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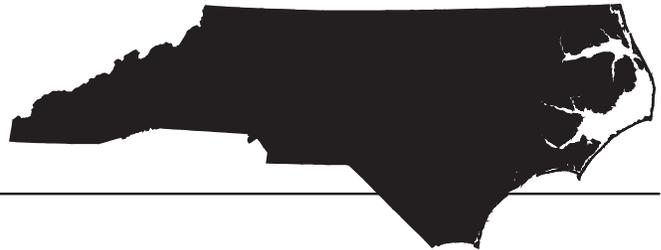


Southern  
Research Station

Resource Bulletin  
SRS-109

# North Carolina Harvest and Utilization Study, 2002

James W. Bentley and  
Tony G. Johnson

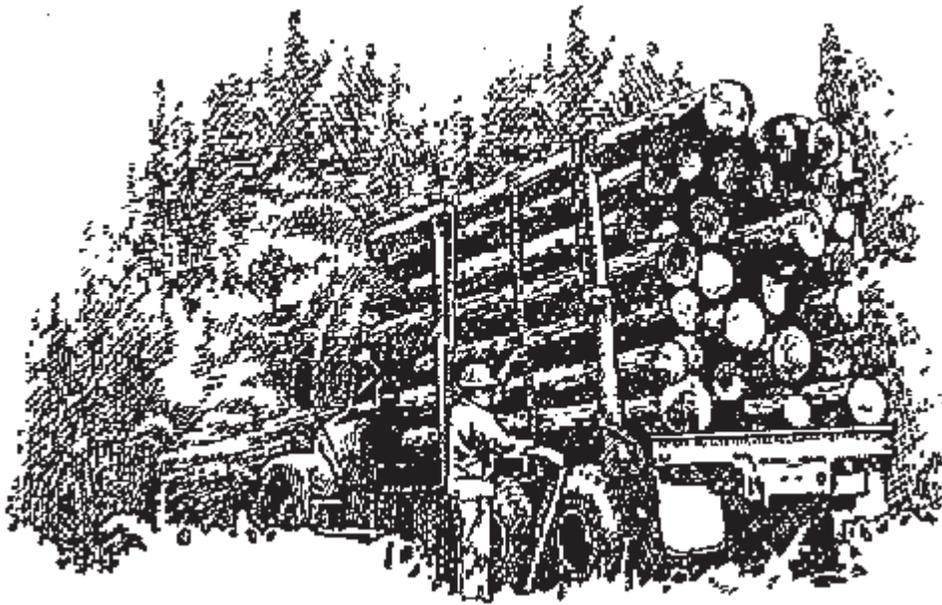


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## Foreword

This resource bulletin describes the principal findings of a harvest and utilization study conducted during the seventh inventory of North Carolina's forest resources. Survey crews sampled and measured trees harvested in a variety of logging operations, and analysts calculated wood volume and percent of wood utilization. Harvest volume data and factors for growing-stock and nongrowing-stock logging residue are described and interpreted.

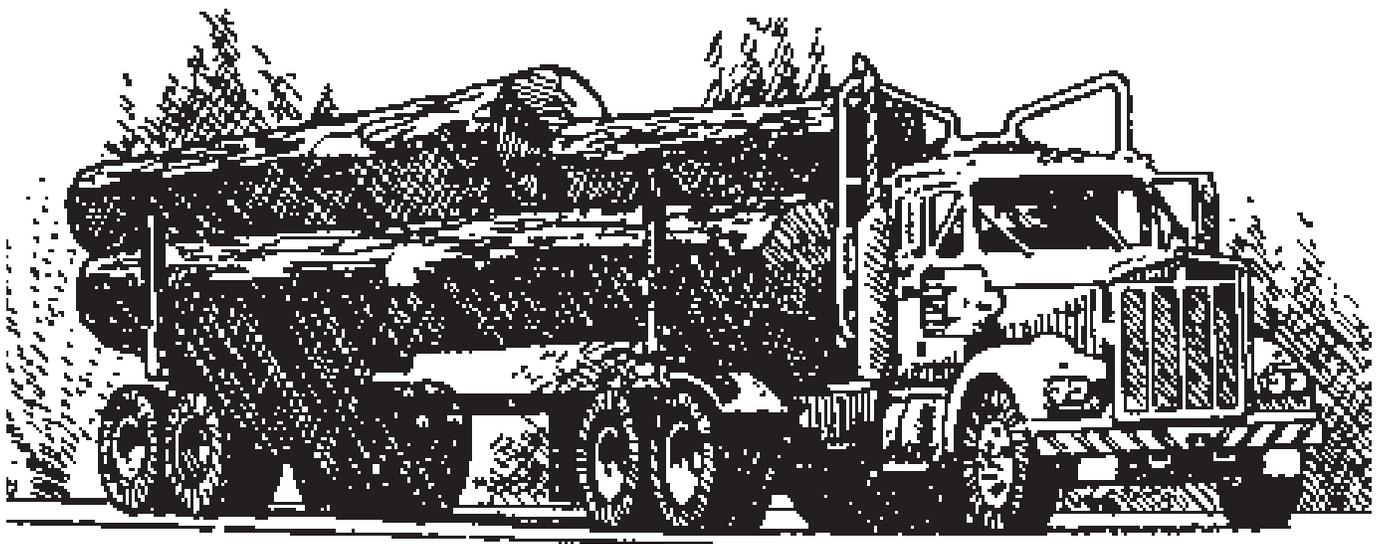
Annual surveys of America's forest resources are mandated by the Forest and Rangeland Act of 1978. Surveys and utilization studies are part of a continuing, nationwide undertaking by regional experiment stations of the U.S. Department of Agriculture Forest Service. Inventories and utilization studies of the 13 Southern States (Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, and Virginia) and the Commonwealth of Puerto Rico are conducted by the Southern Research Station, Forest Inventory and Analysis (FIA) Research Work Unit. Unit headquarters is in Knoxville, TN; and FIA has operational offices in Asheville, NC, and Starkville, MS. The primary objective of these appraisals is

to develop and maintain resource information needed to formulate sound forest policies and programs. More information about Forest Service resource inventories is available in "The Enhanced Forest Inventory and Analysis Program—National Sampling Design and Estimation Procedures" (Bechtold and Patterson 2005).

Tabular data included in FIA resource bulletins present a comprehensive array of forest resource statistics, but additional information is available to those who require more specific information. Access to data for the Southern States can be found at [www.ncrs.fs.fed.us/tools-data/mapping-tools](http://www.ncrs.fs.fed.us/tools-data/mapping-tools).

## Acknowledgments

The authors thank Michael Mann for his review and comments; Carolyn Steppleton for keypunching and processing preliminary data; Anne Jenkins, Janet Griffin, and Sharon Johnson for the map, tables, graphs, and statistical checking; and Louise Wilde for editorial review, styling, and publication of this report.





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<sup>a</sup> All tables in this report are available in Microsoft® Excel workbook files. Upon request, these files will be supplied in the format the customer requests.

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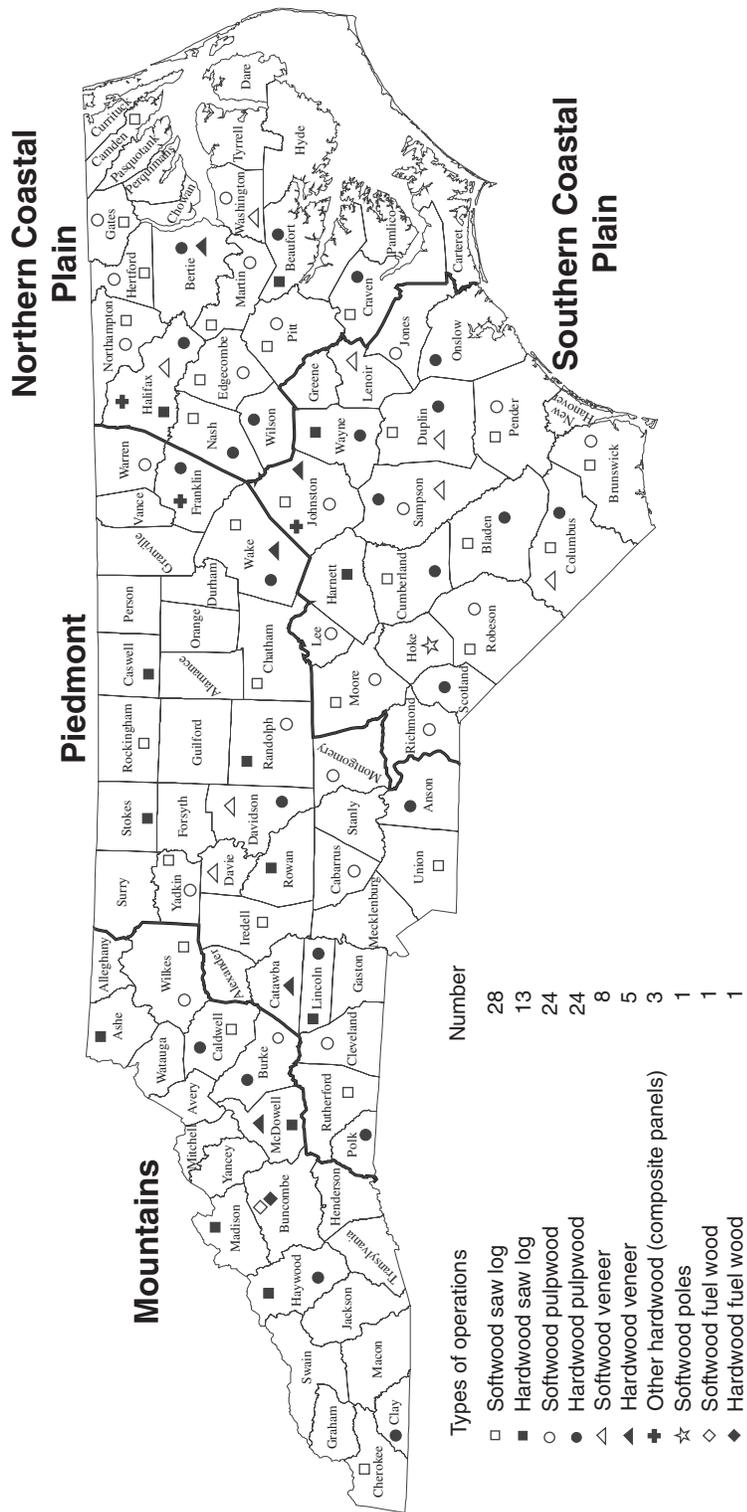


Figure 1—Harvest operations, North Carolina, 2002.

# North Carolina Harvest and Utilization Study, 2002

James W. Bentley and Tony G. Johnson

## Introduction

Forest planners and managers have a continuing need for information about the timber resource, and the general public is expressing increasing interest in the effects of logging. Therefore, up-to-date data on the Nation's forests—and how they are changing—are essential to well-informed decision-making. Information about the condition of and changes in the timber resource of North Carolina comes from three primary sources: (1) inventory plots, which describe current conditions and quantify changes due to mortality, growth, removals, and land use; (2) mill surveys, which quantify timber volume harvested and delivered to primary wood products facilities, i.e., sawmills, pulpmills, veneer mills, composite panel mills, and pole mills; and (3) logging utilization studies, which characterize harvest operations and quantify the timber volume that is cut and utilized, and that portion that is left in the forest during the harvesting of timber.

This bulletin presents the findings of a 2002 harvest and utilization study in North Carolina. The study's main goal was to provide an estimate of softwood and hardwood volume used, and of volume left in the woods as logging residue. Survey crews randomly selected and measured felled trees on 108 active harvest operations throughout North Carolina (fig. 1). This bulletin also provides information on logging in North Carolina and some general characteristics of trees harvested for various products, examples of which are average diameter at breast height (d.b.h.) by product, average bole length by product, average heights of residual stumps, and average diameter outside bark (d.o.b.) at the end of utilization.

Some standard FIA terms are used in this study. Two that are particularly important for understanding and interpreting study results are growing stock and nongrowing stock. A growing-stock tree is a live tree of commercial species that either contains or is capable of producing at least one 12-foot or two 8-foot logs in the saw-log portion. A nongrowing-stock tree is one that does not meet the requirements of growing stock due to poor form or rot. For growing-stock trees, the growing-stock portion of a tree (5 inches d.b.h. or larger) includes the volume of sound wood between a 1-foot stump and a 4-inch top, d.o.b. Volume in the 1-foot stump, volume

in the main stem from 4 inches to the growing top of the tree, and the volume of any limbs 4 inches or larger with at least one 5-foot section are considered nongrowing-stock volume by FIA standards. Rough or rotten trees were also sampled and make up another piece of nongrowing stock (cull). Figure 2 illustrates a poletimber and a sawtimber tree and the growing-stock section of each.

## Methods

### Site Stratification and Selection

Producing a complete list of timber-harvesting operations and ownerships in a State such as North Carolina is problematic. Because the industry is so complex, it is impossible to list the names and locations of all during the timeframe considered in this resource bulletin. Many uncontrolled factors affect how, when, and where harvesting operations will take place; but the most common events that affect harvesting operations are weather and timber markets. A random sample would have to provide a reasonably accurate estimate of utilization.

The sites selected for study were stratified by species group and product using the most recent data available from the publication "North Carolina's Timber Industry—An Assessment of Timber Product Output and Use, 1999" (Johnson 2002), which provides county-level output of timber products harvested in North Carolina by species group. Using those proportions, we designated 62 of the 108 selected sites as softwood operations, and the remaining 46 as hardwood operations. Harvest operations by product were based along these same general guidelines, although some flexibility was given to field crews for substitution due to the difficulty of locating harvesting operations for some specific products. Table 1 shows the final breakdown number of harvest operations and trees by species group and product.

After the harvest operations were stratified by major species group and product, the operations were placed in the appropriate region and county in the State. Using county-level

Sawtimber tree

Softwood = at least 9.0 inches d.b.h.

Hardwood = at least 11.0 inches d.b.h.

Poletimber tree

Softwood = 5.0 – 8.9 inches d.b.h.

Hardwood = 5.0 – 10.9 inches d.b.h.

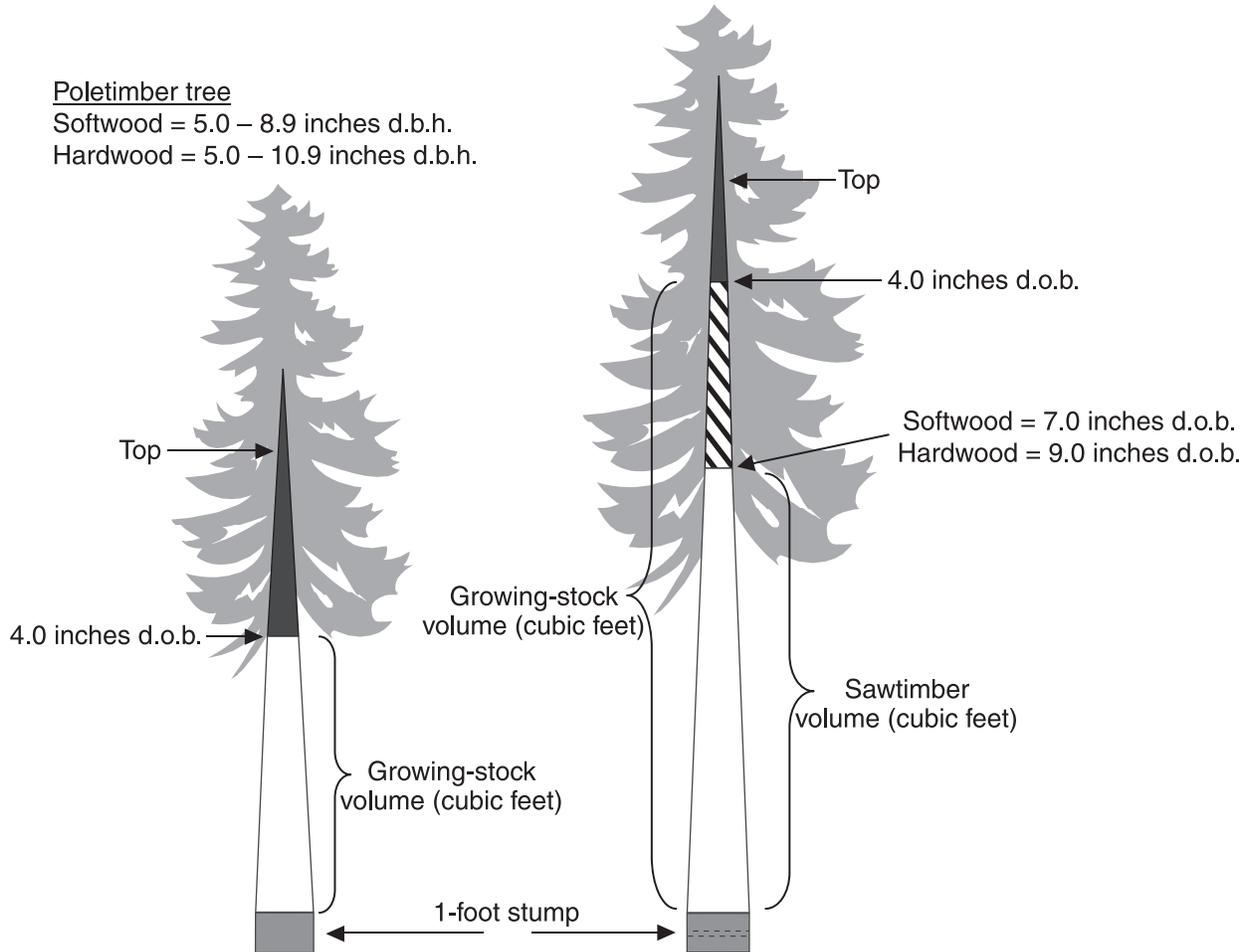


Figure 2—Stem sections of poletimber and sawtimber trees.

product output data from “North Carolina’s Timber Industry—An Assessment of Timber Product Output and Use, 1999” (Johnson 2002) and a map that showed current mill locations, prospective utilization sites were selected based on a high probability of being able to locate a harvesting operation for the particular product and species group assigned. Figure 1 shows where the final harvest operations considered in this bulletin were located.

**Data Collection**

During the seventh survey, field crews were trained to collect data on felled trees at harvest locations. Using the list of operations and a map of sites, they began collecting data by county for the particular species group and designated

product(s). Data were collected from January 1998 to December 2002 on active harvest operations. Field crews visited local mills and talked to county personnel to locate active harvest sites.

At each harvest operation site, crew members talked to the logger or the person in charge of operations. Those contacts provided vital information about product(s) utilized, specific diameters, and log lengths the receiving mill(s) would accept, along with minimum diameters at the cutoff points for specific products. Crews also noted the type of logging equipment that was being used. This information was used to determine the level of mechanization for each harvesting operation.

**Table 1—Number of operations and trees by product and species group, North Carolina, 2002**

Product and species group	Operations	Trees
	<i>number</i>	
Saw logs		
Softwood	28	879
Hardwood	13	356
Total	41	1,235
Veneer logs		
Softwood	8	188
Hardwood	5	119
Total	13	307
Pulpwood		
Softwood	24	583
Hardwood	24	656
Total	48	1,239
Poles		
Softwood	1	25
Hardwood	0	0
Total	1	25
Fuel wood		
Softwood	1	18
Hardwood	1	18
Total	2	36
Other		
Softwood	0	0
Hardwood	3	84
Total	3	84
All products		
Softwood	62	1,693
Hardwood	46	1,233
Total	108	2,926

On each harvest operation site, crew members' goal is to measure 25 to 30 trees for each product to ensure an adequate representation of overutilization and underutilization for a given type of harvest operation. Trees were randomly selected and had to be at least 5 inches d.b.h. and alive prior to harvest. Although they often had been bucked, limbed, and topped, the main bole of each tree selected for measurement had to be intact to be measured for utilization. The State, unit, county, and location number were recorded for each site. Each tree was assigned a number and identified by species, d.b.h., tree class, product, and bole length as well as percent cull if rot was detected. Each tree was measured from the top of the cut stump to the end of utilization. Measurements were made along the main stem in sections no longer than 16 feet until the end of utilization. The end of utilization usually is determined by the sawyer, according to particular specifications set by the receiving mill(s). Again, FIA merchantability standards for growing-stock volume are defined as the volume in the main stem of the tree from a 1-foot stump to a 4-inch top. However, most trees are not cut exactly at a 1-foot stump, nor are they cut off at exactly 4 inches. For example, trees that are cut off above a 1-foot stump and below 4 inches would be considered underutilized, and that volume not utilized would be considered growing-stock residue. On the other hand, by FIA standards, trees cut below a 1-foot stump and above a 4-inch top are considered 100-percent utilized, and those portions below and above are considered overutilization. A myriad of combinations actually occurs on active harvest operations. The aggregated volume from measured trees has provided overutilization and underutilization factors that can be applied to statewide inventory results for an estimate of growing-stock and nongrowing-stock logging residues. Other required measurements, besides d.b.h. and end of utilization, are the top of the sawtimber portion (7.0 inches in softwoods and 9.0 inches in hardwoods). Those measurements allow calculation of the sawtimber and poletimber portion of the growing-stock section.

## Highlights

### Characteristics of Harvested Trees in North Carolina

Results of this study have identified several key characteristics of trees harvested, which cannot be obtained from a typical field inventory or a forest industry study that supplies product output data only. Characteristics such as average d.b.h. by product, average bole length by product, average residual stump height, and average d.o.b. at the end of utilization constitute important information that can help us more fully understand the complex nature of removals. Averages discussed in this section are based on the measurement of

2,926 trees. Of those, 1,693 (58 percent) were softwood, and 1,233 (42 percent) were hardwood.

According to the publication “North Carolina’s Timber Industry—An Assessment of Timber Product Output and Use, 1999” (Johnson 2002), softwood and hardwood saw-log volume together accounted for 53 percent of the total product output for the State. This study classified 879 trees as softwood saw log averaging 13.4 inches d.b.h. It classified 356 hardwood trees as saw log averaging 15.4 inches d.b.h. Veneer and plywood constitute another important component of the product mix for North Carolina. Based on 188 trees measured for softwood veneer, the average d.b.h. was 15.9 inches. Advances in lathe technology at softwood plywood mills are resulting in a drop of the average d.b.h. of peeler logs across the South. One hundred and nineteen trees were measured for hardwood veneer, and they averaged 20.0 inches d.b.h. As expected, the d.b.h. of trees measured for pulpwood was significantly smaller. Of 583 softwood trees total, the average d.b.h. was 7.7 inches, while the 656 trees measured for hardwood pulpwood averaged 8.2 inches d.b.h. Table 2 shows the breakdown of average d.b.h. for each product by species group.

Bole length is the distance between a 1-foot stump and a 4-inch top. As expected, trees harvested for solid wood products tended to have longer average bole lengths than trees harvested for pulpwood or composite panel products. The average bole length for both softwood and hardwood trees measured for saw logs was 65 feet. In comparison, trees measured for pulpwood had average bole lengths of 37 and 36 feet, respectively. Softwood veneer trees had an average bole length of 72 feet, while hardwood veneer trees had an average bole length of 75 feet. Table 3 shows the average bole length by species group.

Planted sites constituted a subset of the total number of trees measured. Trees measured in planted stands tended to have shorter bole lengths than those measured in the natural stands. Table 4 shows the average bole length for each product by species group and stand origin.

Residual stump height is a key component in determining utilization rates for harvested trees. By FIA standards, the stump is that portion of the tree measured at ground level from the uphill side of the tree to 1 foot up the bole. Loggers try to maximize volume harvested by cutting the tree as close to the ground as possible. Residual stump heights across the

**Table 2—Average diameter at breast height by species group and product, North Carolina, 2002**

Species group	Product					
	Saw logs	Veneer logs	Pulpwood	Poles	Fuel wood	Other
	<i>inches</i>					
Softwood	13.44	15.88	7.66	12.87	13.60	—
Hardwood	15.39	20.03	8.19	—	13.60	10.16

— = no sample for the cell.

**Table 3—Average bole length by species group and product, North Carolina, 2002**

Species group	Product					
	Saw logs	Veneer logs	Pulpwood	Poles	Fuel wood	Other
	<i>feet</i>					
Softwood	65.29	72.00	37.45	61.40	52.06	—
Hardwood	65.23	75.00	35.70	—	52.06	46.90

— = no sample for the cell.

products ranged from 0.26 to 0.83 feet; however, most softwood trees harvested had an average residual stump height of about a one-half foot, while hardwood trees harvested averaged slightly higher residual stumps. In softwoods and across all products, this accounted for about 37 percent of the stump volume being used. In hardwoods and across all products, about 20 percent of stump volume was used. Stump volume for both hardwood and softwood contributed to utilization of the nongrowing-stock portion of trees, i.e., overutilization. Table 5 shows the average residual stump heights for each product by species group.

The final component we used to determine use rates was d.o.b. at the end of utilization. Tops and limbs constitute most of the nongrowing-stock volume, although they accounted for only 31 percent of the nongrowing-stock portion that was utilized. The average end of utilization for softwood saw logs was 5.5 inches, and for hardwood saw logs 8.2 inches. For

veneer logs it was 5.9 and 11.4 inches for softwood and hardwood, respectively. Pulpwood and composite panel products averaged 3.6 and 5.3 inches for softwoods and hardwoods, respectively. Table 6 shows the average end of utilization by the different products and species group.

### Softwood Removals

Results from this study document 54,124 cubic feet of softwood volume, of which 46,451 cubic feet, or 86 percent, was used for product(s). Fourteen percent, or 7,673 cubic feet, was left onsite as logging residue (fig. 3). Thirty percent of the residue volume came from the growing-stock portion of the tree, while 70 percent came from the nongrowing-stock portion (stumps, tops, and limbs) (fig. 4) (table A.1).

The total softwood growing-stock volume measured was 47,769 cubic feet. Of that total, 95.2 percent was utilized, and

**Table 4—Average bole length by species group, stand origin, and product, North Carolina, 2002**

Species group and stand origin	Product					
	Saw logs	Veneer logs	Pulp- wood	Poles	Fuel wood	Other
<i>feet</i>						
Softwood						
Natural	66.17	73.00	38.30	61.40	52.06	—
Planted	54.09	50.00	32.19	—	—	—
Hardwood						
Natural	65.23	75.00	35.70	—	52.06	46.90
Planted	—	—	—	—	—	—

— = no sample for the cell.

**Table 5—Average residual stump height by species group and product, North Carolina, 2002**

Species group	Product					
	Saw logs	Veneer logs	Pulp- wood	Poles	Fuel wood	Other
<i>feet</i>						
Softwood	0.56	0.63	0.47	0.26	0.57	—
Hardwood	0.78	0.83	0.58	—	0.65	0.64

— = no sample for the cell.

4.8 percent was logging residue (fig. 5). By FIA merchantability standards, the logging residue portion of growing-stock trees is underutilized volume. Of the total utilized volume, 964 cubic feet, or 2.1 percent, was from the nongrowing-stock portion of trees. By the same merchantability standards, that volume is considered overutilization (tables A.2 and A.3).

Softwood volumes and percentages are broken down further by poletimber and sawtimber, and by the various products measured (tables A.2 through A.7). By product, trees harvested for pulpwood had above average rates of utilization for the merchantable portion of the tree (96 percent) and the highest rates of overutilization (6.9 percent). This means that more of the nongrowing-stock portion of the tree was being used for product(s) and less was left as logging residue.

Softwood percentages and volumes presented in these tables represent just trees measured in this study of 108 active harvest operations. However, it is possible to apply the percentages to inventory data from North Carolina's seventh survey (Brown 2004) to get an estimate of total softwood logging residues for the State. Annual softwood removals from all live trees was 728.6 million cubic feet. Softwood growing-stock removals were 726.2 million cubic feet, or 99.7 percent of the total. Applying the factors from this study to total softwood removals for all live trees tallied in the State survey provides an estimate of 115.8 million cubic feet total annual softwood residue. Of the total residue for all live trees, 34.7 million cubic feet, or 30 percent, was considered growing-stock residue. The remaining 70 percent, or 81.1 million cubic feet, was nongrowing-stock residue from stumps, tops and limbs, and cull trees not used.

### Hardwood Removals

Results from this study document 40,339 cubic feet of hardwood volume, of which 30,272 cubic feet, or 75 percent, was utilized for product(s). Twenty-five percent, or 10,067 cubic

feet, was left onsite as logging residue (fig. 6). Forty percent of residue volume came from the growing-stock portion of trees, and 60 percent came from the nongrowing-stock portion (stumps, tops, and limbs) (fig. 7) (table 1).

The total hardwood growing-stock volume measured was 33,675 cubic feet. Of that total, 88 percent was used, and 12 percent was logging residue (fig. 8). By FIA merchantability standards, the logging residue portion is underutilized volume. Of the total utilized volume, 610 cubic feet, or 2.0 percent, was from the nongrowing-stock portion of trees. By the same merchantability standards, that volume is considered overutilization (tables A.8 and A.9).

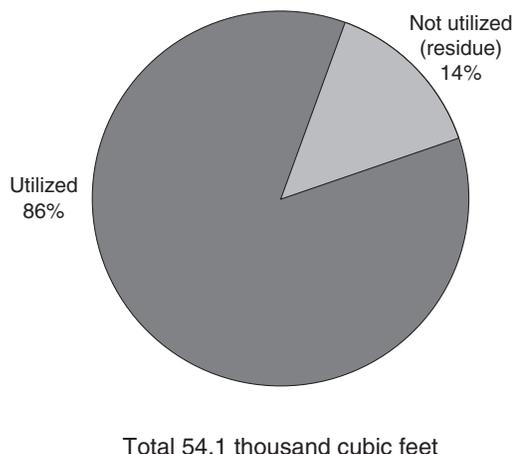


Figure 3—Disposition of total softwood harvest volume, 2002.

**Table 6—Average end of utilization by species group and product, North Carolina, 2002**

Species group	Product					
	Saw logs	Veneer logs	Pulpwood	Poles	Fuel wood	Other
Softwood	5.50	5.89	3.57	4.15	0.33	—
Hardwood	8.24	11.40	5.25	—	0.19	8.87

— = no sample for the cell.

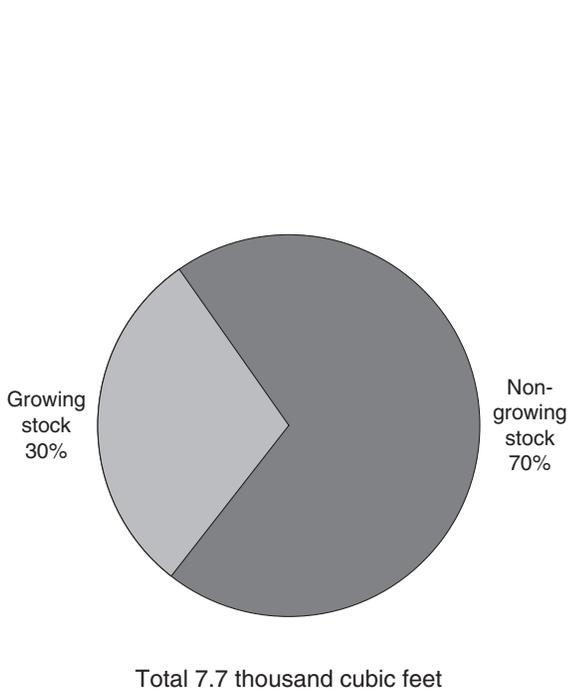


Figure 4—Softwood residue by volume type, 2002.

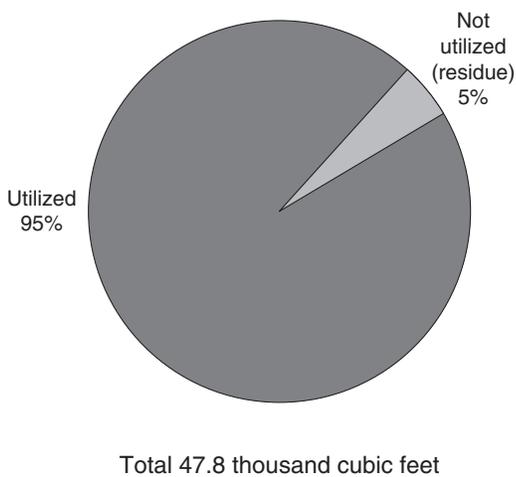
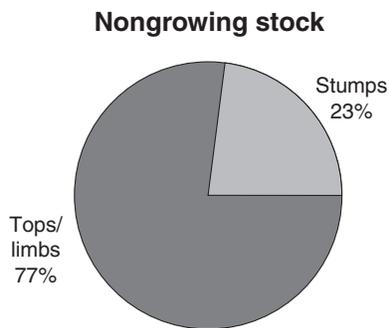
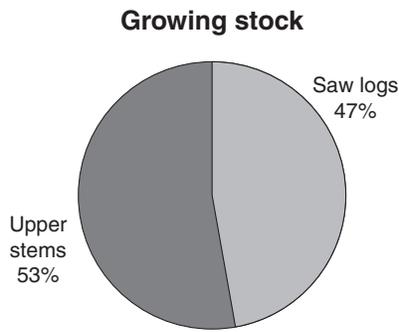
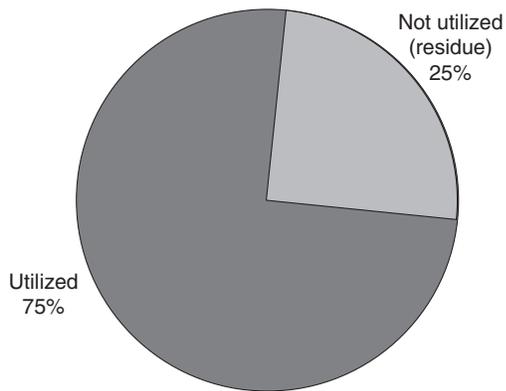


Figure 5—Disposition of softwood growing-stock volume, 2002.

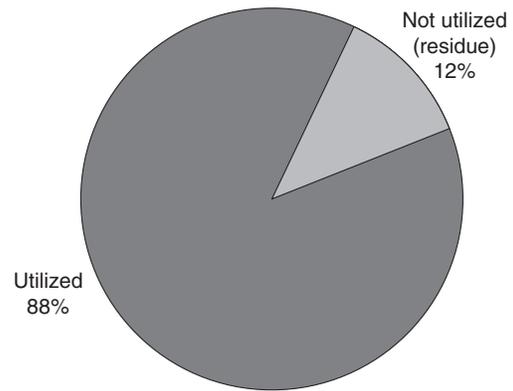
Hardwood volumes and percentages also were measured for poletimber and sawtimber, and differentiated by the various products they provided (tables A.8 through A.13). At 92 percent, however, those trees measured for pulpwood were more fully utilized. Also, more of the nongrowing-stock portion was used for pulpwood. Trees measured for hardwood saw logs and veneer were the least utilized of all, although they have the most nongrowing-stock material.

Hardwood percentages and volumes presented in the tables represent just trees measured in this study of 108 active harvest operations. However, it is possible to apply the percentages to inventory data from North Carolina's seventh survey (Brown 2004) to provide an estimate of total hardwood logging residues for the State. Annual hardwood removals from all live trees totaled 498.4 million cubic feet. Hardwood growing-stock removals totaled 465.2 million cubic feet, or 93 percent of that total. Applying factors from this study to total hardwood removals from all live trees tallied in the State survey provides an estimate of 131.86 million cubic feet total annual hardwood residue. Of that total, 55.45 million cubic feet, or 42 percent, was considered growing-stock residue. The remaining 58 percent, or 76.41 million cubic feet, was nongrowing-stock residue from stumps, tops and limbs, and rough or rotten trees that were not used.



Total 40.3 thousand cubic feet

Figure 6—Disposition of total hardwood harvest volume, 2002.



Total 33.7 thousand cubic feet

Figure 8—Disposition of hardwood growing-stock volume, 2002.

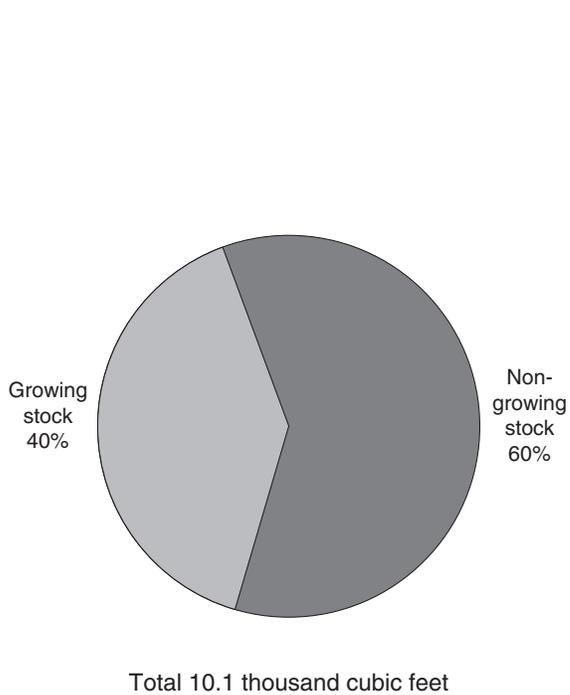
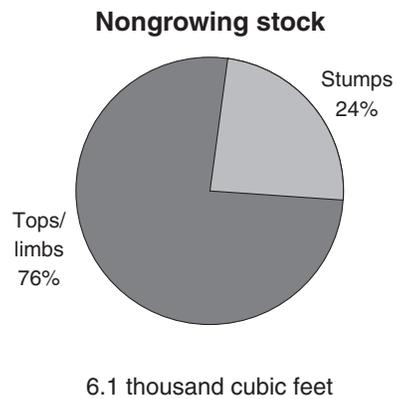
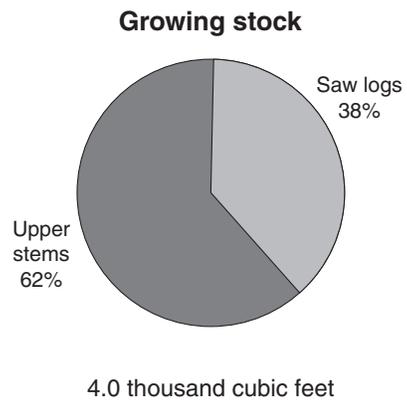


Figure 7—Hardwood residue by volume type, 2002.



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## Glossary

**Board foot.** Unit of measure applied to roundwood. It relates to lumber that is 1-foot long, 1-foot wide, and 1-inch thick (or its equivalent).

**Composite products.** Roundwood products manufactured into chips, wafers, strands, flakes, shavings, or sawdust and then reconstituted into a variety of panel and engineered lumber products.

**Drain.** The volume of roundwood removed from any geographic area where timber is grown.

**Fuel wood.** Roundwood harvested to produce some form of energy, e.g., heat, steam, in residential, industrial, or institutional settings.

**Growing-stock removals.** The growing-stock volume removed from poletimber and sawtimber trees in the timberland inventory. (Note: Includes volume removed for roundwood products, logging residues, and other removals.)

**Growing-stock trees.** Living trees of commercial species classified as sawtimber, poletimber, saplings, and seedlings. Growing-stock trees must contain at least one 12-foot or two 8-foot logs in the saw-log portion, currently or potentially (if too small to qualify). The log(s) must meet dimension and merchantability standards and have, currently or potentially, one-third of the gross board-foot volume in sound wood.

**Growing-stock volume.** The cubic-foot volume of sound wood in growing-stock trees at least 5.0 inches d.b.h. from a 1-foot stump to a minimum 4.0-inch top d.o.b. of the central stem.

**Hardwoods.** Dicotyledonous trees, usually broadleaf and deciduous.

*Soft hardwoods.* Hardwood species with an average specific gravity of 0.50 or less, such as gums, yellow-poplar, cottonwoods, red maple, basswoods, and willows.

*Hard hardwoods.* Hardwood species with an average specific gravity > 0.50, such as oaks, hard maples, hickories, and beech.

**Industrial roundwood products.** Any primary use of the main stem of a tree, such as saw logs, pulpwood, and veneer logs, intended to be processed into primary wood products, such as lumber, wood pulp, and sheathing, at primary wood-using mills.

**International 1/4-inch rule.** A log rule or formula for estimating the board-foot volume of logs, allowing 1/2-inch of taper for each 4-foot length. The rule appears in a number of forms that allow for kerf. In the form used by FIA, a 1/4-inch of kerf is assumed. This rule is used as the USDA Forest Service standard log rule in the Eastern United States.

**Log.** A primary forest product harvested in long, primarily 8-, 12-, and 16-foot lengths.

**Logging residues.** The unused portion(s) of live trees cut or destroyed during logging operations.

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

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

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

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

**Nongrowing-stock sources.** The net volume removed from the nongrowing-stock portions of poletimber and sawtimber trees (stumps, tops, limbs, cull sections of central stem) and from any portion of a rough, rotten, sapling, dead, or nonforest tree.

**Other forestland.** Forestland other than timberland and productive reserved forestland. It includes available and reserved forestland that is incapable of producing annually 20 cubic feet per acre of industrial wood under natural conditions because of adverse site conditions such as sterile soils, dry climate, poor drainage, high elevation, steepness, or rockiness.

**Other products.** A miscellaneous category of roundwood products, e.g., cooperage, excelsior, shingles, and mill residue byproducts (charcoal, bedding, mulch, etc.).

**Other removals.** The growing-stock volume of trees removed from the inventory by cultural operations such as timber stand

improvement, land clearing, and other changes in land use, resulting in the removal of the trees from timberland.

**Other sources.** (See: Nongrowing-stock sources.)

**Posts, poles, and pilings.** Roundwood products milled (cut or peeled) into standard sizes (lengths and circumferences) to be put in the ground to provide vertical and lateral support in buildings, foundations, utility lines, and fences. May also include nonindustrial (unmilled) products.

**Poletimber-size trees.** Softwoods 5.0 to 8.9 inches d.b.h. and hardwoods 5.0 to 10.9 inches d.b.h.

**Primary wood-using plants.** Industries that convert roundwood products (saw logs, veneer logs, pulpwood, etc.) into primary wood products, such as lumber, veneer or sheathing, and wood pulp.

**Pulpwood.** A roundwood product that will be reduced to individual wood fibers by chemical or mechanical means. The fibers are used to make a broad generic group of pulp products that includes paper products, as well as chipboard, fiberboard, insulating board, and paperboard.

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

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

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

**Roundwood chipped.** Any timber cut primarily for industrial manufacture, delivered to nonpulpmills, chipped, and then sold to pulpmills for use as fiber. Includes tops, jump sections, whole trees, and pulpwood sticks.

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

**Roundwood product drain.** That portion of total drain used for a product.

**Salvable dead trees.** Standing or downed dead trees that were formerly growing stock and considered merchantable. Trees must be at least 5.0 inches d.b.h. to qualify.

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

**Saw log.** A roundwood product, usually 8 feet in length or longer, processed into a variety of sawn products such as lumber, cants, pallets, railroad ties, and timbers.

**Saw-log portion.** The part of the bole of sawtimber trees between a 1-foot stump and the saw-log top.

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

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

**Sawtimber volume.** Growing-stock volume in the saw-log portion of sawtimber-sized trees in board feet (International ¼-inch rule).

**Seedlings.** Trees < 1.0 inch d.b.h. and > 1 foot tall for hardwoods, > 6 inches tall for softwood, and > 0.5 inch in diameter at ground level for longleaf pine.

**Softwoods.** Coniferous trees, usually evergreen, having leaves that are needles or scalelike.

**Standard cord.** A unit of measure applied to roundwood, usually bolts or split wood. It is a stack of wood 4 feet high, 4 feet wide, and 8 feet long encompassing 128 cubic feet of wood, bark, and air space. This usually translates to approximately 75.0 to 81.0 cubic feet of solid wood for pulpwood, because pulpwood is more uniform.

**Standard unit.** A unit measure applied to roundwood timber products. Board feet (International ¼-inch rule) is the standard unit used for saw logs and veneer; cords are used for pulpwood, composite panel, and fuel wood; hundred pieces for poles; thousand pieces for posts; and thousand cubic feet for all other miscellaneous forest products.

**Timberland.** Forestland capable of producing 20 cubic feet of industrial wood per acre per year and not withdrawn from timber utilization.

**Timber products.** Roundwood products and byproducts.

**Timber product output.** The total volume of roundwood products from all sources plus the volume of byproducts recovered from mill residues (equals roundwood product drain).

**Timber removals.** The total volume of trees removed from the timberland inventory by harvesting, cultural operations such as stand improvement, land clearing, or changes in land use. (Note: Includes roundwood products, logging residues, and other removals.)

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

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

**Utilization studies.** Studies conducted on active logging operations to develop factors for merchantable portions of trees left in the woods (logging residues), logging damage, and utilization of the unmerchantable portion of growing-stock trees and nongrowing-stock trees.

**Veneer log.** A roundwood product either rotary cut, sliced, stamped, or sawn into a variety of veneer products such as plywood, finished panels, veneer sheets, or sheathing.

**Weight.** A unit of measure for mill residues, expressed as oven-dry tons (2,000 oven-dry pounds).

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**Table A.1—Harvest and utilization volume by species group, source, and volume type, North Carolina, 2002**

Species group and source	Total tree volume	Growing stock					Nongrowing stock				
		Total	Saw log		Upper stem		Total	Stumps		Tops/limbs	
			Utilized	Not utilized	Utilized	Not utilized		Utilized	Not utilized	Utilized	Not utilized
<i>cubic feet</i>											
Softwood											
Sawtimber	50,486.01	44,754.25	40,899.65	1,076.97	1,634.03	1,143.60	5,731.76	614.69	1,145.34	66.26	3,905.47
Poletimber	3,637.81	3,014.62	—	—	2,952.86	61.76	623.19	101.78	93.17	181.67	246.57
Total	54,123.82	47,768.87	40,899.65	1,076.97	4,586.89	1,205.36	6,354.95	716.47	1,238.51	247.93	4,152.04
Hardwood											
Sawtimber	34,759.81	29,201.24	24,182.74	1,528.74	1,347.83	2,141.93	5,558.57	222.92	1,224.13	59.63	4,051.89
Poletimber	5,579.01	4,473.77	—	—	4,131.51	342.26	1,105.24	141.48	225.78	186.15	551.83
Total	40,338.82	33,675.01	24,182.74	1,528.74	5,479.34	2,484.19	6,663.81	364.40	1,449.91	245.78	4,603.72

Numbers in rows and columns may not sum to totals due to rounding.

— = no sample for the cell.

**Table A.2—Volume of softwood growing stock by product and utilization for sawtimber and poletimber, North Carolina, 2002**

Product	Total volume utilized	Growing stock			Nongrowing stock utilized	Saw-log portion			
		Total	Utilized	Not utilized		Total	Utilized	Cull utilized	Not utilized
<i>cubic feet</i>									
Saw logs	30,863.21	31,973.78	30,374.71	1,599.07	488.50	29,761.29	28,992.20	750.29	18.80
Veneer logs	9,616.70	9,966.08	9,495.84	470.24	120.86	9,507.38	9,314.30	187.66	5.42
Pulpwood	4,590.24	4,452.85	4,275.48	177.37	314.76	1,420.62	1,324.14	96.48	—
Poles	716.71	719.30	693.73	25.57	22.98	676.43	664.66	11.77	—
Fuel wood	664.08	656.86	646.78	10.08	17.30	610.90	604.35	6.55	—
Other	—	—	—	—	—	—	—	—	—
Total	46,450.94	47,768.87	45,486.54	2,282.33	964.40	41,976.62	40,899.65	1,052.75	24.22

Numbers in rows and columns may not sum to totals due to rounding.

— = no sample for the cell.

**Table A.3—Percent of overutilization and underutilization for softwood growing stock by product for sawtimber and poletimber, North Carolina, 2002**

Product	Overutilization		Underutilization		Saw-log portion		
	Growing stock utilized/ total volume utilized	Nongrowing stock utilized/ total volume utilized	Growing stock utilized/ total growing-stock volume	Growing stock not utilized/ total growing- stock volume	Saw log utilized/ total saw-log volume	Cull utilized/ total saw-log volume	Saw log not utilized/ total saw- log volume
	<i>percent</i>						
Saw logs	98.42	1.58	95.00	5.00	97.42	2.52	0.06
Veneer logs	98.74	1.26	95.28	4.72	97.97	1.97	0.06
Pulpwood	93.14	6.86	96.02	3.98	93.21	6.79	—
Poles	96.79	3.21	96.45	3.55	98.26	1.74	—
Fuel wood	97.39	2.61	98.47	1.53	98.93	1.07	—
Other	—	—	—	—	—	—	—
All products	97.92	2.08	95.22	4.78	97.43	2.51	0.06

— = no sample for the cell.

**Table A.4—Volume of softwood growing stock by product and utilization for sawtimber, North Carolina, 2002**

Product	Total volume utilized	Growing stock			Nongrowing stock utilized	Saw-log portion			
		Total	Utilized	Not utilized		Total	Utilized	Cull utilized	Not utilized
	<i>cubic feet</i>								
Saw logs	30,608.76	31,725.91	30,131.82	1,594.09	476.94	29,761.29	28,992.20	750.29	18.80
Veneer logs	9,606.21	9,958.26	9,488.02	470.24	118.19	9,507.38	9,314.30	187.66	5.42
Pulpwood	1,637.43	1,709.38	1,588.32	121.06	49.11	1,420.62	1,324.14	96.48	—
Poles	716.71	719.30	693.73	25.57	22.98	676.43	664.66	11.77	—
Fuel wood	645.52	641.40	631.79	9.61	13.73	610.90	604.35	6.55	—
Other	—	—	—	—	—	—	—	—	—
Total	43,214.63	44,754.25	42,533.68	2,220.57	680.95	41,976.62	40,899.65	1,052.75	24.22

Numbers in rows and columns may not sum to totals due to rounding.

— = no sample for the cell.

**Table A.5—Percent of overutilization and underutilization for softwood growing stock by product for sawtimber, North Carolina, 2002**

Product	Overutilization		Underutilization		Saw-log portion		
	Growing stock utilized/ total volume utilized	Nongrowing stock utilized/ total volume utilized	Growing stock utilized/ total growing-stock volume	Growing stock not utilized/ total growing-stock volume	Saw log utilized/ total saw-log volume	Cull utilized/ total saw-log volume	Saw log not utilized/ total saw-log volume
	<i>percent</i>						
Saw logs	98.44	1.56	94.98	5.02	97.42	2.52	0.06
Veneer logs	98.77	1.23	95.28	4.72	97.97	1.97	0.06
Pulpwood	97.00	3.00	92.92	7.08	93.21	6.79	—
Poles	96.79	3.21	96.45	3.55	98.26	1.74	—
Fuel wood	97.87	2.13	98.50	1.50	98.93	1.07	—
Other	—	—	—	—	—	—	—
All products	98.42	1.58	95.04	4.96	97.43	2.51	0.06

— = no sample for the cell.

**Table A.6—Volume of softwood growing stock by product and utilization for poletimber, North Carolina, 2002**

Product	Total volume utilized	Growing stock			Nongrowing stock utilized
		Total	Utilized	Not utilized	
	<i>cubic feet</i>				
Saw logs	254.45	247.87	242.89	4.98	11.56
Veneer logs	10.49	7.82	7.82	—	2.67
Pulpwood	2,952.81	2,743.47	2,687.16	56.31	265.65
Poles	—	—	—	—	—
Fuel wood	18.56	15.46	14.99	0.47	3.57
Other	—	—	—	—	—
Total	3,236.31	3,014.62	2,952.86	61.76	283.45

Numbers in rows and columns may not sum to totals due to rounding.

— = no sample for the cell.

**Table A.7—Percent of overutilization and underutilization for softwood growing stock by product for poletimber, North Carolina, 2002**

Product	Overutilization		Underutilization	
	Growing stock utilized/ total volume utilized	Nongrowing stock utilized/ total volume utilized	Growing stock utilized/ total growing-stock volume	Growing stock not utilized/ total growing-stock volume
	<i>percent</i>			
Saw logs	95.46	4.54	97.99	2.01
Veneer logs	74.55	25.45	100.00	—
Pulpwood	91.00	9.00	97.95	2.05
Poles	—	—	—	—
Fuel wood	80.77	19.23	96.96	3.04
Other	—	—	—	—
All products	91.24	8.76	97.95	2.05

— = no sample for the cell.

**Table A.8—Volume of hardwood growing stock by product and utilization for sawtimber and poletimber, North Carolina, 2002**

Product	Total volume utilized	Growing stock			Nongrowing stock utilized	Saw-log portion			
		Total	Utilized	Not utilized		Total	Utilized	Cull utilized	Not utilized
	<i>cubic feet</i>								
Saw logs	14,220.19	15,931.45	14,077.90	1,853.55	142.29	13,652.94	12,921.68	542.09	189.17
Veneer logs	8,897.67	10,334.58	8,837.83	1,496.75	59.84	9,359.88	8,724.48	447.62	187.78
Pulpwood	5,106.30	5,235.38	4,799.06	436.32	307.24	1,274.03	1,206.81	63.06	4.16
Poles	—	—	—	—	—	—	—	—	—
Fuel wood	681.74	684.81	663.18	21.63	18.56	558.39	548.18	10.21	—
Other	1,366.37	1,488.79	1,284.11	204.68	82.26	866.24	781.59	84.65	—
Total	30,272.27	33,675.01	29,662.08	4,012.93	610.19	25,711.48	24,182.74	1,147.63	381.11

Numbers in rows and columns may not sum to totals due to rounding.

— = no sample for the cell.

**Table A.9—Percent of overutilization and underutilization for hardwood growing stock by product for sawtimber and poletimber, North Carolina, 2002**

Product	Overutilization		Underutilization		Saw-log portion		
	Growing stock utilized/ total volume utilized	Nongrowing stock utilized/ total volume utilized	Growing stock utilized/ total growing-stock volume	Growing stock not utilized/ total growing-stock volume	Saw log utilized/ total saw-log volume	Cull utilized/ total saw-log volume	Saw log not utilized/ total saw-log volume
	<i>percent</i>						
Saw logs	99.00	1.00	88.37	11.63	94.64	3.97	1.39
Veneer logs	99.33	0.67	85.52	14.48	93.21	4.78	2.01
Pulpwood	93.98	6.02	91.67	8.33	94.72	4.95	0.33
Poles	—	—	—	—	—	—	—
Fuel wood	97.28	2.72	96.84	3.16	98.17	1.83	—
Other	93.98	6.02	86.25	13.75	90.23	9.77	—
All products	97.98	2.02	88.08	11.92	94.05	4.46	1.48

— = no sample for the cell.

**Table A.10—Volume of hardwood growing stock by product and utilization for sawtimber, North Carolina, 2002**

Product	Total volume utilized	Growing stock			Nongrowing stock utilized	Saw-log portion			
		Total	Utilized	Not utilized		Total	Utilized	Cull utilized	Not utilized
	<i>cubic feet</i>								
Saw logs	13,852.23	15,553.02	13,722.61	1,830.41	129.62	13,652.94	12,921.68	542.09	189.17
Veneer logs	8,897.67	10,334.58	8,837.83	1,496.75	59.84	9,359.88	8,724.48	447.62	187.78
Pulpwood	1,542.04	1,655.07	1,487.48	167.59	54.56	1,274.03	1,206.81	63.06	4.16
Poles	—	—	—	—	—	—	—	—	—
Fuel wood	622.87	631.42	611.21	20.21	11.66	558.39	548.18	10.21	—
Other	898.32	1,027.15	871.44	155.71	26.88	866.24	781.59	84.65	—
Total	25,813.13	29,201.24	25,530.57	3,670.67	282.56	25,711.48	24,182.74	1,147.63	381.11

Numbers in rows and columns may not sum to totals due to rounding.

— = no sample for the cell.

**Table A.11—Percent of overutilization and underutilization for hardwood growing stock by product for sawtimber, North Carolina, 2002**

Product	Overutilization		Underutilization		Saw-log portion		
	Growing stock utilized/ total volume utilized	Nongrowing stock utilized/ total volume utilized	Growing stock utilized/ total growing-stock volume	Growing stock not utilized/ total growing- stock volume <i>percent</i>	Saw log utilized/ total saw-log volume	Cull utilized/ total saw-log volume	Saw log not utilized/ total saw-log volume
Saw logs	99.06	0.94	88.23	11.77	94.64	3.97	1.39
Veneer logs	99.33	0.67	85.52	14.48	93.21	4.78	2.01
Pulpwood	96.46	3.54	89.87	10.13	94.72	4.95	0.33
Poles	—	—	—	—	—	—	—
Fuel wood	98.13	1.87	96.80	3.20	98.17	1.83	—
Other	97.01	2.99	84.84	15.16	90.23	9.77	—
All products	98.91	1.09	87.43	12.57	94.05	4.46	1.48

— = no sample for the cell.

**Table A.12—Volume of hardwood growing stock by product and utilization for poletimber, North Carolina, 2002**

Product	Total volume utilized	Growing stock			Nongrowing stock utilized
		Total	Utilized	Not utilized	
<i>cubic feet</i>					
Saw logs	367.96	378.43	355.29	23.14	12.67
Veneer logs	—	—	—	—	—
Pulpwood	3,564.26	3,580.31	3,311.58	268.73	252.68
Poles	—	—	—	—	—
Fuel wood	58.87	53.39	51.97	1.42	6.90
Other	468.05	461.64	412.67	48.97	55.38
Total	4,459.14	4,473.77	4,131.51	342.26	327.63

Numbers in rows and columns may not sum to totals due to rounding.

**Table A.13—Percent of overutilization and underutilization for hardwood growing stock by product for poletimber, North Carolina, 2002**

Product	Overutilization		Underutilization	
	Growing stock utilized/ total volume utilized	Nongrowing stock utilized/ total volume utilized	Growing stock utilized/ total growing-stock volume	Growing stock not utilized/ total growing-stock volume
	<i>percent</i>			
Saw logs	96.56	3.44	93.89	6.11
Veneer logs	—	—	—	—
Pulpwood	92.91	7.09	92.49	7.51
Poles	—	—	—	—
Fuel wood	88.28	11.72	97.34	2.66
Other	88.17	11.83	89.39	10.61
All products	92.65	7.35	92.35	7.65

— = no sample for the cell.





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**Bentley, J.W.; Johnson, T.G.** 2006. North Carolina harvest and utilization study, 2002. Resour. Bull. SRS-109. Asheville, NC: U.S. Department of Agriculture Forest Service, Southern Research Station. 23 p.

In 2002, a harvest and utilization study was conducted on 108 operations throughout North Carolina. There were 2,926 total trees measured; 1,693, or 58 percent, were softwood, while 1,233, or 42 percent, were hardwood. Results from this study showed that 86 percent of the total softwood volume measured was utilized for a product, and 14 percent was left as logging residue. Seventy-five percent of the total hardwood volume measured was utilized for a product, while 25 percent was left as logging residue.

**Keywords:** FIA, growing stock, logging residue, nongrowing stock, overutilization, product, removals, underutilization.

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