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North Carolina Harvest and Utilization Study, 2015

David J. Wall, Jason A. Cooper, James W. Bentley, and James A. Gray

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All photos by Tony G. Johnson (retired), U.S. Forest Service.

Thinned loblolly pine plantation.

Cover photo: Harvested and merchandized loblolly pine pulpwood on logging deck.

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FOREWORD

This resource bulletin describes the principal findings of a harvest and utilization study conducted during the ninth 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 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), the Commonwealth of Puerto Rico, and the U.S. Virgin Islands are conducted by the Southern Research Station, Forest Inventory and Analysis (FIA) Research Work Unit headquartered in Knoxville, TN. 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 Clay Altizer and Don Roach for their review and comments and the Southern Research Station (SRS) Technical Publications Team for technical edit, layout, and overall production of this report.

The SRS gratefully acknowledges the cooperation and assistance of the North Carolina Forest Service in collecting harvest and utilization data. Appreciation is also extended to private landowners, forest industry, and loggers for allowing access to their land and logging operations.

Truck mounted knuckleboom loader merchandizing loblolly pine on logging deck.

Contents

[a]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.

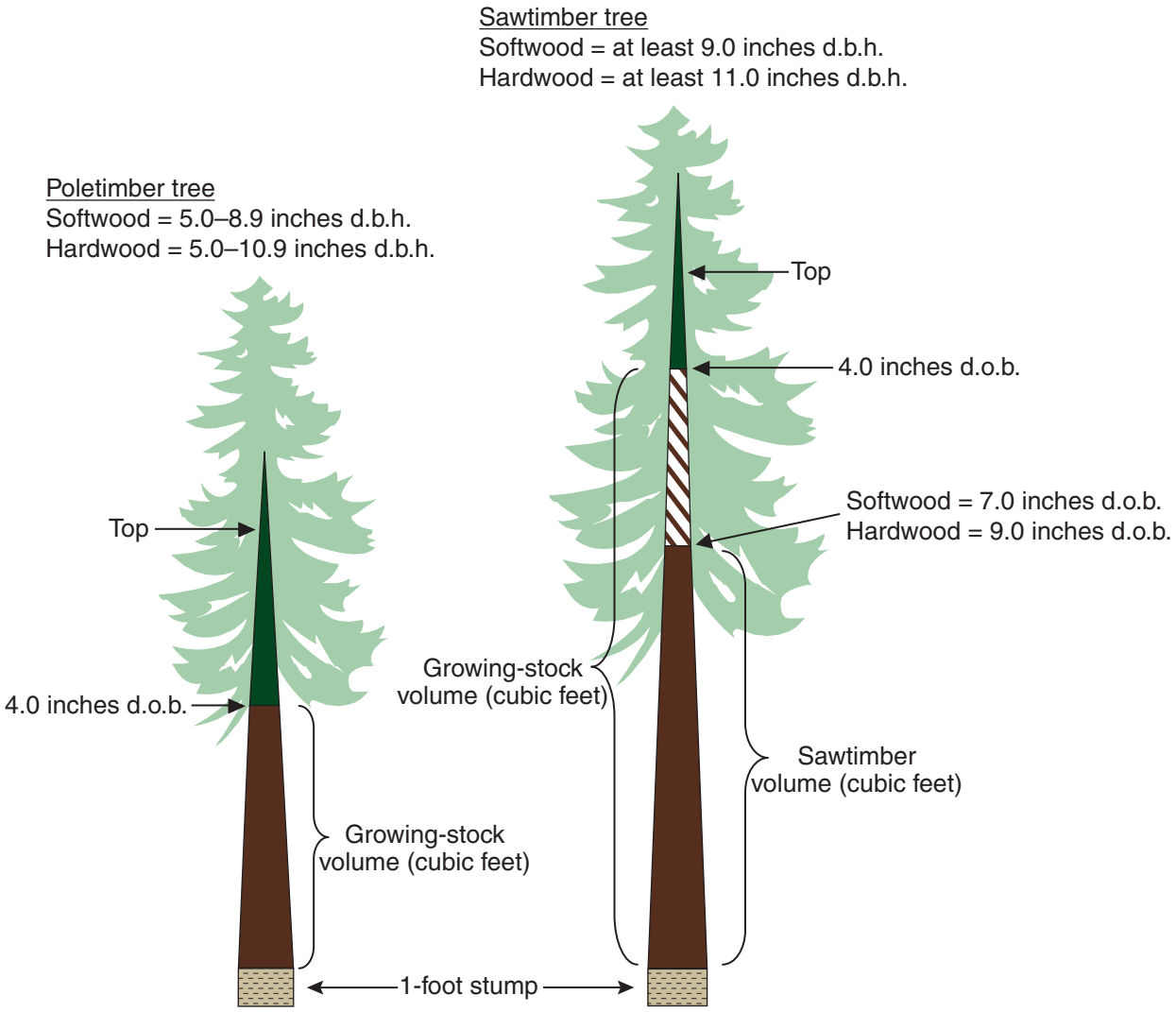

Figure 1—Stem sections of poletimber and sawtimber trees.

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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 the forests are changing—are essential to well informed decisionmaking. 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.

Logging residue in thinned loblolly pine plantation.

This bulletin presents the findings of a 2015 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 95 active harvest operations throughout North Carolina. 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 of particular importance 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 non-growing stock (cull) volume. Figure 1 illustrates a poletimber tree, 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 of the complexity of the timber industry, it is impossible to list the names and locations of all during the timeframe considered in this resource bulletin. Many uncontrollable factors affect how, when, and where harvesting operations 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 for county-level output of timber products harvested in North Carolina by species group (Cooper and Mann 2009). Using those proportions, we designated 65 of the 95 selected sites as softwood operations and the remaining 30 as hardwood operations. We used the same guidelines to designate harvest operations by product but allowed more flexibility because of the difficulty in locating harvesting operations for some products. Table 1 shows the final breakdown number of harvest operations, total trees, trees planted, and percentage of trees planted by product and species group.

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 (Cooper and Mann 2009) and a map showing current mill locations, prospective utilization sites were selected based on a high probability of locating a harvesting operation for the particular product and species group assigned.

Data Collection

During the ninth survey, field crews were trained to collect data on felled trees at harvest locations. Using the list of operations they began collecting data by county for the particular species group and designated product(s). Data collection from active harvest operations was completed in 2015. To locate active harvest sites, field crews visited local mills and consulted county personnel.

At each harvest operation site, field crews talked to the logger or person in charge of operations. These 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

Table 1—Number of operations, total trees, planted trees, and percent planted by product and species group, North Carolina, 2015

Product and species group	Operations	Trees		
		Total	Planted	
	number			*percent*
Saw logs				
Softwood	30	523	309	59
Hardwood	11	220	6	3
Total	41	743	315	42
Veneer logs				
Softwood	7	90	12	13
Hardwood	—	2	—	—
Total	7	92	12	13
Composite panels				
Softwood	7	142	46	32
Hardwood	—	14	6	43
Total	7	156	52	33
Pulpwood				
Softwood	14	389	282	72
Hardwood	12	373	92	25
Total	26	762	374	49
Pilings				
Softwood	—	1	—	—
Hardwood	—	0	—	—
Total	—	1	—	—
Poles				
Softwood	—	10	10	100
Hardwood	—	—	—	—
Total	—	10	10	100
Fuelwood				
Softwood	7	129	38	29
Hardwood	7	228	46	20
Total	14	357	84	24
Miscellaneous				
Softwood	—	—	—	—
Hardwood	—	4	4	100
Total	—	4	4	100
All products				
Softwood	65	1,284	697	54
Hardwood	30	841	154	18
Total	95	2,125	851	40

— = no sample for the cell.

Representation of residual stump height using mechanized felling equipment.

points for specific products. Additional information about the logging crew was noted, such as type and amount of equipment they used as well as the age of the equipment, number of loads hauled per day, certifications of the loggers, and distances they were willing to travel for work. This information was used to determine the level of mechanization for each harvesting operation.

The goal of the field crew, at each harvest operation site, was to measure 25 to 30 trees for each product. This number ensured 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 often 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, bole length, and percentage of 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). 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 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 occur 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 identify several key characteristics of trees harvested. Such findings 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 is vital information for a full understanding of the complex nature of removals. Averages discussed in this section are based on the measurement of 2,125 trees, of which 1,284 (60 percent) were softwood and 841 (40 percent) hardwood.

According to Gray and others (2017), softwood and hardwood saw-log volume together accounted for 45 percent of the total product output for the State. The study classified 523 trees as having softwood saw logs averaging 12.3 inches d.b.h. Fifty-nine percent, or 309 trees, were classified as planted softwood saw logs averaging 12.2 inches d.b.h. Natural softwood saw logs averaged 12.5 inches d.b.h. It classified 220 hardwood trees as having saw logs averaging 15.8 inches d.b.h. Veneer and plywood constitute another component of the product mix for North Carolina. Based on 90 trees measured for softwood veneer, the average d.b.h. was 14.2 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. As expected, the d.b.h. of trees measured for pulpwood and composite panels was significantly smaller. Of the 389 softwood pulpwood trees measured, the average d.b.h. was 7.0 inches, while the 373 trees measured for hardwood pulpwood averaged 7.4 inches d.b.h. Seventy-two percent, or 282 trees, of the softwood pulpwood trees were planted, averaging 6.9 inches d.b.h., slightly smaller in d.b.h when compared to trees that come from natural stands. One hundred forty-two trees were measured for softwood composite panels averaging 7.2 inches d.b.h. Table 2 shows the breakdown of average d.b.h. for each product by species group and stand origin.

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 61 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 29 feet for softwoods and 28 feet for hardwoods. Softwood veneer trees had an average bole length of 66 feet. Planted sites constituted a subset of all trees measured. Trees measured in planted stands tended to have shorter bole lengths than those measured in the natural stands. Table 3 shows the average bole length by species group.

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

Table 2—Average diameter at breast height by species group, stand origin, and product, North Carolina, 2015

Species group and stand origin	Product							
	Saw logs	Veneer logs	Composite panels	Pulp-wood	Pilings	Poles	Fuel-wood	Miscel-laneous
	inches							
Softwood								
Natural	12.46	14.55	7.64	7.19	11.80	—	5.95	—
Planted	12.18	11.58	6.28	6.89	—	14.25	6.43	—
Total	12.29	14.16	7.20	6.97	11.80	14.25	6.09	—
Hardwood								
Natural	15.85	19.45	6.86	7.49	—	—	6.96	—
Planted	14.48	—	6.78	7.26	—	—	6.37	11.08
Total	15.81	19.45	6.83	7.43	—	—	6.84	11.08

— = no sample for the cell.

Table 3—Average bole length by species group, stand origin, and product, North Carolina, 2015

Species group and stand origin	Product							
	Saw logs	Veneer logs	Composite panels	Pulp-wood	Pilings	Poles	Fuel-wood	Miscel-laneous
	feet							
Softwood								
Natural	62.49	67.22	41.53	32.77	50.00	—	18.27	—
Planted	60.28	60.33	26.22	26.92	—	74.00	28.50	—
Total	61.18	66.30	36.57	28.53	50.00	74.00	21.29	—
Hardwood								
Natural	68.56	80.00	20.88	29.62	—	—	27.64	—
Planted	56.00	—	28.83	22.88	—	—	26.39	30.25
Total	68.21	80.00	24.29	27.96	—	—	27.39	30.25

— = no sample for the cell.

across the products ranged from 0.51 to 1.00 foot; however, most softwood trees harvested had an average residual stump height of about a 0.71 foot, while harvested hardwood trees averaged slightly higher residual stumps. In softwoods and across all products, this accounted for 29 percent of the stump volume being utilized. In hardwoods and across all products, 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. Residual stump heights for trees coming from natural stands appear slightly higher than residual stump heights in planted stands. Table 4 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; they accounted for 65 percent of the nongrowing-stock portion that was utilized. The average end of utilization for softwood saw logs was 4.5 inches, and for hardwood saw logs 7.8 inches. The average end of utilization for softwood and hardwood pulpwood was 3.7 and 4.1 inches, respectively. Trees coming from natural and planted stands showed no difference in the end of utilization. Table 5 shows the average end of utilization by the different products and species group.

Table 4—Average residual stump height by species group, stand origin, and product, North Carolina, 2015

Species group and stand origin	Product							
	Saw logs	Veneer logs	Composite panels	Pulp-wood	Pilings	Poles	Fuel-wood	Miscel-laneous
	feet							
Softwood								
Natural	0.79	0.85	0.89	0.73	0.80	—	0.51	—
Planted	0.61	0.51	0.59	0.60	—	0.70	0.76	—
Total	0.69	0.81	0.79	0.64	0.80	0.70	0.58	—
Hardwood								
Natural	0.89	1.00	0.75	0.81	—	—	0.79	—
Planted	0.65	—	0.60	0.58	—	—	0.62	0.70
Total	0.88	1.00	0.69	0.75	—	—	0.76	0.70

— = no sample for the cell.

Table 5—Average end of utilization by species group, stand origin, and product, North Carolina, 2015

Species group and stand origin	Product							
	Saw logs	Veneer logs	Composite panels	Pulp-wood	Pilings	Poles	Fuel-wood	Miscel-laneous
	inches							
Softwood								
Natural	4.80	4.07	4.42	3.69	3.10	—	5.98	—
Planted	4.33	3.68	3.21	3.70	—	3.67	7.29	—
Total	4.52	4.02	4.03	3.69	3.10	3.67	6.37	—
Hardwood								
Natural	7.79	8.15	2.96	4.07	—	—	8.43	—
Planted	7.10	—	4.73	4.13	—	—	7.54	13.13
Total	7.77	8.15	3.72	4.08	—	—	8.25	13.13

— = no sample for the cell.

Softwood Removals

Results from this study document 25,700 cubic feet of softwood volume, of which 21,759 cubic feet, or 85 percent, was used for product(s). Fifteen percent, or 3,941 cubic feet, was left onsite as logging residue (fig. 2). Thirty-four percent of the residue volume came from the growing-stock portion of the tree, while 66 percent came from the nongrowing-stock portion (stumps, tops, and limbs) (fig. 3a) (table A.1).

The total softwood growing-stock volume measured was 22,485 cubic feet, of which 94 percent was utilized and 6 percent was logging residue (fig. 4). By FIA merchantability standards, the logging residue portion of growing-stock trees is underutilized volume. Of the total utilized volume, 603 cubic feet, or 2.8 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.9). By product, pilings had the highest rate of utilization for the merchantable portion of the tree at 100 percent. Pulpwood and composite panels were slighty lower at 98 perecnt for the merchantable portion, and also the highest rates of overutilization (10.2 and 10.8 percent, respectively), meaning that more of the nongrowing-stock portion of the tree was used for product(s) and less was left as logging residue.

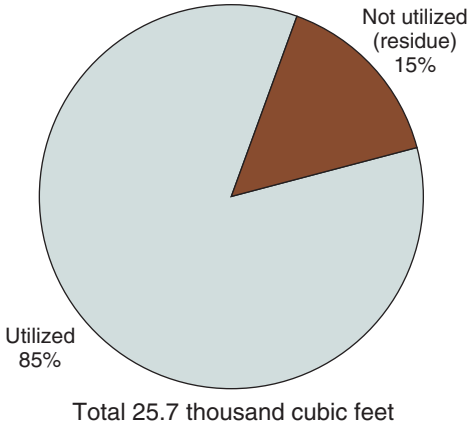

Figure 2—Disposition of total softwood harvest volume, North Carolina, 2015.

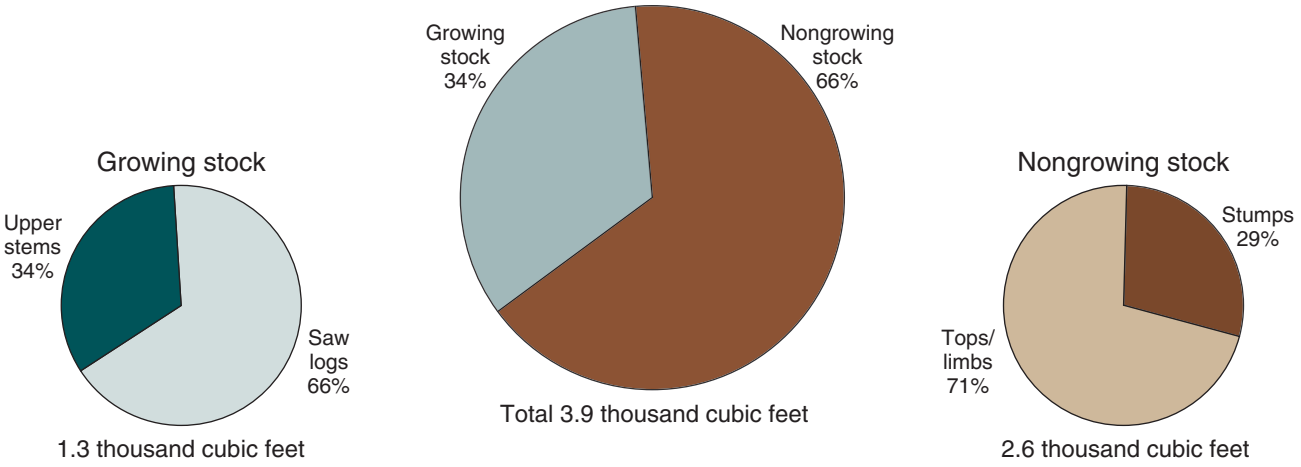

Figure 3—Softwood residue by volume type, North Carolina, 2015.

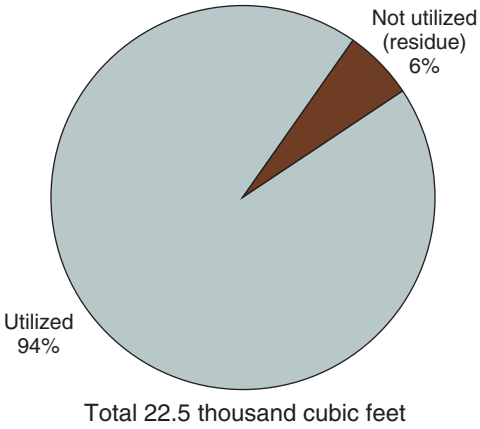

Figure 4—Disposition of softwood growing-stock volume, North Carolina, 2015.

Residual logging residue after a total harvest.

Hardwood Removals

Results from this study document 17,379 cubic feet of hardwood volume, of which 12,910 cubic feet, or 74 percent, was utilized for product(s). Twenty-six percent, or 4,468 cubic feet, was left onsite as logging residue (fig. 5). Forty-seven percent of residue volume came from the growing-stock portion of trees, and 53 percent came from the nongrowing-stock portion (stumps, tops, and limbs) (fig. 6a) (table A.1).The total hardwood growing-stock volume measured was 14,644 cubic feet, of which 86 percent was used and 14 percent was logging residue (fig. 7). By FIA merchantability standards, the logging residue portion is underutilized volume. Of the total utilized volume, 356 cubic feet, or 2.8 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 100 percent, however, those trees measured for miscellaneous products were more fully utilized, and more of the nongrowing-stock portion was used.

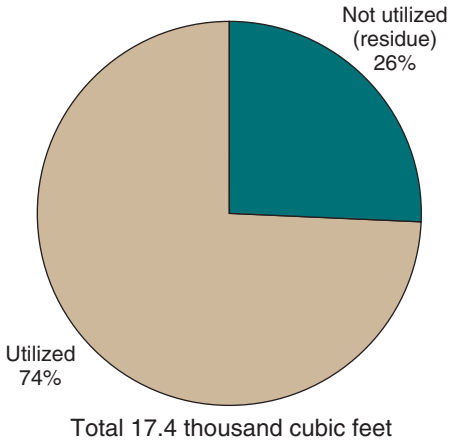

Figure 5—Disposition of total hardwood harvest volume, North Carolina, 2015.

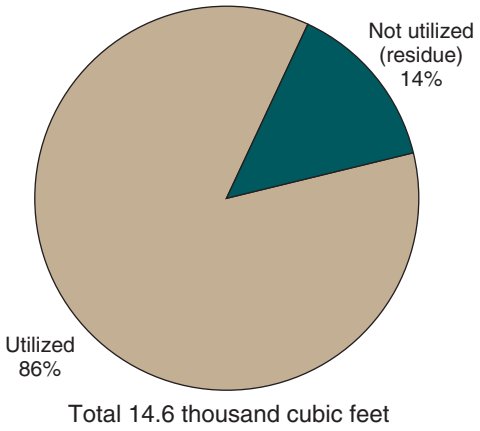

Figure 7—Disposition of hardwood growing-stock volume, North Carolina, 2015.

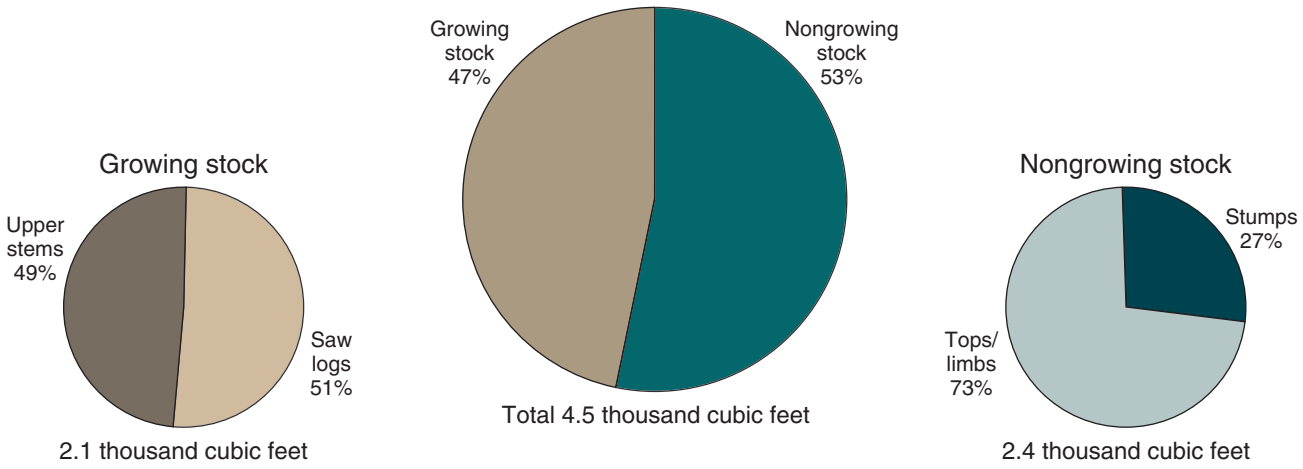

Figure 6—Hardwood residue by volume type, North Carolina, 2015.

Knuckleboom loader with pull-through delimber merchandizing loblolly pine.

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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 ≤ 0.50, 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 ¼-inch rule. A log rule or formula for estimating the board-foot volume of logs, allowing ½-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 ¼-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 of 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 Fuelwood 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 Fuelwood forest products.

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

Grapple skidder pulling felled loblolly pine to logging deck.

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 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).

Appendix

Index of Tables

Table A.1—Harvest and utilization volume by species group, source, and volume type, North Carolina, 2015

Species group and source	Total tree volume	Growing stock					Nongrowing stock				
			Saw log		Upper stem			Stumps		Tops/limbs	
		Total	Utilized	Not utilized	Utilized	Not utilized	Total	Utilized	Not utilized	Utilized	Not utilized
		cubic feet									
Softwood											
Sawtimber	22,475.55	19,894.88	17,352.56	887.71	1,239.75	414.86	2,580.67	195.29	613.49	92.27	1,679.62
Poletimber	3,224.63	2,590.31	—	—	2,564.11	26.20	634.32	54.53	137.21	260.79	181.79
Total	25,700.18	22,485.19	17,352.56	887.71	3,803.86	441.06	3,214.99	249.82	750.70	353.06	1,861.41
Hardwood											
Sawtimber	14,570.68	12,449.16	9,831.65	1,066.59	615.60	935.32	2,121.52	53.76	493.05	50.61	1,524.10
Poletimber	2,808.14	2,194.55	—	—	2,106.83	87.72	613.59	35.90	159.06	216.10	202.53
Total	17,378.82	14,643.71	9,831.65	1,066.59	2,722.43	1,023.04	2,735.11	89.66	652.11	266.71	1,726.63

— = no sample for the cell.

Table A.2—Volume of softwood growing stock by product and utilization for sawtimber and poletimber, North Carolina, 2015

Product	Total volume utilized	Growing stock			Nongrowing stock utilized	Saw-log portion			
		Total	Utilized	Not utilized		Total	Utilized	Cull utilized	Not utilized
					cubic feet				
Saw logs	14,542.55	15,274.33	14,304.00	970.33	238.55	13,661.11	13,026.13	583.17	51.81
Veneer logs	3,423.44	3,548.19	3,382.92	165.27	40.52	3,351.20	3,243.85	107.35	—
Composite panels	992.90	1,039.01	930.07	108.94	62.83	417.98	314.05	103.93	—
Pulpwood	1,940.90	1,841.21	1,762.69	78.52	178.21	360.38	318.95	41.44	—
Pilings	19.00	18.46	18.46	—	0.54	16.58	16.58	—	—
Poles	428.56	429.18	423.68	5.50	4.88	412.94	412.94	—	—
Fuelwood	411.92	334.79	334.59	0.20	77.33	20.07	20.07	—	—
Miscellaneous	—	—	—	—	—	—	—	—	—
Total	21,759.27	22,485.17	21,156.41	1,328.76	602.86	18,240.26	17,352.57	835.89	51.81

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, 2015

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
			percent				
Saw logs	98.36	1.64	93.65	6.35	95.35	4.27	0.38
Veneer logs	98.82	1.18	95.34	4.66	96.80	3.20	—
Composite panes	93.67	6.33	89.52	10.48	75.14	24.86	—
Pulpwood	90.82	9.18	95.74	4.26	88.50	11.50	—
Pilings	97.16	2.84	100.00	—	100.00	—	—
Poles	98.86	1.14	98.72	1.28	100.00	—	—
Fuelwood	81.23	18.77	99.94	0.06	100.00	—	—
Miscellaneous	—	—	—	—	—	—	—
All products	97.23	2.77	94.09	5.91	95.13	4.58	0.28

— = no sample for the cell.

Table A.4—Volume of softwood growing stock by product and utilization for sawtimber, North Carolina, 2015

Product	Total volume utilized	Growing stock			Nongrowing stock utilized	Saw-log portion			
		Total	Utilized	Not utilized		Total	Utilized	Cull utilized	Not utilized
					cubic feet				
Saw logs	14,146.95	14,892.90	13,925.53	967.37	221.42	13,661.11	13,026.13	583.17	51.81
Veneer logs	3,423.44	3,548.19	3,382.92	165.27	40.52	3,351.20	3,243.85	107.35	—
Composite panels	431.83	530.13	426.20	103.93	5.63	417.98	314.05	103.93	—
Pulpwood	402.14	450.59	390.10	60.49	12.04	360.38	318.95	41.44	—
Pilings	19.00	18.46	18.46	—	0.54	16.58	16.58	—	—
Poles	428.56	429.18	423.68	5.50	4.88	412.94	412.94	—	—
Fuelwood	27.94	25.42	25.42	—	2.52	20.07	20.07	—	—
Miscellaneous	—	—	—	—	—	—	—	—	—
Total	18,879.86	19,894.87	18,592.31	1,302.56	287.55	18,240.26	17,352.57	835.89	51.81

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, 2015

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
			percent				
Saw logs	98.43	1.57	93.50	6.50	95.35	4.27	0.38
Veneer logs	98.82	1.18	95.34	4.66	96.80	3.20	—
Composite panels	98.70	1.30	80.40	19.60	75.14	24.86	—
Pulpwood	97.01	2.99	86.58	13.42	88.50	11.50	—
Pilings	97.16	2.84	100.00	—	100.00	—	—
Poles	98.86	1.14	98.72	1.28	100.00	—	—
Fuelwood	90.98	9.02	100.00	—	100.00	—	—
Miscellaneous	—	—	—	—	—	—	—
All products	98.48	1.52	93.45	6.55	95.13	4.58	0.28

— = no sample for the cell.

Table A.6—Volume of softwood growing stock by product and utilization for poletimber, North Carolina, 2015

Product	Total volume utilized	Growing stock			Nongrowing stock utilized
		Total	Utilized	Not utilized	
			cubic feet		
Saw logs	395.60	381.43	378.47	2.96	17.13
Veneer logs	0.00	0.00	0.00	0.00	0.00
Composite panels	561.07	508.88	503.87	5.01	57.20
Pulpwood	1,538.76	1,390.62	1,372.59	18.03	166.17
Pilings	0.00	0.00	0.00	0.00	—
Poles	0.00	0.00	0.00	0.00	—
Fuelwood	383.98	309.37	309.17	0.20	74.81
Miscellaneous	—	—	—	—	—
Total	2,879.41	2,590.30	2,564.10	26.20	315.31

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, 2015

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
	percent			
Saw logs	95.67	4.33	99.22	0.78
Veneer logs	—	—	—	—
Composite panels	89.81	10.19	99.02	0.98
Pulpwood	89.20	10.80	98.70	1.30
Pilings	—	—	—	—
Poles	—	—	—	—
Fuelwood	80.52	19.48	99.94	0.06
Miscellaneous	—	—	—	—
All products	89.05	10.95	98.99	1.01

— = no sample for the cell.

Table A.8—Volume of softwood cull by product and utilization, North Carolina, 2015

Product	Total volume utilized	Nongrowing stock			
		Merchantable			
		Total	Utilized	Not utilized	Unmerchantable utilized
	cubic feet				
Saw logs	—	—	—	—	—
Veneer logs	—	—	—	—	—
Composite panels	153.59	150.61	150.27	0.34	3.32
Pulpwood	261.51	244.46	239.32	5.14	22.19
Pilings	—	—	—	—	—
Poles	—	—	—	—	—
Fuelwood	48.54	40.27	40.27	—	8.27
Miscellaneous	—	—	—	—	—
Total	463.64	435.34	429.86	5.48	33.78

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, North Carolina, 2015

Product	Overutilization		Underutilization	
	Merchantable utilized/ total volume utilized	Unmerchantable utilized/ total volume utilized	Merchantable utilized/total merchantable volume	Merchantable not utilized/ total merchantable volume
	percent			
Saw logs	—	—	—	—
Veneer logs	—	—	—	—
Composite panels	97.84	2.16	99.77	0.23
Pulpwood	91.51	8.49	97.90	2.10
Pilings	—	—	—	—
Poles	—	—	—	—
Fuelwood	82.96	17.04	100.00	—
Miscellaneous	—	—	—	—
All products	92.71	7.29	98.74	1.26

— = no sample for the cell.

Table A.10—Volume of hardwood growing stock by product and utilization for sawtimber and poletimber, North Carolina, 2015

Product	Total volume utilized	Growing stock			Nongrowing stock utilized	Saw-log portion			
		Total	Utilized	Not utilized		Total	Utilized	Cull utilized	Not utilized
					cubic feet				
Saw logs	9,862.76	11,670.75	9,771.87	1,898.88	90.89	10,152.99	9,146.21	747.77	259.01
Veneer logs	128.15	145.93	128.15	17.78	—	135.30	125.81	9.49	—
Composite panels	50.69	53.59	47.47	6.12	3.22	11.54	11.17	0.37	—
Pulpwood	2,003.19	2,058.01	1,891.56	166.45	111.63	540.59	490.64	49.96	—
Pilings	—	—	—	—	—	—	—	—	—
Poles	—	—	—	—	—	—	—	—	—
Fuelwood	837.25	690.62	690.21	0.41	147.04	40.40	40.40	—	—
Miscellaneous	28.40	24.82	24.82	—	3.58	17.43	17.43	—	—
Total	12,910.44	14,643.72	12,554.08	2,089.64	356.36	10,898.25	9,831.66	807.59	259.01

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, North Carolina, 2015

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
			percent				
Saw logs	99.08	0.92	83.73	16.27	90.08	7.37	2.55
Veneer logs	100.00	—	87.82	12.18	92.99	7.01	—
Composite panels	93.63	6.37	88.58	11.42	96.79	3.21	—
Pulpwood	94.43	5.57	91.91	8.09	90.76	9.24	—
Pilings	—	—	—	—	—	—	—
Poles	—	—	—	—	—	—	—
Fuelwood	82.44	17.56	99.94	0.06	100.00	—	—
Miscellaneous	87.39	12.64	100.00	—	100.00	—	—
All products	97.24	2.76	85.73	14.27	90.21	7.41	2.38

— = no sample for the cell.

Table A.12—Volume of hardwood growing stock by product and utilization for sawtimber, North Carolina, 2015

Product	Total volume utilized	Growing stock			Nongrowing stock utilized	Saw-log portion			
		Total	Utilized	Not utilized		Total	Utilized	Cull utilized	Not utilized
					cubic feet				
Saw logs	9,695.06	11,509.23	9,613.37	1,895.86	81.69	10,152.99	9,146.21	747.77	259.01
Veneer logs	128.15	145.93	128.15	17.78	—	135.30	125.81	9.49	—
Composite panels	17.55	17.56	17.19	0.37	0.36	11.54	11.17	0.37	—
Pulpwood	624.17	700.39	612.48	87.91	11.69	540.59	490.64	49.96	—
Pilings	—	—	—	—	—	—	—	—	—
Poles	—	—	—	—	—	—	—	—	—
Fuelwood	63.38	55.41	55.41	—	7.97	40.40	40.40	—	—
Miscellaneous	23.32	20.66	20.66	—	2.66	17.43	17.43	—	—
Total	10,551.63	12,449.18	10,447.26	2,001.92	104.37	10,898.25	9,831.66	807.59	259.01

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, North Carolina, 2015

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
			percent				
Saw logs	99.16	0.84	83.53	16.47	90.08	7.37	2.55
Veneer logs	100.00	—	87.82	12.18	92.99	7.01	—
Composite panels	97.95	2.05	97.89	2.11	96.79	3.21	—
Pulpwood	98.13	1.87	87.45	12.55	90.76	9.24	—
Pilings	—	—	—	—	—	—	—
Poles	—	—	—	—	—	—	—
Fuelwood	87.43	12.57	100.00	—	100.00	—	—
Miscellaneous	88.59	11.41	100.00	—	100.00	—	—
All products	99.01	0.99	83.92	16.08	90.21	7.41	2.38

— = no sample for the cell.

Table A.14—Volume of hardwood growing stock by product and utilization for poletimber, North Carolina, 2015

Product	Total volume utilized	Growing stock			Nongrowing stock utilized
		Total	Utilized	Not utilized	
			cubic feet		
Saw logs	167.70	161.52	158.50	3.02	9.20
Veneer logs	—	—	—	—	—
Composite panels	33.14	36.03	30.28	5.75	2.86
Pulpwood	1,379.02	1,357.62	1,279.08	78.54	99.94
Pilings	—	—	—	—	—
Poles	—	—	—	—	—
Fuelwood	773.87	635.21	634.80	0.41	139.07
Miscellaneous	5.08	4.16	4.16	—	0.92
Total	2,358.81	2,194.54	2,106.82	87.72	251.99

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, North Carolina, 2015

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
	percent			
Saw logs	94.51	5.49	98.13	1.87
Veneer logs	—	—	—	—
Composite panels	91.37	8.63	84.04	15.96
Pulpwood	92.75	7.25	94.21	5.79
Pilings	—	—	—	—
Poles	—	—	—	—
Fuelwood	82.03	17.97	99.94	0.06
Miscellaneous	81.89	18.11	100.00	—
All products	89.32	10.68	96.00	4.00

— = no sample for the cell.

Table A.16—Volume of hardwood cull by product and utilization, North Carolina, 2015

Product	Total volume utilized	Nongrowing stock			
		Merchantable			
		Total	Utilized	Not utilized	Unmerchantable utilized
	cubic feet				
Saw logs	—	—	—	—	—
Veneer logs	—	—	—	—	—
Composite panels	9.31	7.87	7.23	0.64	2.08
Pulpwood	444.33	434.60	421.82	12.78	22.51
Pilings	—	—	—	—	—
Poles	—	—	—	—	—
Fuelwood	486.17	405.02	404.91	0.11	81.26
Miscellaneous	39.42	34.75	34.75	—	4.67
Total	979.23	882.24	868.71	13.53	110.52

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, North Carolina, 2015

Product	Overutilization		Underutilization	
	Merchantable utilized/ total volume utilized	Unmerchantable utilized/ total volume utilized	Merchantable utilized/total merchantable volume	Merchantable not utilized/total merchantable volume
	percent			
Saw logs	—	—	—	—
Veneer logs	—	—	—	—
Composite panels	77.66	22.34	91.87	8.13
Pulpwood	94.93	5.07	97.06	2.94
Pilings	—	—	—	—
Poles	—	—	—	—
Fuelwood	83.29	16.71	99.97	0.03
Miscellaneous	88.15	11.85	100.00	—
All products	88.71	11.29	98.47	1.53

— = no sample for the cell.

Wall, David J.; Cooper, Jason A.; Bentley, James W.; Gray, James A. 2018. North Carolina harvest and utilization study, 2015. e-Resour. Bull. SRS–216. Asheville, NC: U.S. Department of Agriculture Forest Service, Southern Research Station. 23 p.

In 2015, a harvest and utilization study was completed on 95 operations throughout North Carolina. There were 2,125 total trees measured: 1,284 or 60 percent were softwood, while 841 or 40 percent were hardwood. Results from this study showed that 85 percent of the total softwood volume measured was utilized for a product, and 15 percent was left as logging residue. Seventy-four percent of the total hardwood volume measured was utilized for a product, while 26 percent was left as logging residue.

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

Log truck with pole trailer loaded with tree-length loblolly pine pulpwood.

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