

United States  
Department of  
Agriculture

Forest Service



Southern  
Research Station

Resource Bulletin  
SRS-140

# South Carolina Harvest and Utilization Study, 2006

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Tony G. Johnson

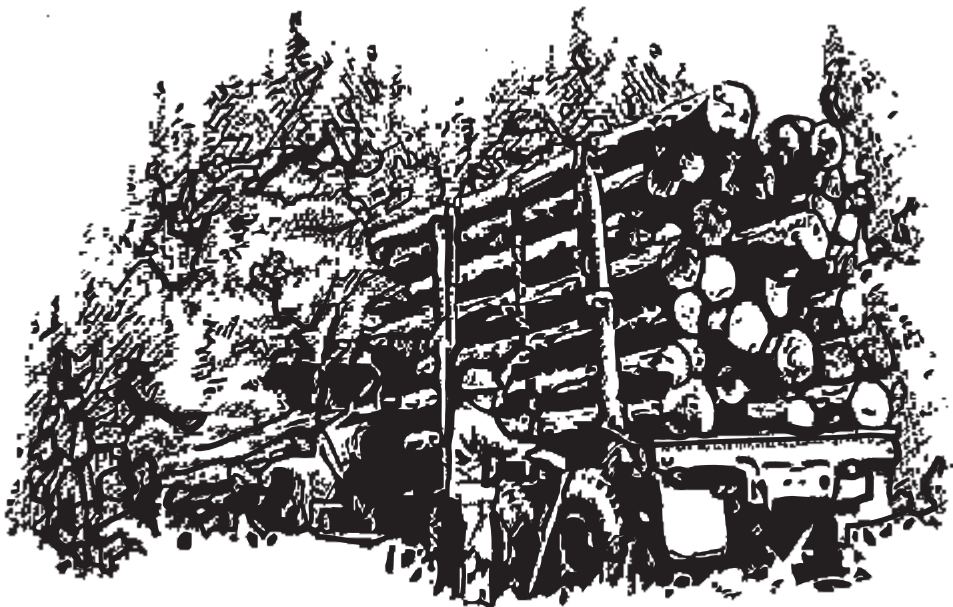


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November 2008

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## Foreword

This resource bulletin describes the principal findings of a harvest and utilization study conducted during the ninth inventory of South 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 Forest Service, U.S. Department of Agriculture. 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: <http://srsfia2.fs.fed.us/data/index.shtml>.

## Acknowledgments

The authors thank Byron Rominger and Tim Adams for their review and comments; Carolyn Steppleton for key-punching and processing preliminary data; Anne Jenkins, Janet Griffin, and Sharon Johnson for the map, tables, graphs, and statistical checking; and the Southern Research Station (SRS) Technical Publications Team 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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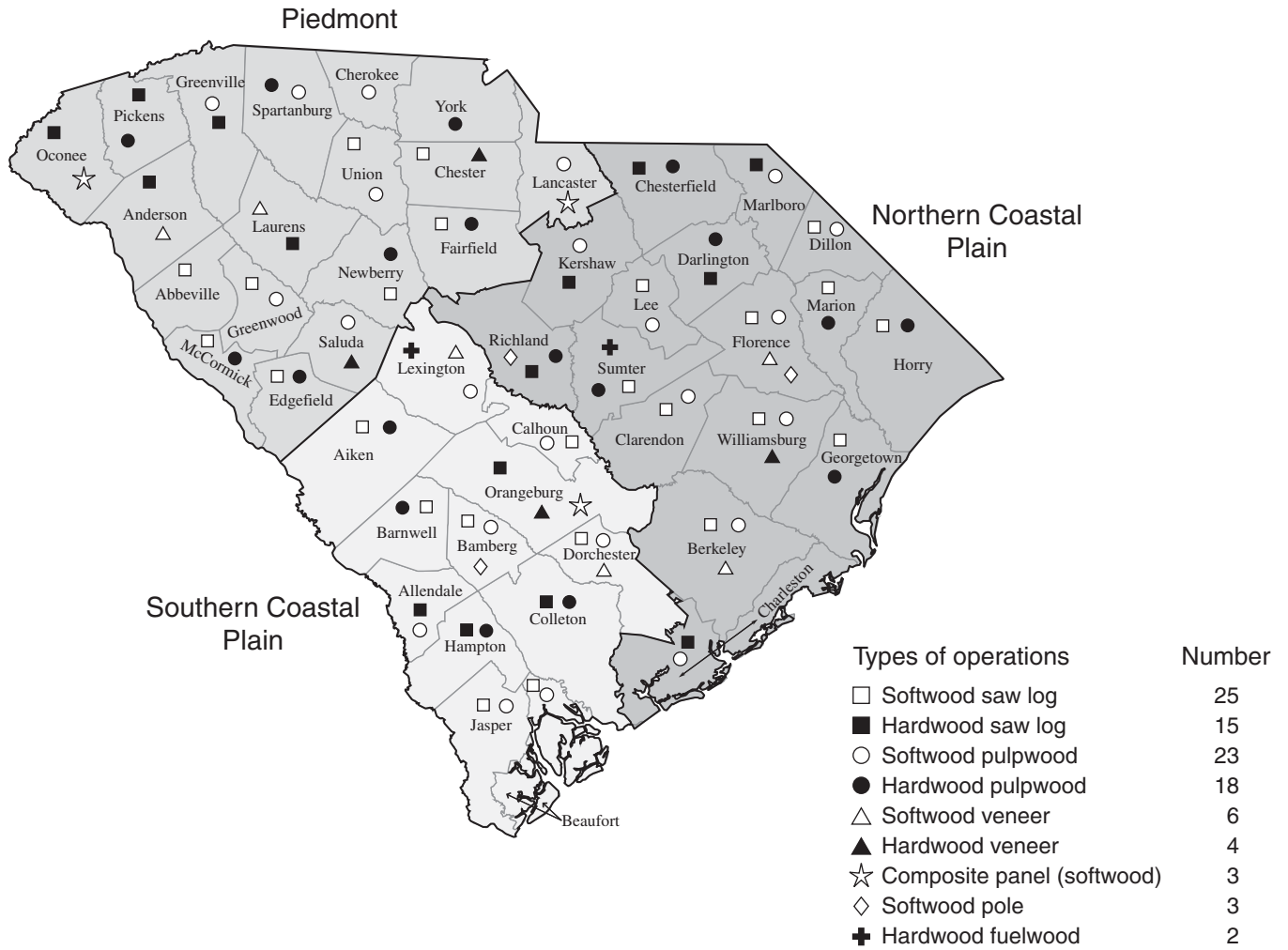


Figure 1—Harvest operations, South Carolina, 2006.

# South Carolina Harvest and Utilization Study, 2006

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 decisionmaking. Information about the condition of and changes in the timber resource of South 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.

This bulletin presents the findings of a 2006 harvest and utilization study in South 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 99 active harvest operations throughout South Carolina (fig. 1). This bulletin also provides information on logging in South 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 of the bole. 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) volume. 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 South 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 provides 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 "South Carolina's Timber Industry—An Assessment of Timber Product Output and Use, 2001" (Johnson and others 2004), which provides county-level output of timber products harvested in South Carolina by species group. Using those proportions, we designated 60 of the 99 selected sites as softwood operations, and the remaining 39 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 product and species group.

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.

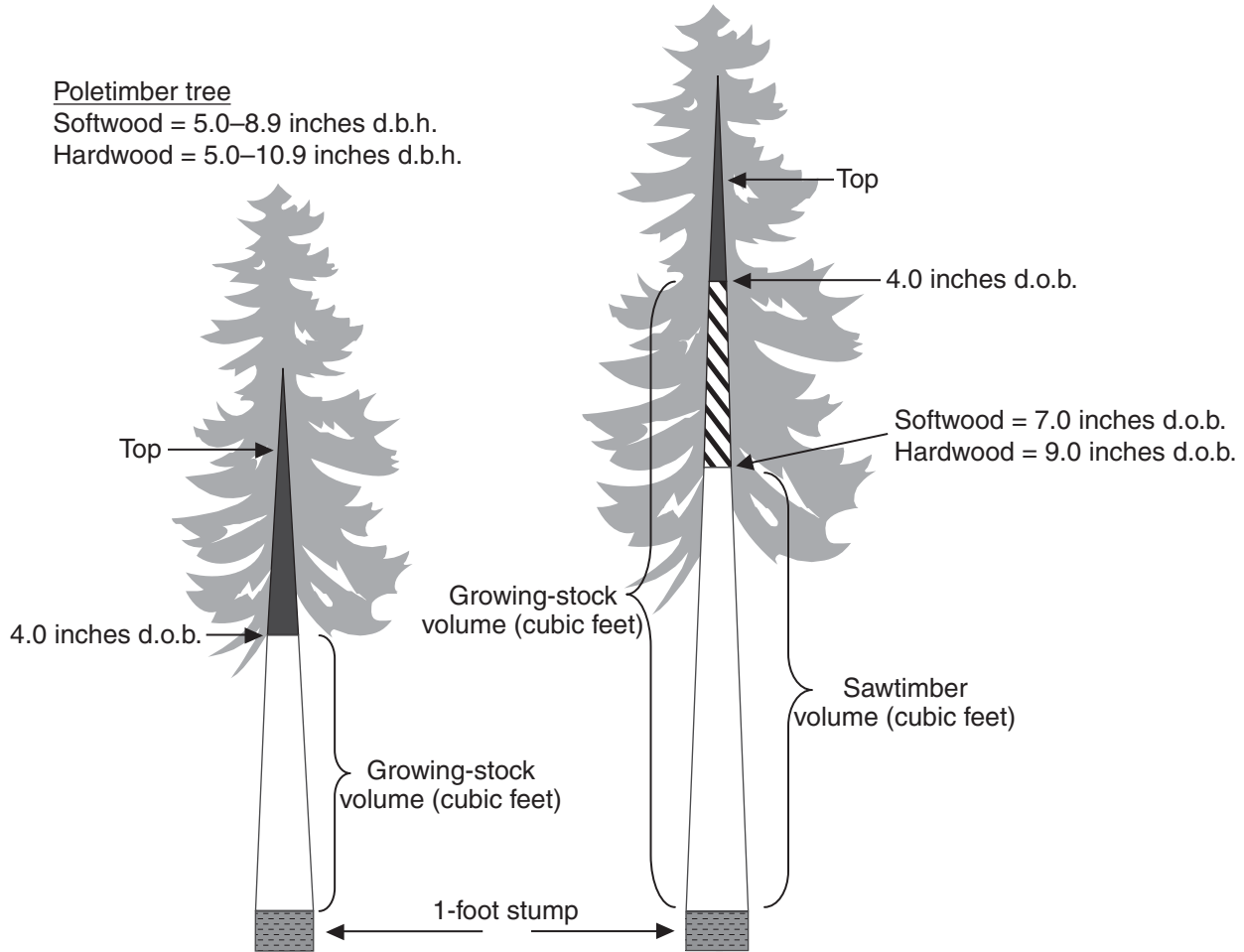


Figure 2—Stem sections of poletimber and sawtimber trees.

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 product output data from the “South Carolina’s Timber Industry—An Assessment of Timber Product Output and Use, 2001” (Johnson and others 2004) 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 ninth 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 October 2005 to December 2006 on active harvest operations. Field crews visited local mills and talked to county personnel to locate active harvest sites.



**Table 1—Number of operations and trees by product and species group, South Carolina, 2006**

Product and species group	Operations	Trees
	<i>number</i>	
Saw logs		
Softwood	25	750
Hardwood	15	410
Total	40	1,160
Veneer logs		
Softwood	6	179
Hardwood	4	77
Total	10	256
Composite panels		
Softwood	3	91
Hardwood	0	0
Total	3	91
Pulpwood		
Softwood	23	662
Hardwood	18	604
Total	41	1,266
Poles		
Softwood	3	81
Hardwood	0	0
Total	3	81
Fuelwood		
Softwood	0	0
Hardwood	2	50
Total	2	50
All products		
Softwood	60	1,763
Hardwood	39	1,141
Total	99	2,904

At each harvest operation site, the 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.

On each harvest operation site, the crew's goal was 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 South 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 2,904 trees. Of those, 1,763 (61 percent) were softwood, and 1,141 (39 percent) were hardwood.

According to the publication “South Carolina’s Timber Industry—An Assessment of Timber Product Output and Use, 2001” (Johnson and others 2004), softwood and hardwood saw-log volume together accounted for 39 percent of the total product output for the State. This study classified 750 trees as having softwood saw log(s) averaging 12.3 inches d.b.h. It classified 410 hardwood trees as having saw log(s) averaging 15.8 inches d.b.h. Veneer and plywood constitute another important component of the product mix for South Carolina. Based on 179 trees measured for softwood veneer, the average d.b.h. was 15.2 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. Seventy-seven trees were measured for hardwood veneer, and they averaged 17.8 inches d.b.h. As expected, the d.b.h. of trees measured for pulpwood was significantly smaller. Of 662 softwood trees total, the average d.b.h. was

7.0 inches, while the 604 trees measured for hardwood pulpwood averaged 7.6 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 softwood trees measured for saw logs was 57 feet, while trees measured for hardwood saw logs had an average bole length of 68 feet. In comparison, trees measured for pulpwood had average bole lengths of 30 and 32 feet, respectively. Softwood veneer trees had an average bole length of 74 feet, while hardwood veneer trees had an average bole length of 76 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 products ranged from 0.20 to 0.75 feet; however, most softwood trees harvested had an average

**Table 2—Average diameter at breast height by species group and product, South Carolina, 2006**

Species group	Product					
	Saw logs	Veneer logs	Composite panels	Pulpwood	Poles	Fuelwood
	<i>inches</i>					
Softwood	12.33	15.15	7.20	7.03	13.83	—
Hardwood	15.81	17.82	9.60	7.63	—	7.38

— = no sample for the cell.

**Table 3—Average bole length by species group and product, South Carolina, 2006**

Species group	Product					
	Saw logs	Veneer logs	Composite panels	Pulp-wood	Poles	Fuel-wood
	<i>feet</i>					
Softwood	57.09	74.00	28.13	29.97	71.51	—
Hardwood	68.02	76.00	34.00	32.36	—	29.52

— = no sample for the cell.

**Table 4—Average bole length by species group, stand origin, and product, South Carolina, 2006**

Species group and stand origin	Product					
	Saw logs	Veneer logs	Composite panels	Pulp-wood	Poles	Fuel-wood
	<i>feet</i>					
Softwood						
Natural	62.64	76.00	29.67	27.13	70.88	—
Planted	52.07	70.00	28.08	30.30	72.57	—
Hardwood						
Natural	68.02	76.00	34.00	32.74	—	29.52
Planted	—	—	—	25.13	—	—

— = no sample for the cell.

residual stump height of about a 0.40 foot, while hardwood trees harvested averaged slightly higher residual stumps. In softwoods and across all products, this accounted for about 52 percent of the stump volume being used. In hardwoods and across all products, about 25 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 47 percent of the nongrowing-stock portion that was utilized. The average end of utilization for softwood saw logs was 3.2 inches, and for hardwood saw logs 4.4 inches. For veneer logs it was 6.0 and 6.2 inches for softwood and hardwood, respectively. The average for pulpwood was 2.2 and 2.9 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 40,344 cubic feet of softwood volume, of which 35,110 cubic feet, or 87 percent, was used for product(s). Thirteen percent, or 5,234 cubic feet, was left onsite as logging residue (fig. 3). Thirty-two percent of the residue volume came from the growing-stock portion of the tree, while 68 percent came from the nongrowing-stock portion (stumps, tops, and limbs) (fig. 4) (table A.1).

The total softwood growing-stock volume measured was 31,838 cubic feet. Of that total, 95 percent was utilized, and 5 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, 1,491 cubic feet, or 4.25 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).

**Table 5—Average residual stump height by species group and product, South Carolina, 2006**

Species group	Product					
	Saw logs	Veneer logs	Composite panels	Pulpwood	Poles	Fuelwood
	<i>feet</i>					
Softwood	0.42	0.37	0.32	0.39	0.60	—
Hardwood	0.67	0.75	0.20	0.47	—	0.44

— = no sample for the cell.

**Table 6—Average end of utilization by species group and product, South Carolina, 2006**

Species group	Product					
	Saw logs	Veneer logs	Composite panels	Pulpwood	Poles	Fuelwood
	<i>inches</i>					
Softwood	3.22	5.95	1.79	2.20	3.78	—
Hardwood	4.37	6.21	3.70	2.92	—	3.91

— = no sample for the cell.

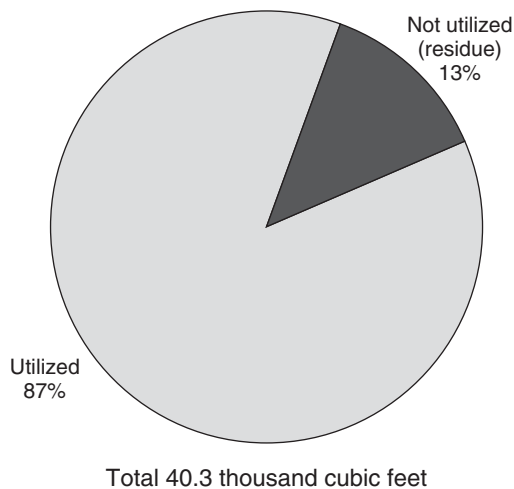


Figure 3—Disposition of total softwood harvest volume, South Carolina, 2006.

Softwood volumes and percentages are broken down further by poletimber and sawtimber, and by the various products measured (tables A.2 through A.9). By product, trees harvested for pulpwood and composite panels had above-average rates of utilization for the merchantable portion of the tree (98 percent) and the highest rates of overutilization (13.4 and 15.6 percent, respectively). This means that more of the non-growing-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 99 active harvest operations. However, it is possible to apply the percentages to inventory data from South Carolina's ninth survey (Conner and others, in press) to get an estimate of total softwood logging residues for the State. Annual softwood removal from all live trees was 596.1 million cubic feet. Softwood growing-stock removals were 581.6 million cubic feet, or 97.6 percent of the total. Applying the factors from this study to total softwood removals for all live trees tallied in the State survey (Conner and others, in press) provides an estimate of 152.6 million cubic feet total annual softwood residue. Of the total residue for all live trees, 42.5 million cubic feet, or 28 percent, was considered growing-stock residue. The remaining 72 percent, or 110.1 million cubic feet, was nongrowing-stock residue from stumps, tops, and limbs, and cull trees not used.

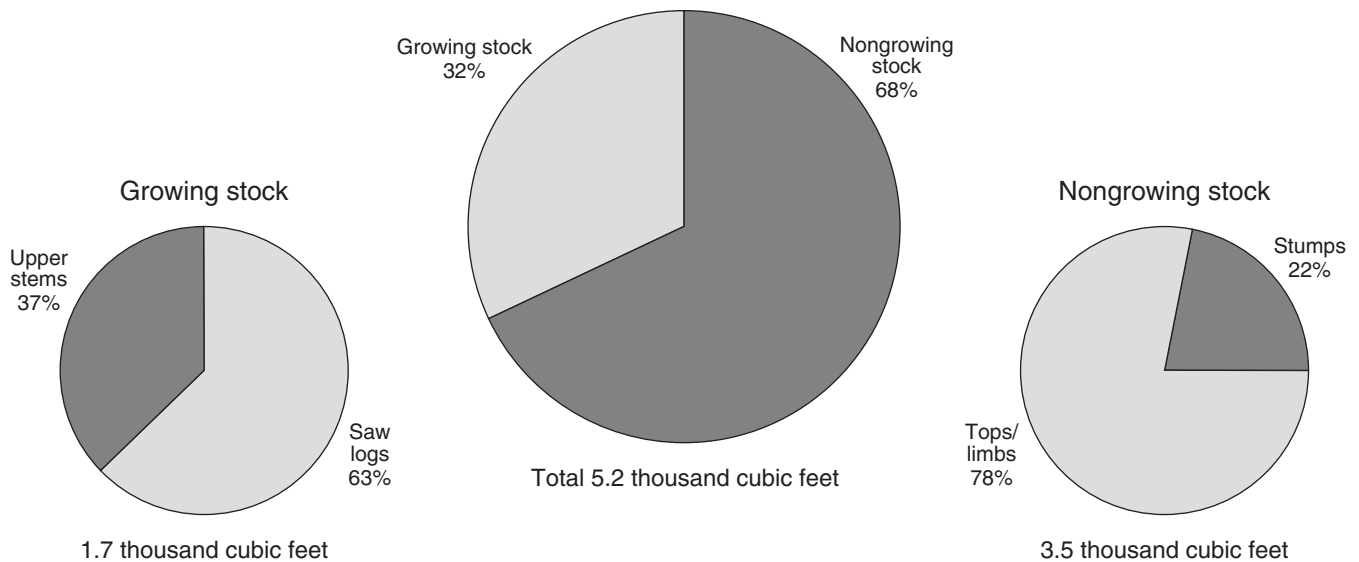


Figure 4—Softwood residue by volume type, South Carolina, 2006.

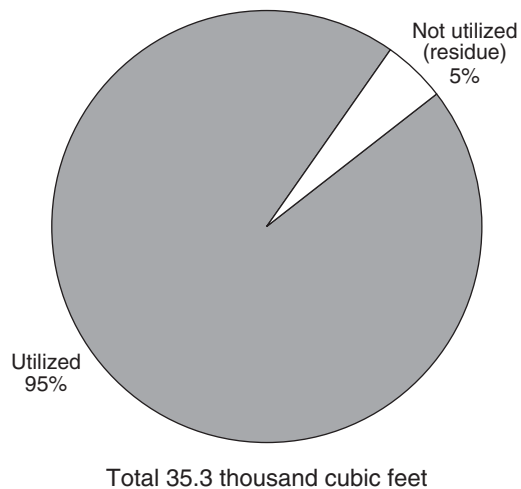


Figure 5—Disposition of softwood growing-stock volume, South Carolina, 2006.

### Hardwood Removals

Results from this study document 35,025 cubic feet of hardwood volume, of which 27,734 cubic feet, or 79 percent, was utilized for product(s). Twenty-one percent, or 7,292 cubic feet, was left onsite as logging residue (fig. 6). Thirty-four percent of residue volume came from the growing-stock portion of trees, and 66 percent came from the nongrowing-stock portion (stumps, tops, and limbs) (fig. 7) (table A.1).

The total hardwood growing-stock volume measured was 29,402 cubic feet. Of that total, 92 percent was used, and 8 percent was logging residue (fig. 8). By FIA merchantability standards, the logging residue portion is underutilized volume. Of the total utilized volume, 818 cubic feet, or 2.9 percent, was from the nongrowing-stock portion of trees. By the same merchantability standards, that volume is considered overutilization (tables A.10 and A.11).

Hardwood volumes and percentages also were measured for poletimber and sawtimber, and differentiated by the various products they provided (tables A.10 through A.17). At 95 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.

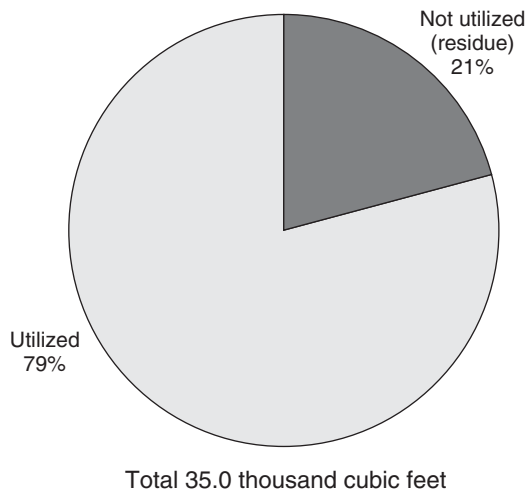


Figure 6—Disposition of total hardwood harvest volume, South Carolina, 2006.

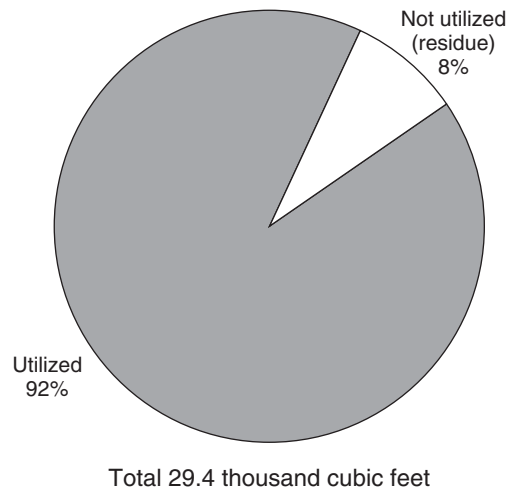


Figure 8—Disposition of hardwood growing-stock volume, South Carolina, 2006.

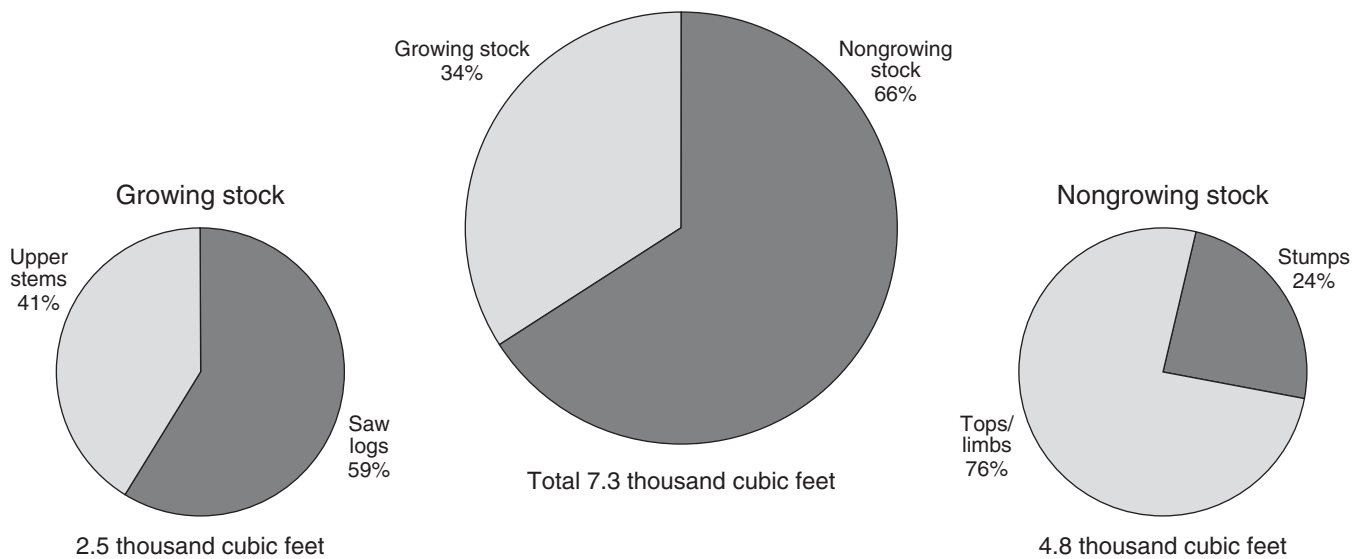


Figure 7—Hardwood residue by volume type, South Carolina, 2006.

Hardwood percentages and volumes presented in the tables represent just trees measured in this study of 99 active harvest operations. However, it is possible to apply the percentages to inventory data from South Carolina's ninth survey (Conner and others, in press) to provide an estimate of total hardwood logging residue for the State. Annual hardwood removals from all live trees totaled 218.1 million cubic feet. Hardwood growing-stock removals totaled 182.5 million cubic feet, or 84 percent of that total.

Applying factors from this study to total hardwood removals from all live trees tallied in the State survey (Conner and others, in press) provided an estimate of 66.8 million cubic feet total annual hardwood residue. Of that total, 20.6 million cubic feet, or 31 percent, was considered growing-stock residue. The remaining 69 percent, or 46.2 million cubic feet, was nongrowing-stock residue from stumps, tops, and limbs, and rough or rotten trees that were not used.

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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.

**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 merchantable portion of growing-stock trees cut or destroyed during logging operations.

**Merchantable portion.** That portion of live trees 5.0 inches d.b.h. and larger between a 1-foot stump and a minimum 4.0-inch top 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.

**Nonforest land.** 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 forest land.** Forest land other than timberland and productive reserved forest land. It includes available and reserved forest land 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.)

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

**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.

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

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

**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 fuelwood; hundred pieces for poles; thousand pieces for posts; and thousand cubic feet for all other miscellaneous forest products.

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

**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 products.** Roundwood products and byproducts.

**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 saw-timber 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, South Carolina, 2006**

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	36,021.14	31,838.13	28,404.53	1,052.53	1,784.89	596.18	4,183.01	689.44	663.05	218.36	2,612.16
Poletimber	4,323.03	3,456.01	—	—	3,429.57	26.44	867.02	139.90	115.68	443.52	167.92
Total	40,344.17	35,294.14	28,404.53	1,052.53	5,214.46	622.62	5,050.03	829.34	778.73	661.88	2,780.08
Hardwood											
Sawtimber	30,650.84	25,939.52	20,810.31	1,460.81	2,757.11	911.29	4,711.32	282.14	1,000.71	166.76	3,261.71
Poletimber	4,374.61	3,462.18	—	—	3,348.68	113.50	912.43	116.64	165.37	252.30	378.12
Total	35,025.45	29,401.70	20,810.31	1,460.81	6,105.79	1,024.79	5,623.75	398.78	1,166.08	419.06	3,639.83

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, South Carolina, 2006**

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	19,590.33	19,883.54	18,948.12	935.42	642.21	17,793.06	17,115.84	670.32	6.91
Veneer logs	8,086.39	8,412.82	7,898.62	514.20	187.77	8,018.87	7,789.75	149.03	80.09
Composite panels	503.22	431.18	424.49	6.69	78.73	68.67	66.10	2.58	—
Pulpwood	3,941.35	3,490.91	3,412.76	78.15	528.59	668.08	623.84	44.24	—
Poles	2,988.90	3,075.66	2,934.97	140.69	53.93	2,908.35	2,808.99	99.36	—
Fuelwood	—	—	—	—	—	—	—	—	—
Total	35,110.21	35,294.14	33,618.99	1,675.15	1,491.22	29,457.03	28,404.52	965.53	87.00

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, South Carolina, 2006**

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	96.72	3.28	95.30	4.70	96.19	3.77	0.04
Veneer logs	97.68	2.32	93.89	6.11	97.14	1.86	1.00
Composite panels	84.36	15.64	98.45	1.55	96.26	3.76	—
Pulpwood	86.59	13.41	97.76	2.24	93.38	6.62	—
Poles	98.20	1.80	95.43	4.57	96.58	3.42	—
Fuelwood	—	—	—	—	—	—	—
All products	95.75	4.25	95.25	4.75	96.43	3.28	0.30

— = no sample for the cell.

**Table A.4—Volume of softwood growing stock by product and utilization for sawtimber, South Carolina, 2006**

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	19,076.29	19,402.07	18,467.89	934.18	608.40	17,793.06	17,115.84	670.32	6.91
Veneer logs	8,086.39	8,412.82	7,898.62	514.20	187.77	8,018.87	7,789.75	149.03	80.09
Composite panels	98.54	94.42	89.67	4.75	8.87	68.67	66.10	2.58	—
Pulpwood	847.08	853.12	798.24	54.88	48.84	668.08	623.84	44.24	—
Poles	2,988.90	3,075.66	2,934.97	140.69	53.93	2,908.35	2,808.99	99.36	—
Fuelwood	—	—	—	—	—	—	—	—	—
Total	31,097.20	31,838.09	30,189.39	1,648.70	907.81	29,457.03	28,404.52	965.53	87.00

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, South Carolina, 2006**

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	96.81	3.19	95.19	4.81	96.19	3.77	0.04
Veneer logs	97.68	2.32	93.89	6.11	97.14	1.86	1.00
Composite panels	91.00	9.00	94.97	5.03	96.26	3.76	—
Pulpwood	94.23	5.77	93.57	6.43	93.38	6.62	—
Poles	98.20	1.80	95.43	4.57	96.58	3.42	—
Fuelwood	—	—	—	—	—	—	—
All products	97.08	2.92	94.82	5.18	96.43	3.28	0.30

— = no sample for the cell.

**Table A.6—Volume of softwood growing stock by product and utilization for poletimber, South Carolina, 2006**

Product	Total volume utilized	Growing stock			Nongrowing stock utilized
		Total	Utilized	Not utilized	
	<i>cubic feet</i>				
Saw logs	514.04	481.47	480.23	1.24	33.81
Veneer logs	—	—	—	—	—
Composite panels	404.68	336.76	334.82	1.94	69.86
Pulpwood	3,094.27	2,637.79	2,614.52	23.27	479.75
Poles	—	—	—	—	—
Fuelwood	—	—	—	—	—
Total	4,012.99	3,456.02	3,429.57	26.45	583.42

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, South Carolina, 2006**

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	93.42	6.58	99.74	0.26
Veneer logs	—	—	—	—
Composite panels	82.74	17.26	99.42	0.58
Pulpwood	84.50	15.50	99.12	0.88
Poles	—	—	—	—
Fuelwood	—	—	—	—
All products	85.46	14.54	99.23	0.77

— = no sample for the cell.

**Table A.8—Volume of softwood cull by product and utilization, South Carolina, 2006**

Product	Total volume utilized	Nongrowing stock			
		Merchantable			Unmerchantable utilized
		Total	Utilized	Not utilized	
		<i>cubic feet</i>			
Saw logs	57.52	54.06	54.06	—	3.46
Veneer logs	5.18	4.38	4.38	—	0.80
Composite panels	33.41	23.37	23.37	—	10.04
Pulpwood	62.72	53.83	53.72	0.11	9.00
Poles	—	—	—	—	—
Fuelwood	—	—	—	—	—
Total	158.83	135.64	135.53	0.11	23.30

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 softwood cull by product, South Carolina, 2006**

Product	Overutilization		Underutilization	
	Merchantable utilized/ total volume utilized	Unmerchantable utilized/ total volume utilized	Merchantable utilized/ total merchantable volume	Merchantable not utilized/ total merchantable volume
	<i>percent</i>			
Saw logs	93.98	6.02	100.00	—
Veneer logs	84.56	15.44	100.00	—
Composite panels	69.95	30.05	100.00	—
Pulpwood	85.65	14.35	99.80	0.20
Poles	—	—	—	—
Fuelwood	—	—	—	—
All products	85.33	14.67	99.92	0.08

— = no sample for the cell.

**Table A.10—Volume of hardwood growing stock by product and utilization for sawtimber and poletimber, South Carolina, 2006**

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	18,963.18	20,338.14	18,594.86	1,743.28	368.32	17,096.25	15,952.71	1,013.84	129.70
Veneer logs	4,661.52	5,156.85	4,600.48	556.37	61.04	4,572.25	4,309.51	191.22	71.51
Composite panels	10.92	9.67	9.67	—	1.25	—	—	—	—
Pulpwood	3,945.23	3,743.19	3,566.59	176.60	378.64	551.57	499.87	51.70	—
Poles	—	—	—	—	—	—	—	—	—
Fuelwood	153.08	153.84	144.48	9.36	8.60	51.05	48.21	2.84	—
Total	27,733.94	29,401.70	26,916.10	2,485.60	817.84	22,271.12	20,810.30	1,259.60	201.21

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 and poletimber, South Carolina, 2006**

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	98.06	1.94	91.43	8.57	93.31	5.93	0.76
Veneer logs	98.69	1.31	89.21	10.79	94.25	4.18	1.56
Composite panels	88.55	11.45	100.00	—	—	—	—
Pulpwood	90.40	9.60	95.28	4.72	90.63	9.37	—
Poles	—	—	—	—	—	—	—
Fuelwood	94.38	5.62	93.92	6.08	94.44	5.56	—
All products	97.05	2.95	91.55	8.45	93.44	5.66	0.90

— = no sample for the cell.

**Table A.12—Volume of hardwood growing stock by product and utilization for sawtimber, South Carolina, 2006**

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	18,585.60	19,964.89	18,228.23	1,736.66	357.37	17,096.25	15,952.71	1,013.84	129.70
Veneer logs	4,661.52	5,156.85	4,600.48	556.37	61.04	4,572.25	4,309.51	191.22	71.51
Composite panels	—	—	—	—	—	—	—	—	—
Pulpwood	706.37	750.20	677.37	72.83	29.00	551.57	499.87	51.70	—
Poles	—	—	—	—	—	—	—	—	—
Fuelwood	62.82	67.57	61.32	6.25	1.50	51.05	48.21	2.84	—
Total	24,016.31	25,939.51	23,567.40	2,372.11	448.91	22,271.12	20,810.30	1,259.60	201.21

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

— = no sample for the cell.

**Table A.13—Percent of overutilization and underutilization for hardwood growing stock by product for sawtimber, South Carolina, 2006**

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	98.08	1.92	91.30	8.70	93.31	5.93	0.76
Veneer logs	98.69	1.31	89.21	10.79	94.25	4.18	1.56
Composite panels	—	—	—	—	—	—	—
Pulpwood	95.89	4.11	90.29	9.71	90.63	9.37	—
Poles	—	—	—	—	—	—	—
Fuelwood	97.61	2.39	90.75	9.25	94.44	5.56	—
All products	98.13	1.87	90.86	9.14	93.44	5.66	0.90

— = no sample for the cell.

**Table A.14—Volume of hardwood growing stock by product and utilization for poletimber, South Carolina, 2006**

Product	Total volume utilized	Growing stock			Nongrowing stock utilized
		Total	Utilized	Not utilized	
	<i>cubic feet</i>				
Saw logs	377.58	373.25	366.63	6.62	10.95
Veneer logs	—	—	—	—	—
Composite panels	10.92	9.67	9.67	0.00	1.25
Pulpwood	3,238.86	2,992.99	2,889.22	103.77	349.64
Poles	—	—	—	—	—
Fuelwood	90.26	86.27	83.16	3.11	7.10
Total	3,717.62	3,462.18	3,348.68	113.50	368.94

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

— = no sample for the cell.

**Table A.15—Percent of overutilization and underutilization for hardwood growing stock by product for poletimber, South Carolina, 2006**

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	97.10	2.90	98.23	1.77
Veneer logs	—	—	—	—
Composite panels	88.55	11.45	100.00	—
Pulpwood	89.20	10.80	96.53	3.47
Poles	—	—	—	—
Fuelwood	92.13	7.87	96.40	3.60
All products	90.08	9.92	96.72	3.28

— = no sample for the cell.

**Table A.16—Volume of hardwood cull by product and utilization, South Carolina, 2006**

Product	Total volume utilized	Nongrowing stock			
		Merchantable			Unmerchantable utilized
		Total	Utilized	Not utilized	
		<i>cubic feet</i>			
Saw logs	104.85	100.86	100.86	—	3.99
Veneer logs	173.23	173.23	173.23	—	—
Composite panels	—	—	—	—	—
Pulpwood	577.19	544.44	529.29	15.15	47.90
Poles	—	—	—	—	—
Fuelwood	162.02	154.37	147.25	7.12	14.77
Total	1,017.29	972.90	950.63	22.27	66.66

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

— = no sample for the cell.

**Table A.17—Percent of overutilization and underutilization for hardwood cull by product, South Carolina, 2006**

Product	Overutilization		Underutilization	
	Merchantable utilized/ total volume utilized	Unmerchantable utilized/ total volume utilized	Merchantable utilized/total merchantable volume	Merchantable not utilized/total merchantable volume
	<i>percent</i>			
Saw logs	96.19	3.81	100.00	—
Veneer logs	100.00	—	100.00	—
Composite panels	—	—	—	—
Pulpwood	91.70	8.30	97.22	2.78
Poles	—	—	—	—
Fuelwood	90.88	9.12	95.39	4.61
All products	93.45	6.55	97.71	2.29

— = no sample for the cell.

**Bentley, James W.; Johnson, Tony G.** 2008. South Carolina harvest and utilization study, 2006. Resour. Bull. SRS-140. Asheville, NC: U.S. Department of Agriculture Forest Service, Southern Research Station. 24 p.

In 2006, a harvest and utilization study was conducted on 99 operations throughout South Carolina. There were 2,904 total trees measured; 1,763 or 61 percent were softwood, while 1,141 or 39 percent were hardwood. Results from this study showed that 87 percent of the total softwood volume measured was utilized for a product, and 13 percent was left as logging residue. Seventy-nine percent of the total hardwood volume measured was utilized for a product, while 21 percent was left as logging residue.

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



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