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# Kentucky Harvest and Utilization Study, 2007

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Cover photo: hardwood forest. (photo by Angie Rowe, U.S. Forest Service)



Felled hardwood tree being measured by field foresters. (photo by Tony Johnson (retired), U.S. Forest Service)



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## Foreword

This resource bulletin describes the principal findings of a harvest and utilization study conducted during the sixth inventory of Kentucky'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 Agricultural Research, Extension, and Education Reform Act of 1998 (1998 Farm Bill). 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 (SRS), Forest Inventory and Analysis (FIA) Research Work Unit. Unit headquarters is located 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

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The SRS gratefully acknowledges the work of the State and Federal FIA field crews 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.



Skidder gathering and skidding felled hardwood. (photo courtesy of Larry Lowe, Kentucky Division of Forestry)



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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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# Kentucky Harvest and Utilization Study, 2007

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## Introduction

Forest planners and managers have a continuing need for information about timber resources, and the public is expressing increased 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 decision making. Information about the condition of and changes in the timber resource of Kentucky 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 (e.g., 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, as well as the portion left in the forest.

This bulletin presents the findings of a 2007 harvest and utilization study conducted in Kentucky. 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 53 active harvest operations throughout Kentucky (fig. 1). This bulletin also provides 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 Forest Inventory and Analysis (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



Draft horses skidding a hardwood log to the logging deck.  
(photo by Tony Johnson (retired), U.S. Forest Service)

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 ( $\geq 5$ -inches d.b.h.) 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, the main stem from 4 inches d.o.b. to the growing top of the tree, and of any limbs  $\geq 4$  inches with at least one 5-foot section are considered nongrowing-stock volume by FIA standards. Rough or rotten trees were also sampled and comprise another piece of non-growing stock (cull) volume. Figure 2 illustrates a poletimber tree, a sawtimber tree, and the growing-stock section of each.

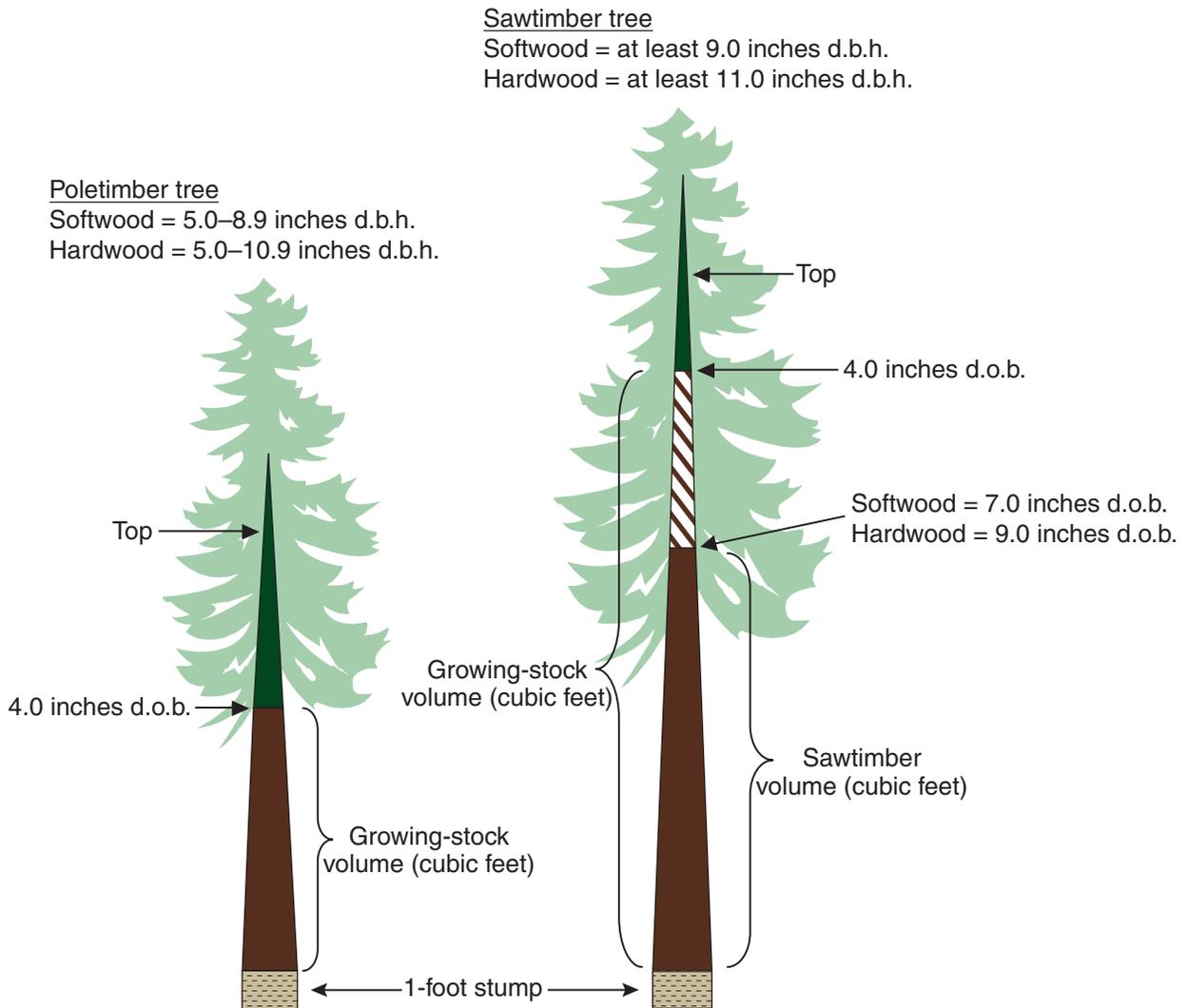


Figure 2—Stem sections of poletimber and sawtimber trees.

## Methods

### Site Stratification and Selection

Producing a complete list of timber-harvesting operations and ownerships in a State such as Kentucky is problematic. Because of the complexity of the timber industry, it is impossible to list the names and locations of all operations 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 Kentucky by species group (Bentley and Lowe 2007). Using those proportions, 11 of the 53 selected sites were designated as softwood operations and the remaining 42 as hardwood operations. The same guidelines were used to designate harvest operations by product, but allow for more flexibility because of the difficulty in locating harvesting operations for some products. Table 1 shows the final breakdown in number of harvest operations, total trees, trees planted, and percentage of trees planted by product and species group.

**Table 1—Number of operations, total trees, planted trees, and percent planted by product and species group, Kentucky, 2007**

Product and species group	Operations	Trees		
		Total	Planted	
		----- number -----	----- percent -----	
<b>Saw logs</b>				
Softwood	4	91	0	—
Hardwood	34	844	25	3
Total	38	935	25	3
<b>Veneer logs</b>				
Softwood	0	0	0	—
Hardwood	0	1	0	—
Total	0	1	0	—
<b>Pulpwood</b>				
Softwood	6	144	0	—
Hardwood	8	189	0	—
Total	14	333	0	—
<b>Fence posts</b>				
Softwood	1	28	0	—
Hardwood	0	0	0	—
Total	1	28	0	—
<b>Miscellaneous</b>				
Softwood	0	0	0	—
Hardwood	0	13	0	—
Total	0	13	0	—
<b>All products</b>				
Softwood	11	263	0	0
Hardwood	42	1,047	25	2
Total	53	1,310	25	2

— = no sample for the cell.

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 (Bentley and Lowe 2007) 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. Figure 1 shows where the final harvest operations considered in this bulletin were located.

### Data Collection

During the sixth survey, field crews were trained to collect data on felled trees at harvest locations. Using the list of operations and a map of sites, crews began collecting data by county for the particular species group and designated product(s). Data collection was completed October 2007 on active harvest operations. 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 points for specific products. Field crews also noted the type of logging equipment used. This information was applied 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. Randomly selected trees alive prior to harvest with a diameter of  $\geq 5$  inches d.b.h. were measured for the study. 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 sawyer, according to particular specifications set by the receiving mill, usually determines the end of utilization. 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 d.o.b. top. However, most trees are not cut exactly at a 1-foot stump, nor are they cut off at exactly 4 inches diameter. For example, trees cut off above a 1-foot stump and below 4 inches d.o.b. 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 diameter 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.



Representation of residual hardwood stump heights. (photo by Tony Johnson (retired), U.S. Forest Service)

## Highlights

### Characteristics of Harvested Trees in Kentucky

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 1,310 trees, of which 263 (20 percent) were softwood and 1,047 (80 percent) were hardwood.

According to Bentley and Lowe (2007), softwood and hardwood saw-log volume together accounted for 78 percent of the total product output for the State. The study classified 91 trees as having softwood saw logs averaging 10.0 inches d.b.h. The study also classified 844 hardwood trees as having saw logs averaging 16.8 inches d.b.h. Three percent, or 25 trees, of the hardwood saw-log trees were planted averaging 16.9 inches d.b.h., little difference in d.b.h. when compared to trees that come from natural stands. Veneer was another product found in the State. One hardwood tree was measured for veneer with a diameter of 16.3 inches d.b.h. Pulpwood and fence posts constitute two components of the product mix for Kentucky. Based on 144 trees measured for softwood pulpwood, the average d.b.h. was 12.3 inches, while the 189 trees measured for hardwood pulpwood averaged 10.2 inches d.b.h. Of the 28 softwood fence post trees measured, the average d.b.h. was 6.8 inches. Miscellaneous products were another product sampled within the State. Thirteen trees were measured for miscellaneous products averaging 15.6 inches d.b.h. Table 2 shows the average d.b.h. for each product by species group.

Bole length is the distance between a 1-foot stump and a 4-inch d.o.b. top. As expected, trees harvested for solid wood products tended to have longer average bole lengths than trees harvested for pulpwood or miscellaneous products. The average bole length for softwood trees measured for saw logs was 39 feet, while trees measured for hardwood saw logs had an average bole length of 65 feet. The bole length for the tree used for veneer logs was 58 feet.

**Table 2—Average diameter at breast height by species group, stand origin, and product, Kentucky, 2007**

Species group and stand origin	Product				
	Saw logs	Veneer logs	Pulpwood	Fence posts	Miscellaneous
	<i>inches</i>				
Softwood					
Natural	10.00	—	12.25	6.79	—
Planted	—	—	—	—	—
Total	10.00	—	12.25	6.79	—
Hardwood					
Natural	16.77	16.30	10.20	—	15.58
Planted	16.91	—	—	—	—
Total	16.77	16.30	10.20	—	15.58

— = no sample for the cell.

One exception to the longer lengths for solid wood products were trees used for pulpwood. Trees measured for pulpwood had average bole lengths of 62 feet for softwoods and 50 feet for hardwoods. Softwood trees measured for fence posts had an average bole length of 27 feet. Hardwood trees measured for miscellaneous products had an average bole length of 46 feet. Planted sites constituted a subset of all trees measured. Trees measured in planted stands tended to have longer bole lengths than those measured in the natural stands. Table 3 shows the average bole length by species group.

**Table 3—Average bole length by species group, stand origin, and product, Kentucky, 2007**

Species group and stand origin	Product				
	Saw logs	Veneer logs	Pulpwood	Fence posts	Miscellaneous
	<i>feet</i>				
Softwood					
Natural	38.73	—	61.99	26.82	—
Planted	—	—	—	—	—
Total	38.73	—	61.99	26.82	—
Hardwood					
Natural	64.89	58.00	49.52	—	45.85
Planted	67.36	—	—	—	—
Total	64.97	58.00	49.52	—	45.85

— = no sample for the cell.

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 0.46 to 0.87 foot. Most softwood trees harvested had an average residual stump height of about a 0.46 to 0.55 foot, while harvested hardwood trees averaged slightly higher residual stumps. In softwoods and across all products, this accounted for about 41 percent of the stump volume being utilized. In hardwoods and across all products, about 22 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 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 3 percent of the nongrowing-stock portion that was utilized. The average end of utilization for softwood saw logs was 5.5 inches, and for hardwood saw logs 10.4 inches. The average end of utilization for softwood and hardwood pulpwood was 5.0 and 6.1 inches, respectively. Hardwood trees coming from natural and planted saw log stands showed under a half of an inch 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, Kentucky, 2007**

Species group and stand origin	Product				
	Saw logs	Veneer logs	Pulp-wood	Fence posts	Miscellaneous
	<i>feet</i>				
Softwood					
Natural	0.55	—	0.46	0.51	—
Planted	—	—	—	—	—
Total	0.55	—	0.46	0.51	—
Hardwood					
Natural	0.73	0.80	0.58	—	0.87
Planted	0.55	—	—	—	—
Total	0.73	0.80	0.58	—	0.87

— = no sample for the cell.

**Table 5—Average end of utilization by species group, stand origin, and product, Kentucky, 2007**

Species group and stand origin	Product				
	Saw logs	Veneer logs	Pulp-wood	Fence posts	Miscellaneous
	<i>inches</i>				
Softwood					
Natural	5.52	—	5.03	4.68	—
Planted	—	—	—	—	—
Total	5.52	—	5.03	4.68	—
Hardwood					
Natural	10.38	11.60	6.07	—	10.11
Planted	10.79	—	—	—	—
Total	10.40	11.60	6.07	—	10.11

— = no sample for the cell.

### Softwood Removals

Results from this study document 6,708 cubic feet of softwood volume, of which 5,530 cubic feet, or 82 percent, was used for product(s). Eighteen percent, or 1,179 cubic feet, was left onsite as logging residue (fig. 3). 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. 4) (table A.1).

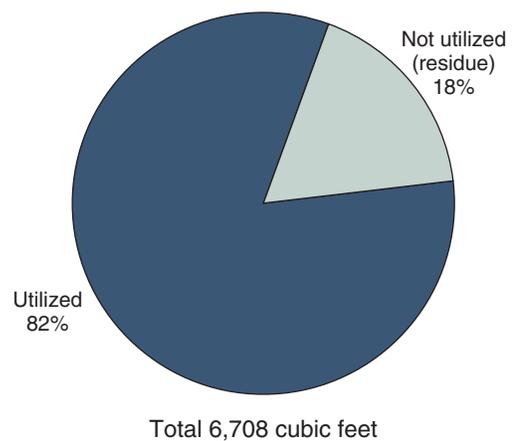


Figure 3—Disposition of total softwood harvest volume, Kentucky, 2007.

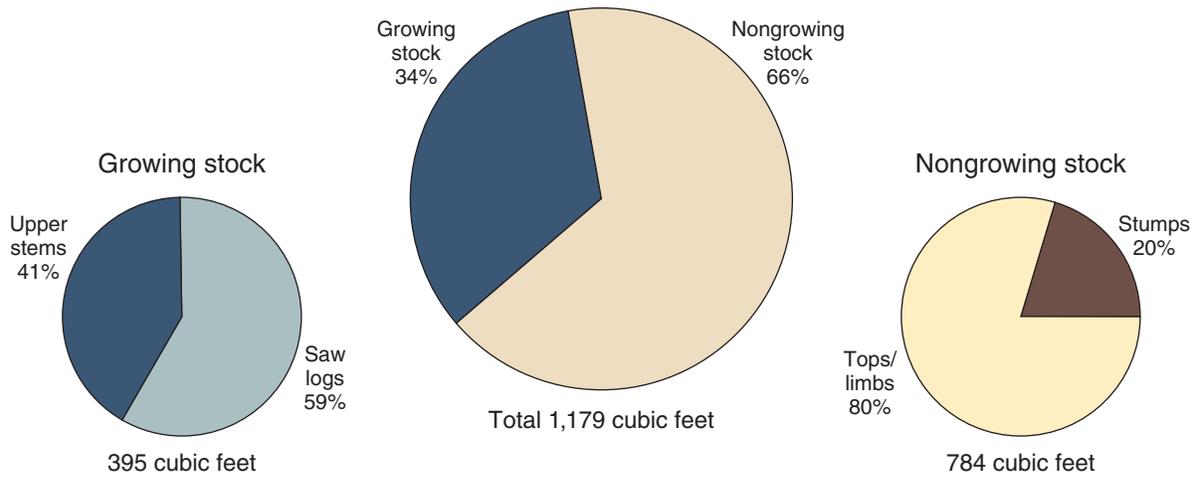


Figure 4—Softwood residue by volume type, Kentucky, 2007.

The total softwood growing-stock volume measured was 5,804 cubic feet, of which 93 percent was utilized and 7 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, 121 cubic feet, or 2.2 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, trees harvested for pulpwood had average rates of utilization for the merchantable portion of the tree (97 percent) and the fourth highest rate of overutilization (2.0 percent), meaning that more of the nongrowing-stock portion of the tree was used for products and less was left as logging residue.

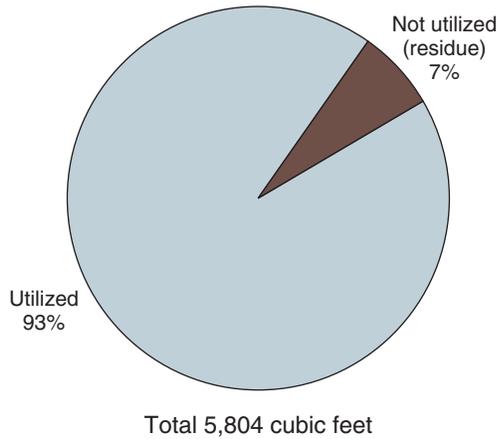


Figure 5—Disposition of softwood growing-stock volume, Kentucky, 2007.



Residual logging residue after harvest activity is complete. (photo by James Bentley, U.S. Forest Service)

## Hardwood Removals

Results from this study document 55,783 cubic feet of hardwood volume, of which 40,355 cubic feet, or 72 percent, was utilized for product(s). Twenty-eight percent, or 15,428 cubic feet, was left onsite as logging residue (fig. 6). Forty-two percent of residue volume came from the growing-stock portion of trees, and 58 percent came from the nongrowing-stock portion (stumps, tops, and limbs) (fig. 7) (table A.1).

The total hardwood growing-stock volume measured was 46,383 cubic feet, of which 86 percent was used and 14 percent was logging residue (fig. 8). By FIA merchantability standards, the logging residue portion is underutilized volume. Of the total utilized volume, 525 cubic feet, or just over 1 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).

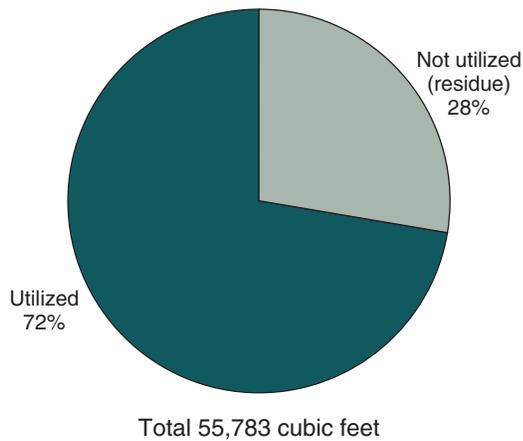


Figure 6—Disposition of total hardwood harvest volume, Kentucky, 2007.

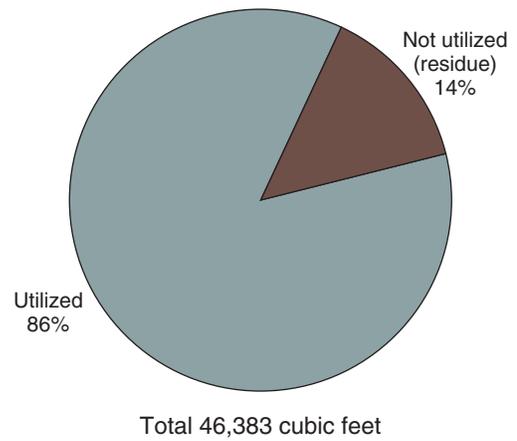


Figure 8—Disposition of hardwood growing-stock volume, Kentucky, 2007.

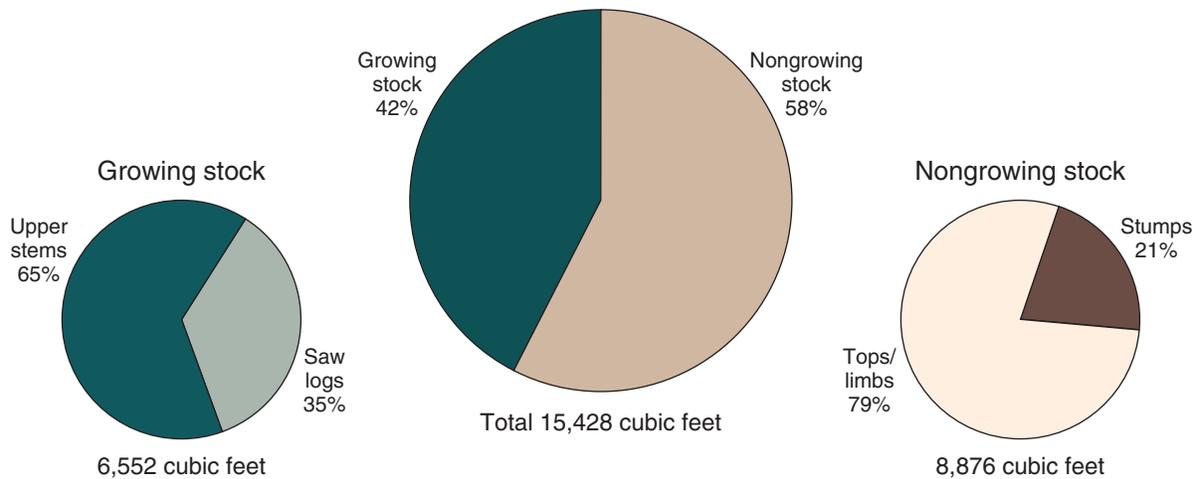


Figure 7—Hardwood residue by volume type, Kentucky, 2007.



Hardwood saw logs stacked on barge for transport. (photo courtesy of Larry Lowe, Kentucky Division of Forestry)

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 89 percent, however, those trees measured for pulpwood were more fully utilized, and more of the nongrowing-stock portion was used for products. Trees measured for hardwood veneer logs were the least utilized of all, although they have the most nongrowing-stock material.

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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  $\geq 5.0$  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  $\leq 0.50$ , 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 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  $\geq 5.0$  inches d.b.h. 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, fence posts, 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  $\geq 8$  feet, 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  $\geq 8$  feet, 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, fence posts, 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  $\geq 5.0$  inches d.b.h. to qualify.

**Saplings**—Live trees 1.0 to 4.9 inches d.b.h.

**Saw log**—A roundwood product, usually  $\geq 8$  feet in length, 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  $\geq 9.0$  inches d.b.h. and hardwoods  $\geq 11.0$  inches d.b.h.

**Sawtimber volume**—Growing-stock volume in the saw-log portion of sawtimber-sized trees in board feet (International  $\frac{1}{4}$ -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  $\frac{1}{4}$ -inch rule) is the standard unit used for saw logs and veneer; cords are used for pulpwood, composite panel, and fuelwood; hundred pieces for Fence posts; 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.



Skidder pulling hardwood logs to the logging deck. (photo courtesy of Larry Lowe, Kentucky Division of Forestry)

**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  $\geq 3$  inches d.b.h., a more or less definitely formed crown of foliage, and a height of  $\geq 13$  feet (at maturity).

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

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

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

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

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**Table A.1—Harvest and utilization volume by species group, source, and volume type, Kentucky, 2007**

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	6,081.25	5,296.36	4,620.49	231.54	337.55	106.78	784.89	94.27	133.06	6.98	550.58
Poletimber	627.10	507.35	—	—	450.57	56.78	119.75	14.23	26.33	5.70	73.49
Total	6,708.35	5,803.71	4,620.49	231.54	788.12	163.56	904.64	108.50	159.39	12.68	624.07
Hardwood											
Sawtimber	53,640.61	44,620.02	36,946.35	2,320.99	1,262.14	4,090.54	9,020.59	474.69	1,807.07	4.54	6,734.29
Poletimber	2,142.66	1,763.12	—	—	1,622.39	140.73	379.54	41.45	70.46	3.92	263.71
Total	55,783.27	46,383.14	36,946.35	2,320.99	2,884.53	4,231.27	9,400.13	516.14	1,877.53	8.46	6,998.00

— = no sample for the cell.

**Table A.2—Volume of softwood growing stock by product and utilization for sawtimber and poletimber, Kentucky, 2007**

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	1,092.41	1,247.77	1,062.33	185.44	30.08	886.27	780.36	103.23	2.69
Veneer logs	—	—	—	—	—	—	—	—	—
Pulpwood	4,322.62	4,427.37	4,236.42	190.95	86.20	3,965.75	3,840.13	92.21	33.41
Fence posts	114.75	128.59	109.86	18.73	4.89	—	—	—	—
Miscellaneous	—	—	—	—	—	—	—	—	—
Total	5,529.78	5,803.73	5,408.61	395.12	121.17	4,852.02	4,620.49	195.44	36.10

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, Kentucky, 2007**

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	97.25	2.75	85.14	14.86	88.05	11.65	0.30
Veneer logs	—	—	—	—	—	—	—
Pulpwood	98.01	1.99	95.69	4.31	96.83	2.33	0.84
Fence posts	95.74	4.26	85.43	14.57	—	—	—
Miscellaneous	—	—	—	—	—	—	—
All products	97.81	2.19	93.19	6.81	95.23	4.03	0.74

— = no sample for the cell.

**Table A.4—Volume of softwood growing stock by product and utilization for sawtimber, Kentucky, 2007**

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	881.90	1,009.25	858.45	150.80	23.45	886.27	780.36	103.23	2.69
Veneer logs	—	—	—	—	—	—	—	—	—
Pulpwood	4,177.39	4,287.12	4,099.59	187.53	77.80	3,965.75	3,840.13	92.21	33.41
Fence posts	—	—	—	—	—	—	—	—	—
Miscellaneous	—	—	—	—	—	—	—	—	—
Total	5,059.29	5,296.37	4,958.04	338.33	101.25	4,852.02	4,620.49	195.44	36.10

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, Kentucky, 2007**

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	97.34	2.66	85.06	14.94	88.05	11.65	0.30
Veneer logs	—	—	—	—	—	—	—
Pulpwood	98.14	1.86	95.63	4.37	96.83	2.33	0.84
Fence posts	—	—	—	—	—	—	—
Miscellaneous	—	—	—	—	—	—	—
All products	98.00	2.00	93.61	6.39	95.23	4.03	0.74

— = no sample for the cell.

**Table A.6—Volume of softwood growing stock by product and utilization for poletimber, Kentucky, 2007**

Product	Total volume utilized	Growing stock			Nongrowing stock utilized
		Total	Utilized	Not utilized	
	<i>cubic feet</i>				
Saw logs	210.51	238.52	203.88	34.64	6.63
Veneer logs	—	—	—	—	—
Pulpwood	145.23	140.25	136.83	3.42	8.40
Fence posts	114.75	128.59	109.86	18.73	4.89
Miscellaneous	—	—	—	—	—
Total	470.49	507.36	450.57	56.79	19.92

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, Kentucky, 2007**

Product	Overutilization		Underutilization	
	Growing stock utilized/ total volume utilized	Nongrowing stock utilized/ total volume utilized	Growing stock utilized/ total growing-stock volume	Growing stock not utilized/ total growing-stock volume
	<i>percent</i>			
Saw logs	96.85	3.15	85.48	14.52
Veneer logs	—	—	—	—
Pulpwood	94.22	5.78	97.56	2.44
Fence posts	95.74	4.26	85.43	14.57
Miscellaneous	—	—	—	—
All products	95.77	4.23	88.81	11.19

— = no sample for the cell.

**Table A.8—Volume of softwood cull by product and utilization, Kentucky, 2007**

Product	Total volume utilized	Nongrowing stock			
		Merchantable		Not utilized	Unmerchantable utilized
Total	Utilized	Utilized	utilized		
	<i>cubic feet</i>				
Saw logs	—	—	—	—	—
Veneer logs	—	—	—	—	—
Pulpwood	16.01	15.53	15.53	—	0.48
Fence posts	—	—	—	—	—
Miscellaneous	—	—	—	—	—
Total	16.01	15.53	15.53	—	0.48

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, Kentucky, 2007**

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	—	—	—	—
Veneer logs	—	—	—	—
Pulpwood	97.00	3.00	100.00	—
Fence posts	—	—	—	—
Miscellaneous	—	—	—	—
All products	97.00	3.00	100.00	—

— = no sample for the cell.

**Table A.10—Volume of hardwood growing stock by product and utilization for sawtimber and poletimber, Kentucky, 2007**

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	37,369.00	43,082.66	36,906.66	6,176.00	462.34	37,894.23	35,662.77	-1,287.92	3,519.40
Veneer logs	31.06	38.33	30.62	7.71	0.44	34.48	30.62	0.89	2.97
Pulpwood	2,598.33	2,840.78	2,538.36	302.42	59.97	985.81	912.31	47.41	26.09
Fence posts	—	—	—	—	—	—	—	—	—
Miscellaneous	357.03	421.32	355.18	66.14	1.85	352.80	340.63	-44.17	56.34
Total	40,355.42	46,383.09	39,830.82	6,552.27	524.60	39,267.32	36,946.33	-1,283.79	3,604.80

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, Kentucky, 2007**

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	98.76	1.24	85.66	14.34	94.11	-3.40	9.29
Veneer logs	98.58	1.42	79.89	20.11	88.81	2.58	8.61
Pulpwood	97.69	2.31	89.35	10.65	92.54	4.81	2.65
Fence posts	—	—	—	—	—	—	—
Miscellaneous	99.48	0.52	84.30	15.70	96.55	-12.52	15.97
All products	98.70	1.30	85.87	14.13	94.09	-3.27	9.18

— = no sample for the cell.

**Table A.12—Volume of hardwood growing stock by product and utilization for sawtimber, Kentucky, 2007**

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	37,122.62	42,816.98	36,664.09	6,152.89	458.53	37,894.23	35,662.77	-1,287.92	3,519.40
Veneer logs	31.06	38.33	30.62	7.71	0.44	34.48	30.62	0.89	2.97
Pulpwood	1,181.65	1,349.83	1,162.89	186.94	18.76	985.81	912.31	47.41	26.09
Fence posts	—	—	—	—	—	—	—	—	—
Miscellaneous	352.34	414.84	350.84	64.00	1.50	352.80	340.63	-44.17	56.34
Total	38,687.67	44,619.98	38,208.44	6,411.54	479.23	39,267.32	36,946.33	-1,283.79	3,604.80

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, Kentucky, 2007**

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	98.76	1.24	85.63	14.37	94.11	-3.40	9.29
Veneer logs	98.58	1.42	79.89	20.11	88.81	2.58	8.61
Pulpwood	98.41	1.59	86.15	13.85	92.54	4.81	2.65
Fence posts	—	—	—	—	—	—	—
Miscellaneous	99.57	0.43	84.57	15.43	96.55	-12.52	15.97
All products	98.76	1.24	85.63	14.37	94.09	-3.27	9.18

— = no sample for the cell.

**Table A.14—Volume of hardwood growing stock by product and utilization for poletimber, Kentucky, 2007**

Product	Total volume utilized	Growing stock			Nongrowing stock utilized
		Total	Utilized	Not utilized	
	<i>cubic feet</i>				
Saw logs	246.38	265.68	242.57	23.11	3.81
Veneer logs	—	—	—	—	—
Pulpwood	1,416.68	1,490.95	1,375.47	115.48	41.21
Fence posts	—	—	—	—	—
Miscellaneous	4.69	6.48	4.34	2.14	0.35
Total	1,667.75	1,763.11	1,622.38	140.73	45.37

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, Kentucky, 2007**

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	98.45	1.55	91.30	8.70
Veneer logs	—	—	—	—
Pulpwood	97.09	2.91	92.25	7.75
Fence posts	—	—	—	—
Miscellaneous	92.54	7.46	66.98	33.02
All products	97.28	2.72	92.02	7.98

— = no sample for the cell.

**Table A.16—Volume of hardwood cull by product and utilization, Kentucky, 2007**

Product	Total volume utilized	Nongrowing stock			
		Merchantable			Unmerchantable utilized
		Total	Utilized	Not utilized	
<i>cubic feet</i>					
Saw logs	50.64	49.90	49.90	—	0.74
Veneer logs	—	—	—	—	—
Pulpwood	52.13	50.92	50.92	—	1.21
Fence posts	—	—	—	—	—
Miscellaneous	—	—	—	—	—
Total	102.77	100.82	100.82	—	1.95

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, Kentucky, 2007**

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	98.54	1.46	100.00	—
Veneer logs	—	—	—	—
Pulpwood	97.68	2.32	100.00	—
Fence posts	—	—	—	—
Miscellaneous	—	—	—	—
All products	98.10	1.90	100.00	—

— = no sample for the cell.

**Cooper, Jason A.; Bentley, James W.** 2013. Kentucky harvest and utilization study, 2007. e-Resour. Bull. SRS-195. Asheville, NC: U.S. Department of Agriculture Forest Service, Southern Research Station. 25 p.

In 2007, a harvest and utilization study was conducted on 53 operations in Kentucky. There were 1,310 total trees measured: 263 or 20 percent were softwood, while 1,047 or 80 percent were hardwood. Results from this study showed that 82 percent of the total softwood volume measured was utilized for a product, and 18 percent was left as logging residue. Seventy-two percent of the total hardwood volume measured was utilized for a product, while 28 percent was left as logging residue.

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



Tracked feller buncher used for mechanized felling. (photo courtesy of Larry Lowe, Kentucky Division of Forestry)



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