—	—	345,875	10,244	11,777	28,483	—	—
More than 5,000	394,282	—	—	1,889	329,284	36,632	5,778	20,699	—	—
All classes	1,011,434	—	—	1,889	802,489	56,777	85,382	58,505	—	6,392
<b>Other public:</b>										
Less than 1,500	387,376	1,391	6,113	5,922	58,099	116,248	96,850	55,512	42,414	4,827
1,500 to 5,000	247,178	1,863	5,788	24,320	27,181	61,276	37,057	45,153	44,340	200
More than 5,000	99,462	—	—	25,328	19,509	17,840	5,180	24,477	—	7,128
All classes	734,016	3,254	11,901	55,570	104,789	195,364	139,087	125,142	86,754	12,155
<b>Forest industry:</b>										
Less than 1,500	1,265,690	32,154	11,670	27,709	44,085	733,418	241,757	157,467	17,430	—
1,500 to 5,000	478,474	53,028	23,470	23,230	52,861	169,533	96,372	59,980	—	—
More than 5,000	390,629	57,900	46,477	33,080	31,083	179,267	5,963	36,859	—	—
All classes	2,134,793	143,082	81,617	84,019	128,029	1,082,218	344,092	254,306	17,430	—
<b>Farmer and misc. private:</b>										
Less than 1,500	5,562,406	60,600	82,391	241,061	469,576	1,344,789	451,838	2,745,734	142,563	23,854
1,500 to 5,000	5,498,971	60,960	124,762	462,554	1,116,266	1,138,358	237,814	2,270,166	52,141	35,950
More than 5,000	4,603,215	182,359	169,399	626,297	795,017	1,191,331	75,474	1,506,862	16,426	40,050
All classes	15,664,592	303,919	376,552	1,329,912	2,380,859	3,674,478	765,126	6,522,762	211,130	99,854
<b>All ownerships:</b>										
Less than 1,500	7,436,245	94,145	100,174	274,692	699,090	2,204,356	858,272	2,968,036	202,407	35,073
1,500 to 5,000	6,621,002	115,851	154,020	510,104	1,542,183	1,379,411	383,020	2,403,782	96,481	36,150
More than 5,000	5,487,588	240,259	215,876	686,594	1,174,893	1,425,070	92,395	1,588,897	16,426	47,178
All classes	19,544,835	450,255	470,070	1,471,390	3,416,166	5,008,837	1,333,687	6,960,715	315,314	118,401

<sup>1</sup> International 1/4-inch rule.

**Table 32. — Area of commercial forest land, by stand volume (cubic feet) and ownership classes, by physiographic classes, North Carolina, 1974**

Ownership class and stand volume per acre <sup>1</sup> (Cu. ft.)	All classes	Physiographic class								
		Deep swamps	Broad stream margins	Narrow stream margins	Mountain tops and slopes	Flatwoods and dry pocosins	Bays and wet pocosins	Rolling uplands	Sandhills	Other misc. classes
----- Acres -----										
<b>National Forest:</b>										
Less than 500	184,523	—	—	—	105,445	5,723	57,640	9,323	—	6,392
500 to 1,000	115,525	—	—	—	101,707	8,012	2,233	3,573	—	—
More than 1,000	711,386	—	—	1,889	595,337	43,042	25,509	45,609	—	—
All classes	1,011,434	—	—	1,889	802,489	56,777	85,382	58,505	—	6,392
<b>Other public:</b>										
Less than 500	329,401	1,391	325	4,826	35,148	103,340	78,684	56,029	44,831	4,827
500 to 1,000	163,897	—	5,788	12,937	22,575	32,335	34,521	30,544	25,197	—
More than 1,000	240,718	1,863	5,788	37,807	47,066	59,689	25,882	38,569	16,726	7,328
All classes	734,016	3,254	11,901	55,570	104,789	195,364	139,087	125,142	86,754	12,155
<b>Forest industry:</b>										
Less than 500	1,073,349	23,719	5,714	21,480	35,192	640,140	199,952	129,722	17,430	—
500 to 1,000	267,856	11,070	2,288	12,908	8,056	113,904	84,348	35,282	—	—
More than 1,000	793,588	108,293	73,615	49,631	84,781	328,174	59,792	89,302	—	—
All classes	2,134,793	143,082	81,617	84,019	128,029	1,082,218	344,092	254,306	17,430	—
<b>Farmer and misc. private:</b>										
Less than 500	3,487,368	48,680	57,290	146,755	244,177	1,001,494	366,657	1,472,800	140,414	9,101
500 to 1,000	3,216,909	15,801	54,321	193,178	444,416	805,438	182,938	1,457,898	50,442	12,477
More than 1,000	8,960,315	239,438	264,941	989,979	1,692,266	1,867,546	215,531	3,592,064	20,274	78,276
All classes	15,664,592	303,919	376,552	1,329,912	2,380,859	3,674,478	765,126	6,522,762	211,130	99,854
<b>All ownerships:</b>										
Less than 500	5,074,641	73,790	63,329	173,061	419,962	1,750,697	702,933	1,667,874	202,675	20,320
500 to 1,000	3,764,187	26,871	62,397	219,023	576,754	959,689	304,040	1,527,297	75,639	12,477
More than 1,000	10,706,007	349,594	344,344	1,079,306	2,419,450	2,298,451	326,714	3,765,544	37,000	85,604
All classes	19,544,835	450,255	470,070	1,471,390	3,416,166	5,008,837	1,333,687	6,960,715	315,314	118,401

<sup>1</sup> Growing-stock volume.

**Table 33. — Average net volume and growth per acre on commercial forest land, by physiographic class, tree class, and species group, North Carolina, 1974**

Physiographic class and tree class	Net volume per acre						Net growth per acre					
	Softwood		Hardwood		Total		Softwood		Hardwood		Total	
	<i>Cubic feet</i>	<i>Board feet</i>	<i>Cubic feet</i>	<i>Board feet</i>	<i>Cubic feet</i>	<i>Board feet</i>	<i>Cubic feet</i>	<i>Board feet</i>	<i>Cubic feet</i>	<i>Board feet</i>	<i>Cubic feet</i>	<i>Board feet</i>
<b>Deep swamps:</b>												
Growing stock	473.7	1,934	1,772.9	5,372	2,246.6	7,306	12.7	75	43.2	155	55.9	230
Rough and rotten trees	19.2	—	448.4	—	467.6	—	0.4	—	7.2	—	7.6	—
Total	492.9	1,934	2,221.3	5,372	2,714.2	7,306	13.1	75	50.4	155	63.5	230
<b>Broad stream margins:</b>												
Growing stock	188.8	821	1,503.5	4,489	1,692.3	5,310	6.9	33	47.6	166	54.5	199
Rough and rotten trees	8.3	—	297.9	—	306.2	—	0.2	—	7.1	—	7.3	—
Total	197.1	821	1,801.4	4,489	1,998.5	5,310	7.1	33	54.7	166	61.8	199
<b>Narrow stream margins:</b>												
Growing stock	286.2	1,180	1,390.4	4,341	1,676.6	5,521	10.8	56	50.6	196	61.4	252
Rough and rotten trees	8.1	—	293.4	—	301.5	—	0.2	—	6.6	—	6.8	—
Total	294.3	1,180	1,683.8	4,341	1,978.1	5,521	11.0	56	57.2	196	68.2	252
<b>Mountain tops and slopes:</b>												
Growing stock	256.6	881	1,216.9	3,411	1,473.5	4,292	12.0	47	44.1	148	56.1	195
Rough and rotten trees	6.8	—	221.0	—	227.8	—	0.2	—	4.3	—	4.5	—
Total	263.4	881	1,437.9	3,411	1,701.3	4,292	12.2	47	48.4	148	60.6	195
<b>Flatwoods and dry pocosins:</b>												
Growing stock	731.8	2,743	380.4	907	1,112.2	3,650	37.1	155	17.2	48	54.3	203
Rough and rotten trees	7.1	—	75.8	—	82.9	—	0.4	—	2.1	—	2.5	—
Total	738.9	2,743	456.2	907	1,195.1	3,650	37.5	155	19.3	48	56.8	203
<b>Bays and wet pocosins:</b>												
Growing stock	537.9	1,389	157.7	305	695.6	1,694	21.7	75	6.7	14	28.4	89
Rough and rotten trees	37.8	—	53.1	—	90.9	—	1.1	—	1.3	—	2.4	—
Total	575.7	1,389	210.8	305	786.5	1,694	22.8	75	8.0	14	30.8	89
<b>Rolling uplands:</b>												
Growing stock	608.3	1,640	638.6	1,614	1,246.9	3,254	35.6	121	31.8	102	67.4	223
Rough and rotten trees	7.6	—	89.9	—	97.5	—	0.4	—	2.9	—	3.3	—
Total	615.9	1,640	728.5	1,614	1,344.4	3,254	36.0	121	34.7	102	70.7	223
<b>Sandhills:</b>												
Growing stock	371.4	1,408	7.7	4	379.1	1,412	18.7	81	0.8	—	19.5	81
Rough and rotten trees	5.3	—	55.7	—	61.0	—	0.3	—	1.7	—	2.0	—
Total	376.7	1,408	63.4	4	440.1	1,412	19.0	81	2.5	—	21.5	81
<b>Other misc. classes:</b>												
Growing stock	508.2	2,028	976.6	2,695	1,484.8	4,723	21.8	85	35.5	139	57.3	224
Rough and rotten trees	10.4	—	162.8	—	173.2	—	0.6	—	3.6	—	4.2	—
Total	518.6	2,028	1,139.4	2,695	1,658.0	4,723	22.4	85	39.1	139	61.5	224
<b>All classes:</b>												
Growing stock	531.3	1,723	738.0	2,005	1,269.3	3,728	27.4	104	30.1	99	57.5	203
Rough and rotten trees	9.7	—	135.6	—	145.3	—	0.4	—	3.3	—	3.7	—
Total	541.0	1,723	873.6	2,005	1,414.6	3,728	27.8	104	33.4	99	61.2	203

**Table 34. — Land area, by class, major forest type, and survey completion date, North Carolina, 1955, 1964, and 1974**

Land use class	Survey completion date			Change 1964-1974
	1955	1964 <sup>1</sup>	1974	
----- Acres -----				
Forest land:				
Commercial forest land:				
Pine and oak-pine types	10,021,900	10,671,457	9,388,453	-1,283,004
Hardwood types	9,319,500	9,304,463	10,156,382	+ 851,919
Total	19,341,400	19,975,920	19,544,835	- 431,085
Noncommercial forest land:				
Productive-reserved	340,500	372,002	433,792	+ 61,790
Unproductive	393,800	48,767	46,230	- 2,537
Total	734,300	420,769	480,022	+ 59,253
Nonforest land:				
Cropland	8,288,000	7,072,817	6,402,053	- 670,764
Pasture and range	1,471,100	1,723,634	1,808,363	+ 84,729
Other	1,433,100	1,941,220	2,819,840	+ 878,620
Total	11,192,200	10,737,671	11,030,256	+ 292,585
All land <sup>2</sup>	31,267,900	31,134,360	31,055,113	- 79,247

<sup>1</sup> These figures differ slightly from reported figures because of revisions in the estimates of land area.

<sup>2</sup> Excludes all water areas.

**Table 35. — Volume of sawtimber, growing stock, and all live timber on commercial forest land, by species group, diameter class, and survey completion date, North Carolina, 1955, 1964, and 1974**

Species group	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
<i>SAWTIMBER (In thousand board feet, International 1/4-inch rule)</i>											
Softwood	1955	26,622,734	—	—	5,690,595	6,375,986	5,020,081	3,621,056	2,388,628	1,378,808	2,147,580
	1964	29,124,671	—	—	6,047,009	6,746,960	5,743,238	4,205,777	2,836,959	1,457,430	2,087,298
	1974	33,683,959	—	—	6,978,850	7,341,538	6,624,630	5,027,600	3,291,822	1,880,168	2,539,351
Hardwood	1955	30,433,841	—	—	—	5,486,384	6,150,621	5,123,194	4,288,589	3,100,721	6,284,332
	1964	31,941,629	—	—	—	6,148,735	6,534,549	5,740,162	4,562,202	3,012,272	5,943,709
	1974	39,186,054	—	—	—	7,576,254	8,163,891	7,083,630	5,551,938	3,631,747	7,178,594
<i>GROWING STOCK (In thousand cubic feet)</i>											
Softwood	1955	8,502,327	1,100,368	1,616,211	1,638,148	1,476,503	1,020,213	670,155	415,096	230,214	335,419
	1964	9,039,787	1,130,028	1,594,628	1,743,877	1,563,333	1,168,008	778,148	492,389	243,193	326,183
	1974	10,383,814	1,257,049	1,844,789	2,012,574	1,703,515	1,349,981	931,878	572,362	314,527	397,039
Hardwood	1955	11,033,385	961,547	1,438,029	1,707,977	1,618,730	1,532,613	1,147,643	887,540	610,385	1,128,921
	1964	11,848,741	1,162,342	1,555,785	1,791,308	1,814,761	1,629,007	1,286,811	944,301	593,531	1,070,895
	1974	14,423,807	1,367,806	1,843,598	2,180,004	2,235,442	2,036,709	1,590,444	1,152,246	717,041	1,300,517
<i>ALL LIVE TIMBER (In thousand cubic feet)</i>											
Softwood	1955	8,658,190	1,139,360	1,654,405	1,667,076	1,490,810	1,026,942	675,286	416,898	235,195	352,218
	1964	9,207,277	1,172,162	1,634,315	1,776,132	1,578,868	1,175,832	784,127	494,400	248,398	343,043
	1974	10,573,676	1,302,863	1,888,767	2,049,097	1,720,364	1,359,678	939,304	574,832	322,246	416,525
Hardwood	1955	13,086,916	1,383,664	1,821,826	2,003,085	1,832,959	1,689,577	1,260,954	989,705	685,521	1,419,625
	1964	14,071,033	1,673,620	1,977,464	2,101,625	2,054,439	1,795,998	1,413,231	1,050,812	667,014	1,336,830
	1974	17,074,072	1,972,617	2,339,142	2,553,031	2,525,881	2,243,809	1,741,525	1,282,270	804,261	1,611,536

<sup>1</sup> To provide a basis for valid comparisons, adjustments have been made to allow for differences in volume tables and sawtimber specifications used in previous surveys.

**Table 36. — Volume of all live timber, by species group and Survey Unit, North Carolina, 1955, 1964, and 1974**

Species group and Survey Unit	1955	1964	Change 1955-1964	1974	Change 1964-1974
	<i>Thousand cu. ft.</i>	<i>Thousand cu. ft.</i>	<i>Percent</i>	<i>Thousand cu. ft.</i>	<i>Percent</i>
<b>Softwood:</b>					
Southern Coastal Plain	2,336,979	2,708,603	+15.9	3,055,308	+12.8
Northern Coastal Plain	2,594,699	2,878,228	+10.9	2,798,504	- 2.8
Piedmont	2,815,237	2,645,713	- 6.0	3,417,266	+29.2
Mountain	911,275	974,733	+ 7.0	1,302,598	+33.6
All units	8,658,190	9,207,277	+ 6.3	10,573,676	+14.8
<b>Hardwood:</b>					
Southern Coastal Plain	2,554,945	2,649,991	+ 3.7	2,958,037	+11.6
Northern Coastal Plain	3,232,568	3,460,829	+ 7.1	3,708,131	+ 7.1
Piedmont	3,655,947	3,899,538	+ 6.7	5,108,971	+31.0
Mountain	3,643,456	4,060,675	+11.5	5,298,933	+30.5
All units	13,086,916	14,071,033	+ 7.5	17,074,072	+21.3

Knight, Herbert A., and Joe P. McClure

1975. North Carolina's timber, 1974. USDA For. Serv. Resour. Bull. SE-33, 52 p. Southeast. For. Exp. Stn., Asheville, N. C.

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