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Weight, Volume, and Physical Properties of Major Hardwood Species In the Upland-South

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ABSTRACT

Weight, volume, and physical properties of trees 1 to 20 inches d.b.h. were determined for sweetgum, yellow-poplar, hickory, post oak, scarlet oak, southern red oak, and white oak in Alabama, Mississippi, Arkansas, Kentucky, and Tennessee. Equations for hard hardwoods, soft hardwoods, and individual species are presented for predicting green and dry weight and green volume of the total tree above stump and its components. Input variables are d.b.h. and total height, d.b.h. and height to a 4-inch top, d.b.h. and saw-log merchantable height, or d.b.h. alone. Equations were developed by destructive sampling of 486 trees at 15 locations. Average specific gravity, moisture content, and weight per cubic foot of wood, bark, and wood and bark combined are presented for each species by tree size class and component. Bark percentage is also presented for each species by tree size class and component.

Keywords: Biomass, equations, specific gravity, moisture content, bark percentage, weight per cubic foot.

Hardwood forests of the Upland-South are underutilized. Harvests of wood for energy and fiber products could be increased many fold in these forests, and growth of high-quality sawtimber trees could be improved in the process. Increased utilization of Upland-South hardwoods for low-value fiber and energy products, however, is unlikely in the absence of reliable data on the resource. Until now, however, few data have been available on the weight, volume, and physical properties of total trees and their components for hardwood species of this region.

To meet this need, a southwide study was initiated by the North Carolina State Hardwood Research Cooperative and the USDA Forest Service with partial funding from the Tennessee Valley Authority's Southeastern Regional Biomass Energy Program, and the Department of Energy. The primary objectives of this study were to determine the amount and distribution of biomass in even-aged fully stocked natural stands and to develop equations for estimating the weight and volume of forest stands, individual trees, and treo components. Secondary objectives were to determine the specific gravity, moisture content, and energy potential of Upland-South hardwoods.

For this study, the South was divided into three geographic rsgions--the Gulf and Atlantic Coastal Plains, the Piedmont Plateau, and the Upland-South. The data collected in the Gulf and Atlantic Coastal Plains and Piedmont have been reported in earlier publications (Clark and others 1983, 198510, 1986; Frederick and others 1983; Gower and others 1983; Messina and others'1983, Megalos and others 1986).

This Paper presents tree physical properties and green weight, dry weight, and qreen cubic-volume prediction equations for total tree and trees components of seven species --sweetgum (*Liquidambar styraciflua* L.), yellow-poplar (*Liriodendron tulipifera* L.), hickory species (*Carya* spp.), post oak (*Quercus stellata* Wangenh.), scarlet oak (*Q. coccinea* Muenchh.), southern red oak (*Q. falcata* Michx.), and whi te oak (*Q. alba* L.) sampled in the Upland-South.

Other species were also sampled but not in sufficient number for reliable predicting of their weights and volumes in separate equations. Values for red maple (*Acer rubrum* L.), silver maple (*A. saccharinum* L.), blackgum (*Nyssa sylvatica* var. *biflora* (Walt.) Sary.), and sycamore (*Platanus occidentalis* L.) trees are included in the soft-hardwood averages presented. Dogwood (*Cornus florida* L.), white ash (*Fraxinus americana* L.), cherrybark oak (*Quercus falcata* var. *pagodifolia* Ell.), chestnut oak (*Q. prinus* L.) and other minor species data are included in the hard-hardwood averages.

Wood and bark specific gravity, moisture content, bark content, and green weight per cubic foot are presented for the total tree and its components by species and tree size classes. Equations are given for estimating the weight and volume of wood, bark, and foliage, wood and bark and wood only in the total tree, total stem, and the saw-log component of the stem. Katio equations are also included for estimating total stem and saw-log stem weight or volume to any specified top diameter outside bark (d.o.b.).

Procedure

Field

Biomass was sampled on 12 1/10-acre circular plots in mixed, even-aged hardwood stands in the Upland-South (fig. 1). Three age classes (20, 40, and 60 years) were sampled on two site types:

Bottom land. Flood plain areas of major drainage systems and adjacent stream margins, predominantly sandy loam to silt loam surface soils.

Upland (slopes and ridges). Land occupying the large upland interstream divides, predominantly clay to sandy clay loam surface soils.

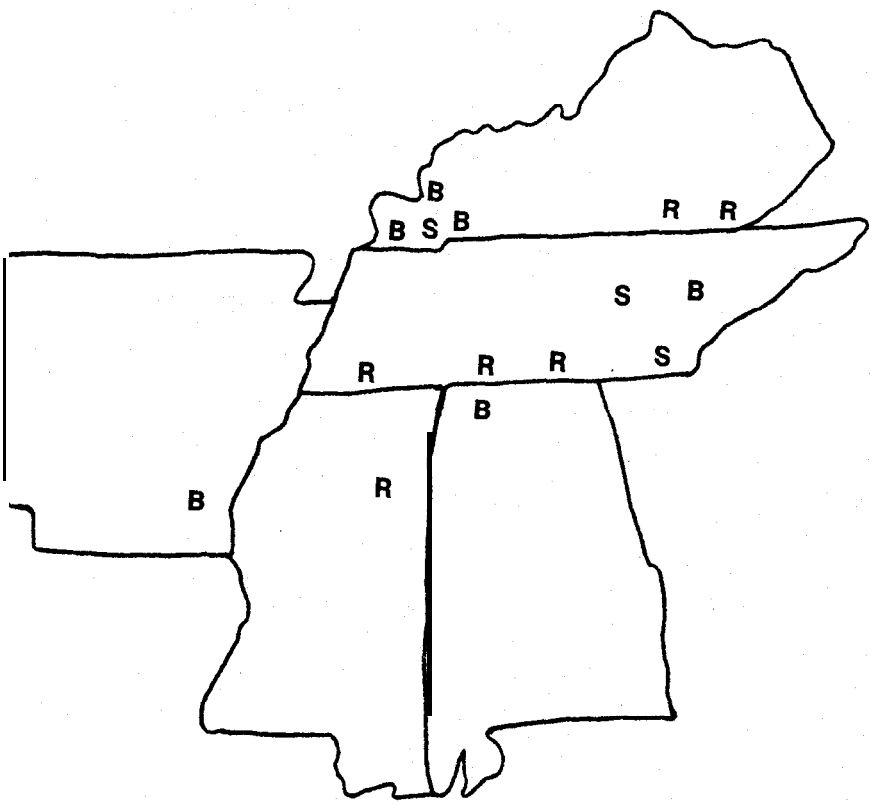

Figure 1.--Locations of plots where trees were sampled on bottom-land sites (B), ridge and upland sites (R), and supplemental (S) locations.

Age and site combinations were replicated twice. Plots for all ages and site types were randomly located within representative fully stocked stands. Tree data collected on all plots were used to develop the species equations and properties data reported here. In addition to samples taken on the fixed-area plots, a stratified random sample of three trees per 2-inch class from 6- to 20-inches in diameter at breast height (d.b.h.) was taken at each of three locations to obtain an even distribution of trees across d.b.h. classes for commercially important species. Figure 1 shows the location of the fixed area and stratified random sample plots.

Weights and volumes of entire trees above stumps and of tree cornponents were collected for trees 1 inch d.b.h. and larger. All trees > 5.0 inches d.b.h. on the 1/10-acre plots were sampled. At the center of each plot, a concentric 1/50-acre subplot was located on which all trees 1.0 to 4.9 inches d.b.h. were sampled.

Means and ranges in age and physical dimensions of measured trees are shown in table 1 for each species and species group sampled. Stump height averaged 0.2 foot for trees 1.0 to 4.9 inches d.b.h., 0.6 foot for trees 5.0 to 10.9 inches d.b.h., and 1.0 foot for trees > 11.0 inches d.b.h. Girard form class of the sawtimber-size trees (> 11.0 inches d.b.h.) ranged from 60 to 85 and averaged 76 for the soft hardwoods; it ranged from 64 to 87 and averaged 76 for the hard hardwoods.

Each tree was felled and measured for d.o.b. at 4-foot intervals up the stem. Total height; height to the saw-log top; height to 9-, 4-, and 2-inch d.o.b. tops, and height to base of full live crown were also recorded. Cross-sectional disks of wood and bark were removed from the stem and branches of sample trees for laboratory determination of specific gravity, moisture content, bark percentage, energy value, and nutrient concentration. In all trees > 5.0 inches d.b.h, except sawtimber-quality trees (trees > 11.0 inches d.b.h. with a minimum of one 16-foot grade 3 log), disks were cut at the butt, at breast height, at quarter-points to the 4-inch d.o.b. top, and at the 2-inch top. In sawtimber trees, disks were removed at the butt, at each saw-log bucking point, and at the stem locations where d.o.b. measured 9, 4, and 2 inches. For trees less than 5.0 inches d.b.h., three disks per stem were taken--at stump height and at 25 and 75 percent of total stem height.

The branches of each tree were cut from the stem and placed in four size categories: extra large (> 4.0 inches d.o.b.), large (2.0 to 3.9 inches d.o.b.), medium (0.6 to 1.9 inches d.o.b.), and small (< 0.5 inches d.o.b.). Three cross-sectional disks were cut from randomly selected branches in each size category for analysis in the laboratory. Sample branches were randomly selected and weighed with and without foliage to estimate foliage weight. A subsample of the foliage was taken to determine foliage moisture content and nutrient content.

The stem of each tree was weighed by components (saw logs, pulpwood, and topwood) and the branches of each tree were weighted by size category.

Laboratory

Specific gravity was computed from green volume and ovendry weight. Moisture content as a percentage of ovendry weight was computed on the basis of weight loss after samples were dried to a constant weight at 215 °F. Percentage of bark was determined from disks and based on the green weight of sample disks. Moisture content, specific gravity, and percentages of bark in stem, branches, and total tree were calculated by weighting disk values in proportion to the volume of the component they represented. Weighted values for moisture content were used to convert component green weiyhts to ovendry weights.

For each species, diameter inside bark (d.i.b.) prediction equations were developed from d.o.b. and d.i.b. stem disk measurements and the d.o.b. and height measurements taken at 4-foot intervals up the stem of each tree. The volume of wood in the stem to the saw-log, 9-inch, 4-inch, 3-inch, and 2-inch tops, and to the tip were calculated using Smalian's formula. Green weight per cubic foot of stem bark and branch wood and bark were calculated from weighted values for specific gravity and moisture content with the equation:

$$\text{Green weight per cubic foot} = \left[1 + \frac{MC}{100}\right] \cdot SG \cdot C \qquad (1)$$

where: MC = weighted moisture content in percent

SG = weighted specific gravity

C = 62.4 pounds (weight of water per cubic foot)

Cubic-foot vol ume of stem bark and branch wood and bark were computed by dividing green component weiyht by its green weight per cubic foot. Cubic-foot volume of stem wood and bark combined was computed by adding the volume of bark to the volume of wood.

Analysis

Regression equations were developed to predict green and dry weight of wood, bark, and foliage and green volume of wood and bark in the total tree above stump, in the stem from butt to tip, and in the saw-log stem. Independent variables were diameter at breast height (D), total height (Th), saw-log merchantable height (Mh), and height to a 4-inch d.o.b. top (H4).

A logarithmic transformation (base 10) was used to obtain relatively homogeneous variance, which is assumed in regression analysis. Two equations were developed for the d.b.h., d.b.h. and total height, and d.b.h. and height to 4-inch top--one for trees < 11.0 inches d.b.h. and one for trees > 11.0 inches d.b.h. The 11 inches was not the statistically optimum point to shift from one equation to the other for al1 species or tree components, but it was the most desirable from a practica1 standpoint. Hardwood trees < 11 inches in diameter are classified as sapling or poletimber, and trees > 11 inches are classified as sawtimber. The procedure outlined in Draper and Smith (1981) for fitting two linear equations with a known point of intersection was used to develop the following equations:

$$\log Y_p = a + b \log X + E \qquad (2)$$

$$\log Y_s = a + b \log (11^2 H) + c \log (D^2/11^2) + E \qquad (3)$$

where: Y_p = predicted component weight or volume for trees < 11.0 inches d.b.h.

Y_s = predicted component weight or volume for trees > 11.0 inches d.b.h.

X = D^2, D^2Th, or D^2H4

H = Th or H4

D = d.b.h.

E = experimental error

a,b,c = regression coefficients

The following model was used for developing regression equations based on d.b.h. and saw-log merchantable height:

$$\log Y = a + b \log X_1 + c \log X_2 + E \quad (4)$$

where: Y = predicted component weight or volume

$X_1 = D^2$

$X_2 = Mh$

E = experimental error

a,b,c = regression coefficients

When logarithmic estimates are converted back to original units, they are biased downward because the antilogarithm of an estimated mean is the geometric rather then the arithmetic mean (Cunia 1964). To adjust for this bias, a. correction factor was computed and applied to each model by using Baskerville's (1972) procedure. The final equations, including correction factors, were:

$$Y = 10^{a + b \log (D^2) + c \log (Mh) + (S^2_{y.x} \log_e 10)/2} \quad (5)$$

$$Y_p = 10^{a + b \log (D^2H) + (S^2_{y.x} \log_e 10)/2} \quad (6)$$

$$Y_s = 10^{a + b \log (11^2H) + c \log (D^2/11^2) + (S^2_{y.x} \log_e 10)/2} \quad (7)$$

Equations (5), (6), and (7) can be simplified to:

$$Y = a' (D^2)^b (Mh)^c \quad (8)$$

$$Y_p = a' (D^2H)^b \quad (9)$$

$$Y_s = a'' (D^2)^b (H)^c \quad (10)$$

where: $a' = 10^{a + (S^2_{y.x} \log_e 10)/2}$

$a'' = a' (11^2)^{b - c}$

$S^2_{y.x}$ = error mean square from regression analysis

Comparison of average deviations (actual minus predicted) by d.b.h. classes and the sums of the squared deviations for the single log-log equation and segmented log-log equation showed that segmented log-log equations (9) and (10) gave the best results for the d.b.h., d.b.h. and total height, and d.b.h. and height to 4-inch top independent variable combinations (Clark and others 1985a). Equations (9) and (10) are more complex than a single equation, but the improved accuracy justified their use.

The exponential ratio equation used to estimate the proportion of predicted total-stem weight or volume in a lesser stom section to a specified top d.o.b. was:

$$Y_R = e^a (d^b D^c) \tag{11}$$

where: Y_R = ratio of stem weight or volume to top d.o.b. to predicted total stem

d = specified stem top diameter in inches

D = tree diameter at breast height in inches

a,b,c = regression coefficients

e = base of natural log = 2.71828

The exponential ratio model shown below was developed to estimate a ratio for expanding saw-log stem weight or volume to any d.o.b. top above the saw-log top.

$$Y_R = e^a \left[(Mh)^b \left(\left(1 - \left(\frac{d}{.78D} \right)^2 \right)^2 \right)^c \right] \tag{12}$$

where: Y_R = ratio of stem weight or volume to specified top d.o.b. to estimated saw-log stem weight or volume

Mh = saw-log merchantable height in feet

d = specified top diameter in inches

D = tree diameter at breast height in inches

.78 = constant based on average form class

a,b,c = regression coefficients

e = 2.71828 (base of natural log)

Results

Phvsical Prooerties of Sample Trees

The average specific gravity of wood and bark by tree component is shown in table 2 for individual species, s,oft hardwoods, hard hardwoods, and all trees combined. The average total-tree wood specific gravity of the soft-hardwood species was 0.523 for saplings (1.0 to 4.9 inches d.b.h.), 0.466 for poletimber (5.0 to 10.9 inches d.b.h.), and 0.465 for sawtimber (≥ 11.0 inches d.b.h.). Averages for hard-hardwood species were 0.612 for saplings, 0.632 for poletimber, and 0.613 fo-r sawtimber. .Specific gravity of bark was generally lower than that of wood for both soft-hardwood and hard-hardwood species (table 2).

Average moisture contents of wood and bark by tree component and size class aro is shown in table 3 for the species and species groups sampled. Total-tree wood moisture content for the soft hardwoods averaged 81 percent for saplings, 90 percent for poletimber, and 87 percent for sawtimber. Values for hard hardwoods averaged 66 percent for saplings, 63 percent for poletimber, and 68 percent for

sdwtimber. Hickory had a lower total-tree wood moisture content than the other hard-hardwood species.

For the soft hardwoods, bark moisture content of total trees averaged 84 percent in saplings, 105 percent in poletimber, and 109 percent in sawtimber. For the hard-hardwood species, averages were 74 percent for saplings, 66 percent for poletimber, and 58 percent for sawtimber (table 3).

Table 4 shows the average proportions of total green weight in bark, by tree component and size class, for the species sampled. The percentage of stem weight in bark decreased as stem d.b.h. increased. For example, the proportion of total-tree green weight in bark averaged 20 percent for saplings, 16 percent for poletimber, and' 13 percent for sawtimber in'the soft-hardwood group. In the hard-hardwood group, proportions in bark averaged 21 percent for saplings, 18 percent for poletimber, and 17 percent for sawtimber.

The average green weights per cubic foot of wood, bark, and wood and bark combined, by tree component, for saplings, poletimber, and sawtimber are shown in table 5. The average green weight per cubic foot of wood for the soft-hardwood species was 59 pounds for sapling, 55 pounds for poletimber, and 54 pounds for sawtimber. Values for hard hardwoods were 61 pounds for saplings, and 62 pounds for poletimber and sawtimber hard hardwoods.

The average green weight of wood and bark per cubic foot of wood is shown by tree component for saplings, poletimber, and sawtimber-size trees in table 6. The weight of wood and bark per cubic-foot volume of wood is a useful factor for estimating the volume of wood in a tree or its components when weight of wood and bark is known or for estimating green weight of wood and bark when volume of wood is known. The green weight of wood and bark per cubic foot of wood for the total tree averaged 66 pounds for poletimber and 62 pounds for sawtimber in soft hardwoods compared with 76 pounds for poletimber and sawtimber in hard hardwoods.

The average green weight of wood and bark per cubic foot of wood was highest for branches and decreased with increasing stem diameter (table 6).

Prediction Equations

A series of equations was developed to predict total-tree and tree-component weights and volumes for each species, for the soft hardwood and hard hardwood groups, and for al1 species combined. Equations were developed for predicting the yreen and dry weight of wood, bark and foliage, wood and bark combined, and wood alone in the above-stump total tree. Stem equations were developed for estimating the green and dry weight of wood and bark combined and wood alone for the total stem. Volume equations were also developed for wood and bark combined and wood alone in the above-stump total tree and total stem.

Since tree height is measured to different top limits by various oryanizations, equations were developed by using diameter (D) alone and in combination with total height (Th), height to 4-inch top (H4), and merchantable height (Mh) as independent variables. Equation (9) was used to estimate the weight and volume of the total tree and stem for trees 1.0 to 10.9 inches d.b.h., and equation (10) was used for trees $\geq$ 11.0 inches d.b.h. when D alone, D and Th, or D and H4 were the independent variables.

Equation (8) was used to estimate weight and volume of the total tree and saw-log merchantable stem for trees $\geq$ 11.0 inches d.b.h. when D and Mh were the independent variables. Equations based on D and Mh were developed only for

species sampled sufficiently in the sawtimber diameter classes. Equations were developed for the soft hardwoods, hard hardwoods, scarlet oak, southern red oak, and all species combined.

Equation (11) was used to estimate the proportion of total weight or volume in the stem to selected d.o.b. tops when stem weight or volume was estimated with D, D and Th, or D and H4 as the independent variables. Equation (12) was used to estimate a ratio for expandiny estimated saw-log stem weight or volume to selected d.o.b. tops above the saw-log top when D and Mh were the independent variables.

Equations that use D with Th or D with H4 fit the existing total-tree and total-stem weight and volume data well, based on the criteria of mean square error and absolute deviation of observed from predicted values. Equations that use D and Mh also fit existing saw-log merchantable-stem weight and volume data well. When average tree height and stem taper are similar to those of our sample trees, the equations with D alone will result in good estimates of the tree weight and volume. When average tree heights by d.b.h. class are different from the sample trees, however, the equations that include a height variable should be applied directly *or* used to develop local weight-volume tables based on D alone.

Kegression coefficients for estimating species and species group weight and volume are listed in tables 7 through 22. Each table contains a series of equations for a specific independent variable, tree component and unit of measure (weiyht or volume). Listed below is a guide to the tables by independent variable, unit of measure, tree component, and table number.

Independent variable	Weight			Volume		
	Total tree	Total stem	Saw-log stem	Total tree	Total stem	Saw-log stem
D alone	7	8		9	10	
D and Th	11	12		13	14	
D and H4	15	16		17	18	
D and Mh	19		20	21		22

In addition to the regression coefficients, tabl es 7 through 22 contain the coefficients of determination (R^2) and standard error ($S_{y.x}$, log,,) for each equation.

Regression coefficients for estimating the proportion of the total-stem weight and volume in the stem to a specified d.o.b. top are given in tables 23 and 24. Table 23 contains coefficients for estimating ratios for stem green and dry weight of wood and bark combined and wood only, and table 24 contains the coefficients for stem volume of wood and bark combined and wood alone. Equation coefficients for expanding estimated weights and volumes of saw-log merchantable stems are shown in fables 25 and 26.

How to Use Prediction Equations

Use of the coefficients in tables 7 through 26 to estimate the weight and volume is best illustrated through examples.

Assume that we have two soft hardwood trees and we want to estimate the green weight of their stems with bark to a 4-inch d.o.b. top. The first tree has a d.b.h. of 10.0 inches and a total height of 70 feet and the second tree measures 14.0 inches d.b.h. and 90 feet in total height. To estimate stem weight to a 4-inch top, we must first estimate total stem weight and then estimate the proportion of total stem weight in the stem to a 4-inch d.o.b. top.

Since our independent variables are d.b.h. and total height and we want to estimate the weight of the total stem, we would select our regression coefficients from table 12 as shown by the above guide. Since our 10.0-inch d.b.h. tree is less than 11.0 inches d.b.h., we would use the a' and b coefficients listed for soft hardwoods under trees < 11.0 inches d.b.h. and the equation for trees < 11.0 inches d.b.h. at the bottom of table 12. To estimate total stemwood and bark green weight (Y_{STEMWB}), we would substitute our trees' d.b.h., total height, and the regression coefficients into the equation for trees < 11.0 inches d.b.h. and solve as follows:

$$Y_{STEMWB} = a' (D^2Th)^b$$

$$= 0.25113 ((102) (70))^{0.91865}$$

$$= 0.25113 (7000)^{0.91865}$$

$$= 0.25113 (3,406.43)$$

$$Y_{STEMWB} = 855 \text{ pounds}$$

To estimate the total stem weight of our 14-inch tree, we would use the soft hdrdwood coefficients listed for trees $\geq$ 11.0 inches d.b.h. and the equation for trees $\geq$ 11.0 inches d.b.h. at the bottom of table 12 and solve as follows:

$$Y_{STEMWB} = a'' (D^2)^b (Th)^c$$

$$= 0.22629 (14^2)^{0.94037} (90)^{0.91865}$$

$$= 0.22629 (196)^{0.94037} (90)^{0.91865}$$

$$= 0.22629 (143.08) (62.41)$$

$$Y_{STEMWB} = 2,021 \text{ pounds}$$

The same mathematical procedure shown above would be used to solve any of the tree component equations in tables 7 through 18.

To estimate the proportion of total-stem wood and bark green weight of our 10-inch tree in the stem to a 4-inch top, we would use the ratio equation shown in table 23 and the green-weight coefficients for soft hardwoods. We would solve the equation as follows:

$$Y_R = e^a (d)^b (D)^c$$

$$= 2.71828^{-1.66655} (4)^{4.50927} (10)^{-4.50649}$$

$$= 2.71828^{-1.66655} (518.62) (0.0000312)$$

$$= 2.71828^{-0.02693}$$

$Y_R = 0.973$

S em weight to 4-inch top = (Y_{STEMWB}) (Y,)

= 855 (0.973)

Stem weight to 4-inch top = 832 pounds

The procedure shown above can be used to est mate the proportion of total stem in the stem to any d.o.b. top by substituting for d in the above equation.

In a second example, assume we have a 14.0-inch 2-log soft hardwood tree and we want to estimate the green weight of wood and bark in the saw-log merchantable stem (Y_{SAWWB}). Since our independent variables are D and Mh and we want to estimate the weight of the saw-log merchantable stem, we would use the soft-hardwood coefficients and equation listed in table 20. To use the D and Mh equation, Mh must be in feet. Thus:

Mh = 33.1 feet = (2.0 logs) (16.3 ft/log) + (0.5 ft for stump)

We would then solve the D and Mh equation as follows:

$$Y_{SAWWB} = a' (D^2)^b (Mh)^c$$

$$= 0.67303 (14^2)^{0.84073} (33.1)^{0.90211}$$

$$= 0.67303 (84.56) (23.50)$$

$$Y_{SAWWB} = 1,337 \text{ pounds}$$

The same mathematical procedure shown above would be used to solve any of the D and Mh equations in tables 19 through 22.

To estimate a ratio (Y_R) for expanding estimated saw-log merchantable-stem green weight of wood and bark of the previous example tree to weight to a 4-inch d.o.b. top, the following soft-hardwood ratio equation would be selected from tahle 25 and solved as shown below:

$$Y_R = e^a \left[(Mh)^b \left(\left(1-\left(\frac{d}{.78D}\right)^2\right)^2\right)^c \right]$$

$$= 2.718288^{.47209} \left[(33.1)^{-0.87551} \left(\left(1-\left(\frac{4}{.78(14)}\right)^2\right)^2\right)^{0.38432} \right]$$

$$= 2.718288^{.47209(0.04671)(0.89517)}$$

$$= 2.718280^{.35425}$$

$$Y_R = 1.425$$

Stem weight to 4-inch top = (Y_{SAWWB}) (Y,)

= 1,337 (1.425)

Stem weight to 4-inch top = 1,905 pounds

The tree components predicted by using the equations provided can be used to calculate additional tree components. For example, to estimate the weight or volume of the crown (branches and topwood), subtract estimated weight of the stem to a specified d.o.b. top from total-tree weight of wood and bark. The weight or volume of bark alone can also be estimated by subtracting component weight or volume of wood from wood and bark.

Similar-size trees may vary in weight and volume because of differences in crown size, stem taper, and weight per cubic foot. Therefore, these equations should be apylied only to trees growing in natural, fully stocked stands with tree dimensions and weight per cubic foot similar to the tree sampled.

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Table 1.--Mean and range of tree age and measurements, by species and tree size class

Tree size class (inches)	Sample trees	Age		D.b.h.		Total height		Height to 4-inch d.o.b. top		Height to saw-log merchantable top		D.o.b. at saw-log merchantable top	
		Average	Range	Average	Range	Average	Range	Average	Range	Average	Range	Average	Range
	Number			Inches		Feet						Inches	
						SOFT HARDWOODS							
1.0- 4.9	40	21	a-55	6.7	1.3- 4.9	31	15- 52	--	--	--		--	--
5.0-10.9	54	31	13-64	14.6	11.0-19.3 5.0-10.4	59	35-104	32	8-80	--	--	--	--
>11.0	28	45	36-65			96	78-112	75	49-87	41	21-68	10.0	9.0-14.0
All trees	122	32	8-65	7.2	1.3-19.3	59	15-112	44	1-87	41	21-68	10.0	9.0-14.0
						SWEETGUM							
1.0- 4.9	10	20	9-55	3.4	1.9- 4.9	39	25- 52	--	--	--	--	--	--
5.0-10.9	20	28	15-57	6.6	5.2- 8.5	61	44- 89	32	12-63	--	--	--	--
>11.0	9	51	40-65	14.5	11.0-17.2	93	78-108	73	49-87	38	21-50	10.6	9.0-13.1
All trees	39	32	9-65	7.6	1.9-17.2	63	25-108	41	4-87	38	21-50	10.6	9.0-13.1
						YELLOW-POPLAR							
5.0-10.9	10	30	19-38	7.7	5.3-10.2	69		46	20-80	--	--	--	--
>11.0	9	39	37-41	15.0	12.6-18.7	105	48-104 92-112	82	75-87	52	37-68	9.8	9.0-12.4
All trees	19	34	19-41	11.1	5.3-18.7	86	48-112	63	20-87	52	37-68	9.8	g-o-12.4
						HARD HARDWOODS							
1.0- 4.9	102	21	9- 53	2.3	1.0- 4.9	28	10- 50	--	--	--	--	--	--
5.0-10.9	191	46	15-100	7.4	5.0-10.9	54	31- 88	30	7-68	--	--	--	--
>11.0	71	77	22-130	14.9	11.0-22.0	71	50-103	52	34-86	27	12-45	11.5	8.6-16.9
All trees	364	48	9-130	7.4	1.0-22.0	50	10-103	35	2-86	27	12-45	11.5	8.6-16.9
						HICKORY							
1.0- 4.9	15	24	14- 40	6.9	1.0- 4.7	25	10- 42	--	--	--	--	--	
5.0-10.9	20	55	19- 93	16.1	15.0-10.8	50	32- 88	24	7-64	--	--	--	--
>11.0		83	66-100			88	72-103	71	55-86	31	27-34	13.5	12.0-14.9
All trees	3:	47	14-100	5.4	1.0-18.1	42	10-103	27	7-86	31	27-34	13.5	12.0-14.9

Continued

Table 1.--Mean and range of tree age and measurements, by species and tree size class--Continued

Tree size class (inches)	Sample trees	Age		D.b.h.		Total height		Height to 4-inch d.o.b. top		Height to saw-log merchantable top		D.o.b. at saw-log merchantable top	
		Average	Range	Average	Range	Average	Range	Average	Range	Average	Range	Average	Range
	Number			Inches		Feet						Inches	
						POST OAK							
5.0-10.9	14	54	41-100	6.7	5.1-10.2	57	33-66	23	10-49	--	--	--	--
> 11.0	12	110	88-130	14.4	11.2-20.9	51	33-66	43	36-54	24	12-35	10.2	8.7-13.2
All trees	26	80	41-130	10.3	5.1-20.9			32	10-54	24	12-35	10.2	8.7-13.2
						SCARLET OAK							
5.0-10.9	24	44	36-65	8.1	5.1-10.9	60	45-73	35	17-51	--	--	--	--
> 11.0	17	63	39-98	15.0	11.5-20.0	79	58-94	57	42-69	30	13-45	11.7	8.8-15.1
All trees	42	52	36-98	10.8	4.8-20.0	68	45-94	44	16-69	30	13-45	11.7	8.8-15.1
						SOUTHERN RED OAK							
5.0-10.9	17	51	37-74	8.2	5.4-10.2			36	13-54	--	--	--	--
> 11.0	17	69	44-100	15.6	11.3-22.0	7:	68-80	54	45-65	24	18-35	12.5	8.6-16.9
All trees	34	60	37-100	11.9	5.4-22.0	69	53-84	45	13-65	24	18-35	12.5	8.6-16.9
						WHITE OAK							
1.0-4.9	12	27	14-53	3.2	1.3-4.7	34	16-47	--	--	--	--	--	--
5.0-10.9	65	48	27-76	7.0	5.0-10.6	64	31-69	26	7-52	--	--	--	--
> 11.0	10	98	53-112	17.1	13.3-20.5	49	53-74	48	37-57	29	21-38	12.4	9.5-14.4
All trees	87	51	14-112	7.7	1.3-20.5			28	5-57	29	21-38	11.8	9.0-14.4
						ALL SPECIES							
1.0-4.9	142	21	8-55	2.4	1.0-4.9	29	10-52	--	--	--	--	--	--
5.0-10.9	245	43	13-100	7.2	5.0-10.9	55	31-104	30	7-80	--	--	--	--
> 11.0	99	68	22-130	14.9	11.0-22.0	78	50-112	59	34-87	31	12-68	11.1	8.6-16.9
All trees	486	43	8-130	7.4	1.0-22.0	52	10-112	37	1-87	30	12-68	10.9	8.6-16.9

Table 2.--Average specific gravity of wood, bark, and wood and bark combined, by tree component and size class, for hardwood species in the Upland-South

Tree size class (inches)	Average and standard deviation						
		Stem					
	Total tree	Butt to Y-inch top	Y-inch to 4-inch top	Butt to 4-inch top	4-inch to tip	Butt to tip	Branches
				SOFT HARDWOODS			
				Wood			
1.0- 4.9	0.523 ± 0.042	--	--	--	--	0.529 ± 0.047	0.489 ± 0.038
5.0-10.9	0.466 ± 0.054	0.455 ± 0.029	0.471 ± 0.057	0.471 ± 0.057	0.461 ± 0.054	0.468 ± 0.058	0.464 ± 0.051
≥11.0	0.465 ± 0.041	0.464 ± 0.044	0.464 ± 0.040	0.464 ± 0.042	0.477 ± 0.034	0.464 ± 0.042	0.473 ± 0.040
				Bark			
1.0- 4.9	0.445 ± 0.065	--		--	--	0.456 ± 0.082	0.423 ± 0.046
5.0-10.9	0.407 ± 0.072	0.419 ± 0.090	0.405 i-0.095	0.405 ± 0.095	0.418 ± 0.078	0.406 ± 0.088	0.421 ± 0.053
>11.0	0.422 ± 0.068	0.418 ± 0.079	0.430 ± 0.078	0.423 ± 0.077	0.429 ± 0.062	0.424 ± 0.076	0.419 ± 0.055
				Wood and Bark			
1.0- 4.9	0.507 ± 0.039		--	--	--	0.514 ± 0.046	0.468 ± 0.031
5.0-10.9	0.457 ± 0.051	0.442 i-0.032	0.459 ± 0.054	0.459 ± 0.054	0.451 ± 0.050	0.459 ± 0.055	0.450 ± 0.046
≥11.0	0.459 ± 0.042	0.458 ± 0.044	0.458 ± 0.043	0.458 ± 0.043	0.467 ± 0.035	0.459 ± 0.044	0.459 ± 0.038
				SWEETGUM			
				Wood			
1.0- 4.9	0.485 ± 0.022	--	--	--	--	0.485 ± 0.022	0.488 ± 0.058
5.0-10.9	0.481 ± 0.027	0.484 ± 0.000	0.486 ± 0.028	0.486 ± 0.028	0.472 ± 0.032	0.480 ± 0.028	0.476 ± 0.028
>11.0	0.498 ± 0.015	0.497 ± 0.016	0.493 ± 0.019	0.496 ± 0.017	0.500 ± 0.026	0.496 ± 0.017	0.510 ± 0.018
				Bark			
1.0- 4.9	0.370 ± 0.031	--	--	--	--	0.369 ± 0.030	0.376 ± 0.047
5.0-10.9	0.388 ± 0.040	0.419 ± 0.000	0.370 ± 0.047	0.370 ± 0.047	0.421 ± 0.040	0.384 ± 0.045	0.421 ± 0.036
≥11.0	0.418 ± 0.027	0.406 ± 0.035	0.428 ± 0.045	0.417 ± 0.032	0.446 ± 0.026	0.418 ± 0.030	0.419 ± 0.021
				Wood and Bark			
1.0- 4.9	0.465 ± 0.021	--	--	--		0.465 ± 0.022	0.449 ± 0.044
5.0-10.9	0.467 ± 0.024	--	0.467 ± 0.023	0.467 ± 0.023	0.462 i-0.030	0.468 ± 0.025	0.458 ± 0.021
>11.0	0.488 ± 0.015	0.485 ± 0.015	0.482 ± 0.019	0.484 ± 0.017	0.489 ± 0.020	0.487 ± 0.017	0.487 ± 0.013
				YELLOW-POPLAR			
				Wood			
5.0-10.9	0.389 ± 0.052	0.441 ± 0.031	0.389 ± 0.053	0.390 ± 0.053	0.392 ± 0.053	0.388 ± 0.050	0.402 ± 0.071
≥11.0	0.412 ± 0.020	0.409 ± 0.027	0.414 ± 0.023	0.410 ± 0.020	0.445 ± 0.023	0.410 ± 0.020	0.428 ± 0.1120
				Bark			
5.0-10.9	0.350 ± 0.018	0.346 ± 0.016	0.345 ± 0.019	0.345 ± 0.019	0.350 ± 0.023	0.345 ± 0.019	0.365 ± 0.053
>11.0	0.344 ± 0.017	0.330 ± 0.017	0.342 ± 0.019	0.336 ± 0.018	0.352 ± 0.018	0.337 ± 0.018	0.356 ± 0.026

Continued

Table 2.--Average specific gravity of wood, bark, and wood and bark combined, by tree component and size class, for hardwood species in the Upland-South--Continued

Tree size class (inches)	Average and standard deviation						
		Stem					
	Total tree	autt to Y-inch top	Y-inch to 4-inch top	Butt to 4-inch top	4-inch to tip	Butt to tip	Branches
				Wood and Bark			
5.0-10.9	0.383 ± 0.045	0.425 ± 0.023	0.345 ± 0.019	0.345 ± 0.019	0.350 ± 0.023	0.345 ± 0.019	0.365 ± 0.053
≥ 11.0	0.404 ± 0.018	0.400 ± 0.024	0.402 ± 0.018	0.400 ± 0.018	0.427 ± 0.019	0.401 ± 0.018	0.410 ± 0.015
				HARD HARDWOODS			
				Wood			
1.0- 4.9	0.612 ± 0.040		--			0.617 ± 0.041	0.578 ± 0.045
5.0-10.9	0.632 ± 0.049	0.613 I-0.062	0.631 ± 0.051	0.631 i-0.051	0.634 i-0.048	0.631 ± 0.049	0.639 ± 0.055
> 11.0	0.613 ± 0.031	0.596 ± 0.040	0.622 ± 0.031	0.600 ± 0.034,	0.649 ± 0.027	0.601 ± 0.034	0.646 ± 0.037
				Bark			
1.0- 4.9	0.483 ± 0.083	--	--		--	0.498 ± 0.094	0.443 ± 0.063
5.0-10.9	0.541 ± 0.061	0.552 ± 0.067	0.561 ± 0.075	0.559 i-0.072	0.548 ± 0.067	0.558 ± 0.071	0.511 ± 0.078
> 11.0	0.582 ± 0.077.	0.596 ± 0.087	0.599 ± 0.098	0.596 ± 0.088	0.582 ± 0,080	0.596 ± 0.087	0.561 ± 0.066
				Wood and Bark			
1.0- 4.9	0.587 ± 0.035	--	--	--	--	0.594 ± 0.036	0.533 ± 0.039
5.0-10.9	0.616 ± 0.042	0.597 ± 0.058	0.619 ± 0.044	0.619 ± 0.044	0.616 ± 0.042	0.620 ± 0.043	0.596 ± 0.048
> 11.0	0.609 ± 0.027	0.596 ± 0.036	0.619 ± 0.031	0.600 ± 0.030	0.633 ± 0.030	0.601 ± 0.029	0.621 ± 0.036
				HICKORY			
				Wood			
1.0- 4.9	0.642 ± 0.050	--	--	--	--	0.655 ± 0.055	0.557 ± 0.038
5.0-10.9	0.651 ± 0.043	0.622 ± 0.029	0.663 ± 0.043	0.662 ± 0.044	0.656 ± 0.050	0.659 ± 0.044	0.611 ± 0.058
> 11.0	0.624 ± 0.056	0.627 ± 0.061	0.649 ± 0.017	0.632 ± 0.053	0.628 ± 0.077	0.631 ± 0.053	0.604 ± 0.057
				Bark			
1.0- 4.9	0.526 ± 0.035	--	--		--	0.536 ± 0.036	0.465 ± 0.031
5.0-10.9	0.528 ± 0.044	0.529 ± 0.045	0.554 ± 0.050	0.554 Fo.049	0.524 ± 0.058	0.548 ± 0.053	0.479 ± 0.030
> 11.0	0.511 ± 0.048	0.528 ± 0.054	0.542 ± 0.040	0.530 ± 0.050	0.498 ± 0.071	0.529 ± 0.050	0.488 ± 0.039
				Wood and Bark			
1.0- 4.9	0.607 ± 0.038	--	--	--	--	0.615 ± 0.041	0.521 ± 0.028
5.0-10.9	0.625 ± 0.039	0.617 ± 0.019	0.640 ± 0.040	0.640 ± 0.040	0.625 ± 0.045	0.637 ± 0.042	0.563 ± 0.044
≥ 11.0	0.605 ± 0.052	0.613 ± 0.057	0.631 ± 0.021	0.617 ± 0.050	0.593 ± 0.086	0.617 ± 0.051	0.571 ± 0.049
				POST OAK			
				Wood			
5.0-10.9	0.678 ± 0.028	0.650 ± 0.047	0.672 ± 0.039	0.673 ± 0.036	0.664 ± 0.1142	0.671 ± 0.035	0.703 ± 0.025
≥ 11.0	0.646 ± 0.020	0.634 ± 0.028	0.645 ± 0.029	0.635 ± 0.027	0.668 ± 0.027	0.635 ± 0.027	0.679 ± 0.023

Table 2.--Average specific gravity of wood, bark, and wood and bark combined, by tree component and size class, for hardwood species in the Upland-South--Continued

Tree size class (inches)	Average and standard deviation						
	Total tree	Stem					Branches
		Butt to 9-inch top	9-inch to 4-inch top	Butt to 4-inch top	4-inch to tip	Butt to tip	
				Bark			
5.0-10.9	0.492 ± 0.063	0.556 ± 0.119	0.504 ± 0.073	0.501 ± 0.064	0.483 ± 0.077	0.497 ± 0.066	0.484 ± 0.065
> 11.0	0.520 ± 0.052	0.544 ± 0.049	0.504 ± 0.057	0.536 ± 0.052	0.485 ± 0.054	0.534 ± 0.052	0.497 ± 0.052
				Wood and Bark			
5.0-10.9	0.644 ± 0.021	0.633 ± 0.038	0.640 ± 0.027	0.641 ± 0.026	0.622 ± 0.025	0.645 ± 0.026	0.621 ± 0.039
≥ 11.0	0.626 ± 0.016	0.621 ± 0.018	0.622 ± 0.024	0.620 ± 0.018	0.622 ± 0.024	0.623 ± 0.019	0.620 ± 0.028
				SCARLET OAK			
				Wood			
1.0- 4.9	0.634 ± 0.000	--	--	--	--	0.639 ± 0.000	0.556 ± 0.000
5.0-10.9	0.622 ± 0.032	0.609 ± 0.024	0.613 ± 0.029	0.612 ± 0.029	0.630 ± 0.036	0.614 ± 0.029	0.652 ± 0.048
≥ 11.0	0.606 ± 0.022	0.584 ± 0.025	0.626 ± 0.027	0.588 ± 0.025	0.648 ± 0.022	0.588 ± 0.025	0.653 ± 0.026
				Bark			
1.0- 4.9	0.621 ± 0.000	--	--	--	--	0.636 ± 0.000	0.477 ± 0.000
5.0-10.9	0.606 ± 0.022	0.607 ± 0.038	0.643 ± 0.036	0.635 ± 0.035	0.608 ± 0.030	0.631 ± 0.035	0.548 ± 0.028
≥ 11.0	0.623 ± 0.028	0.640 ± 0.032	0.654 ± 0.030	0.641 ± 0.031	0.625 ± 0.035	0.640 ± 0.031	0.593 ± 0.038
				Wood and Bark			
1.0- 4.9	0.630 ± 0.000	--	--	--	--	0.638 ± 0.000	0.522 ± 0.000
5.0-10.9	0.620 ± 0.028	0.608 ± 0.017	0.617 ± 0.025	0.616 ± 0.026	0.626 ± 0.031	0.617 ± 0.026	0.622 ± 0.037
> 11.0	0.609 ± 0.018	0.592 ± 0.022	0.632 ± 0.021	0.595 ± 0.022	0.644 ± 0.019	0.596 ± 0.022	0.638 ± 0.023
				SOUTHERN RED OAK			
				Wood			
5.0-10.9	0.605 ± 0.019	0.607 ± 0.023	0.593 ± 0.018	0.596 ± 0.018	0.618 ± 0.023	0.597 ± 0.018	0.653 ± 0.036
> 11.0	0.601 ± 0.020	0.579 ± 0.022	0.609 ± 0.022	0.581 ± 0.021	0.652 ± 0.028	0.582 ± 0.021	0.652 ± 0.021
				Bark			
5.0-10.9	0.602 ± 0.030	0.592 ± 0.034	0.623 ± 0.031	0.613 ± 0.029	0.623 ± 0.024	0.616 ± 0.027	0.556 ± 0.035
≥ 11.0	0.662 ± 0.026	0.675 ± 0.026	0.695 ± 0.024	0.678 ± 0.025	0.663 ± 0.035	0.677 ± 0.025	0.630 ± 0.042
				Wood and Bark			
5.0-10.9	0.605 ± 0.015	0.605 ± 0.015	0.600 ± 0.014	0.600 ± 0.013	0.619 ± 0.020	0.601 ± 0.014	0.623 ± 0.036
> 11.0	0.615 ± 0.014	0.596 ± 0.017	0.628 ± 0.018	0.598 ± 0.016	0.656 ± 0.022	0.598 ± 0.016	0.645 ± 0.017

Continued

Table 2.--Average specific gravity of wood, bark, and wood and bark combined, by tree component and size class, for hardwood species in the Upland-South--Continued

Tree size class (inches)	Average and standard deviation						
		Stem					
	Total tree	Butt to 9-inch top	9-inch to 4-inch top	Butt to 4-inch top	4-inch to tip	Butt to tip	Branches
				WHITE OAK			
				Wood			
1.0- 4.9	0.641 ± 0.022	--	--	--	--	0.646 ± 0.023	0.594 ± 0.031
5.0-10.9	0.654 ± 0.039	0.659 ± 0.053	0.654 ± 0.041	0.654 ± 0.041	0.650 ± 0.046	0.652 ± 0.041	0.656 ± 0.044
> 11.0	0.635 ± 0.007	0.626 ± 0.011	0.639 ± 0.012	0.627 ± 0.011	0.654 ± 0.013	0.628 ± 0.011	0.657 ± 0.021
				Bark			
1.0- 4.9	0.483 ± 0.048		--	--	--	0.484 ± 0.054	0.473 ± 0.026
5.0-10.9	0.518 ± 0.050	0.530 i-0.047	0.530 ± 0.052	0.530 ± 0.054	0.521 ± 0.056	0.528 ± 0.053	0.508 ± 0.113
> 11.0	0.573 ± 0.036	0.604 ± 0.041	0.608 ± 0.039	0.605 ± 0.040	0.575 ± 0.033	0.604 ± 0.040	0.533 ± 0.035
				Wood and Bark			
1.0- 4.9	0.607 ± 0.026	--	--	--	--	0.614 ± 0.026	0.544 ± 0.031
5.0-10.9	0.632 ± 0.036	0.633 ± 0.060	0.636 ± 0.039	0.635 ± 0.039	0.622 ± 0.045	0.636 ± 0.039	0.605 ± 0.048
> 11.0	0.626 ± 0.005	0.624 ± 0.010	0.633 ± 0.010	0.625 ± 0.009	0.635 ± 0.014	0.625 ± 0.009	0.622 ± 0.022
				ALL SPECIES			
				Wood			
1.0- 4.9	0.582 ± 0.058	--	--	--	--	0.588 ± 0.060	0.549 ± 0.060
5.0-10.9	0.595 ± 0.085	0.601 ± 0.074	0.595 ± 0.085	0.595 ± 0.085	0.598 ± 0.086	0.597 ± 0.084	0.601 ± 0.091
> 11.0	0.571 ± 0.075	0.558 ± 0.072	0.577 ± 0.079	0.561 ± 0.072	0.600 ± 0.083	0.562 ± 0.072	0.597 ± 0.087
				Bark			
1.0- 4.9	0.471 ± 0.079	--	--	--	--	0.484 ± 0.092	0.436 ± 0.058
5.0-10.9	0.511 ± 0.085	0.541 ± 0.077	0.526 ± 0.103	0.525 ± 0.101	0.521 ± 0.087	0.526 ± 0.097	0.491 ± 0.082
> 11.0	0.537 ± 0.104	0.546 ± 0.117	0.551 ± 0.120	0.547 ± 0.115	0.538 ± 0.102	0.547 ± 0.114	0.521 ± 0.090
				Wood and Bark			
1.0- 4.9	0.561 ± 0.052		--	--	--	0.568 ± 0.054	0.511 ± 0.048
5.0-10.9	0.581 ± 0.079	0.583 i-0.072	0.584 ± 0.081	0.583 ± 0.081	0.582 ± 0.080	0.587 ± 0.080	0.564 ± 0.077
> 11.0	0.567 ± 0.075	0.557 ± 0.074	0.574 ± 0.081	0.560 ± 0.073	0.586 ± 0.081	0.561 ± 0.073	0.575 ± 0.082

Table 3.--Average moisture content of wood, bark, and wood and bark combined, by tree component and size class, for hardwood species in the Upland-South

Tree size class (inches)	Average and standard deviation						
	Total tree	Stem					Branches
		Butt to 9-inch top	9-inch to 4-inch top	Butt to 4-inch top	4-inch to tip	Butt to tip	
	Percent						
	SOFT HARDWOODS						
	Wood						
1.0- 4.9	81 ± 17.8	--	--	--		82 ± 18.3	77 ± 20.1
5.0-10.9	90 ± 20.2	89 ± 17.6	90 ± 20.4	90 ± 20.4	95 i-22.2	92 ± 20.6	89 ± 21.1
> 11.0	87 ± 15.2	88 ± 16.6	86 ± 15.4	88 ± 15.9	86 ± 17.1	87 ± 15.8	88 ± 14.2
	Bark						
1.0- 4.9	84 ± 24.7	--	--	--	--	80 ± 27.4	101 ± 30.3
5.0-10.9	105 ± 28.8	102 ± 29.4	100 ± 31.0	100 ± 30.9	116 ± 35.7	105 ± 30.8	117 ± 30.2
≥ 11.0	109 ± 26.9	100 ± 27.9	103 ± 32.0	101 ± 29.4	128 ± 28.1	102 ± 2Y.4	128 ± 26.3
	Wood and Bark						
1.0- 4.9	81 ± 18.1	--	--	--	--	81 ± 18.9	84 ± 22.5
5.0-10.9	92 ± 19.3	89 ± 16.0	92 ± 19.5	92 ± 19.5	98 ± 21.3	94 ± 19.5	97 ± 20.1
≥ 11.0	90 ± 13.9	90 ± 15.5	89 ± 14.8	89 ± 14.7	94 ± 15.9	90 ± 14.7	97 ± 13.9
	SWEETGUM						
	Wood						
1.0- 4.9	104 ± 11.1	--	--	--	--	104 ± 11.4	102 ± 23.2,
5.0-10.9	103 ± 10.3	107 ± 0.0	103 ± 10.3	103 ± 10.3	106 ± 13.9	104 ± 11.2	101 ± 9.2
≥ 11.0	99 ± 5.1	102 ± 7.6	98 ± 5.5	100 ± 5.2	92 ± 7.8	100 ± 5.2	94 ± 6.0
	Bark						
1.0- 4.9	120 ± 16.8	--	--	--		118 ± 22.6	130 ± 37.2
5.0-10.9	103 ± 20.3	82 ± 0.0	97 ± 19.9	97 ± 19.9	113 i-28.3	101 ± 21.4	118 ± 23.4
≥ 11.0	90 ± 7.2	80 ± 11.5	78 ± 7.4	78 ± 7.8	113 ± 19.5	78 ± 7.8	121 ± 16.8
	Wood and Bark						
1.0- 4.9	106 ± 10.7	--	--	--	--	106 ± 11.3	112 ± 26.7
5.0-10.9	103 ± 10.1	--	102 ± 10.1	102 ± 10.1	107 ± 13.5	103 ± 11.0	106 ± 10.6
≥ 11.0	98 ± 4.5	99 ± 7.9	94 ± 5.2	97 ± 5.0	97 ± 9.7	98 ± 4.9	101 ± 7.4
	YELLOW-POPLAR						
	Wood						
5.0-10.9	100 ± 19.7	85 ± 5.9	100 ± 20.0	100 ± 20.0	106 ± 22.7	100 ± 20.0	100 ± 24.5
≥ 11.0	89 ± 6.6	91 ± 6.9	88 ± 6.7	90 ± 6.9	YO ± 16.9	89 ± 7.0	89 ± 12.1
	Bark						
5.0-10.9	142 ± 8.6	128 ± 12.8	141 ± 14.7	141 ± 14.7	161 ± 9.4	142 ± 12.9	148 ± 26.9
> 11.0	145 ± 11.1	136 ± 11.7	145 ± 18.7	140 ± 15.0	162 ± 6.0	141 ± 14.4	158 ± 14.2

Continued

Table 3.--Average moisture content of wood, bark, and wood and bark combined, by tree component and size class, for hardwood species in the Upland-South--Continued

Tree size class (inches)	Average and standard deviation						
	Total tree	Stem					Branches
		Butt to 9-inch top	9-inch to 4-inch top	Butt to 4-inch top	4-inch to tip	Butt to tip	
	Percent						
	Wood and Bark						
5.0-10.9	106 ± 16.4	92 ± 3.8	106 ± 17.4	106 ± 17.4	116 ± 18.2	107 ± 17.0	114 ± 19.8
≥ 11.0	96 ± 4.9	96 ± 5.6	97 ± 6.5	96 ± 5.2	104 ± 11.2	96 ± 4.8	106 ± 10.7
	HARO HARDWOODS						
	Wood						
1.0- 4.9	66 ± 10.1	--	--	--	--	65 ± 10.6	67 ± 9.6
5.0-10.9	63 ± 8.8	69 ± 10.1	64 ± 9.3	64 ± 9.6	61 ± 9.1	64 ± 9.4	59 ± 7.3
≥ 11.0	68 ± 11.0	72 ± 13.3	65 ± 9.8	71 ± 13.4	61 ± 6.6	71 ± 13.3	60 ± 5.7
	Bark						
1.0- 4.9	74 ± 22.5	--	--	--	--	73 ± 22.4	80 ± 28.2
5.0-10.9	66 ± 12.4	61 ± 14.0	61 ± 13.0	61 ± 12.8	69 ± 15.4	63 ± 13.1	74 ± 13.0
≥ 11.0	58 ± 10.6	55 ± 12.3	56 ± 11.9	55 ± 11.9	61 ± 10.7	55 ± 11.8	62 ± 10.4
	Wood and Bark						
1.0- 4.9	68 ± Y.7	--	--	--	--	67 ± 10.3	71 ± 11.7
5.0-10.9	63 ± 7.2	68 ± 8.5	63 ± 7.9	64 ± 8.0	63 ± 8.0	64 ± 7.9	64 ± 7.2
> 11.0	66 ± 8.0	69 ± 10.4	63 ± 6.8	68 ± 10.4	60 ± 4.3	68 ± 10.5	60 ± 3.3
	HICKORY						
	Wood						
1.0- 4.9	52 ± 3.9	--	--	--	--	51 ± 3.3	56 ± 7.7
5.0-10.9	52 ± 3.9	61 ± 9.0	53 ± 4.0	53 ± 4.1	50 ± 4.0	52 ± 4.0	52 ± 8.0
≥ 11.0	54 ± 6.9	57 ± 9.4	51 ± 3.7	56 ± 8.3	51 ± 5.9	56 ± 8.2	51 ± 4.3
	Bark						
1.0- 4.9	76 ± 21.7	--	--	--	--	74 ± 22.5	91 ± 16.2
5.0-10.9	75 ± 15.8	76 ± 12.3	69 ± 16.6	69 ± 16.8	81 ± 20.0	72 ± 18.3	84 ± 12.6
≥ 11.0	81 ± 13.6	81 ± 24.4	78 ± 13.6	81 ± 22.1	83 ± 5.8	81 ± 22.0	83 ± 3.5
	Wood and Bark						
1.0- 4.9	60 ± 9.1	--	--	--	--	59 ± 10.1	70 ± 9.3
5.0-10.9	56 ± 5.1	62 ± 10.4	56 ± 5.4	56 ± 5.6	57 ± 6.4	56 ± 5.8	64 ± 8.1
≥ 11.0	59 ± 7.6	61 ± 11.0	55 ± 5.4	60 ± 9.8	59 ± 8.4	60 ± 9.8	60 ± 3.3
	POST OAK						
	Wood						
5.0-10.9	63 ± 3.4	68 ± 5.0	62 ± 4.7	64 ± 3.9	62 ± 3.3	64 ± 3.9	59 ± 3.7
> 11.0	65 ± 7.0	67 ± 8.9	64 ± 7.3	67 ± 8.6	61 ± 4.0	67 ± 8.5	61 ± 5.0

Continued

Table 3.--Average moisture content of wood, bark, and wood and bark combined, by tree component and size class, for hardwood species in the Upland-South--Continued

Tree size class (inches)	Average and standard deviation						
	Total tree	Stem					Branches
		Butt to 9-inch top	9-inch to 4-inch top	Butt to 4-inch top	4-inch to tip	Butt to tip	
	Percent						
				Bark			
5.0-10.9	63 ± 8.1	56 ± 16.2	60 ± 11.3	60 ± 10.9	67 ± 10.9	62 ± 10.8	65 ± 9.0
> 11.0	58 ± 9.2	55 ± 11.0	62 ± 11.5	57 ± 11.0	63 ± 9.9	57 ± 10.9	62 ± 6.8
				Wood and Bark			
5.0-10.9	63 ± 2.5	66 ± 2.0	62 ± 5.1	63 ± 2.9	63 ± 3.7	63 ± 2.9	61 ± 4.7
≥ 11.0	63 ± 4.2	64 ± 5.4	63 ± 4.6	64 ± 5.2	62 ± 3.5	65 ± 5.4	61 ± 3.3
				SCARLET OAK			
				Wood			
1.0- 4.9	63 ± 0.0	--	--	--	--	63 ± 0.0	61 ± 0.0
5.0-10.9	69 ± 6.8	77 ± 7.9	72 ± 6.2	73 ± 7.1	64 ± 6.4	72 ± 7.0	58 ± 5.4
≥ 11.0	77 ± 4.9	83 ± 5.4	71 ± 4.6	82 ± 5.6	64 ± 3.8	82 ± 5.6	62 ± 3.6
				Bark			
1.0- 4.9	55 ± 0.0	--	--	--	--	52 ± 0.0	81 ± 0.0
5.0-10.9	58 ± 4.0	55 ± 6.1	55 ± 4.6	55 ± 4.8	59 ± 5.9	56 ± 4.5	64 ± 8.3
> 11.0	59 ± 2.8	58 ± 4.0	57 ± 2.7	58 ± 3.7	58 ± 4.4	58 ± 3.7	61 ± 3.8
				Wood and Bark			
1.0- 4.9	61 ± 0.0	--	--	--	--	60 ± 0.0	69 ± 0.0
5.0-10.9	67 ± 5.8	75 ± 5.8	69 ± 5.5	70 ± 6.2	63 ± 5.5	69 ± 6.2	59 ± 4.8
> 11.0	73 ± 4.2	79 ± 4.9	69 ± 3.8	78 ± 5.1	63 ± 2.8	78 ± 5.1	62 ± 2.7
				SOUTHERN RED DAK			
				Wood			
5.0-10.9	70 ± 4.4	76 ± 6.4	72 ± 4.8	73 ± 4.8	65 ± 3.8	73 ± 4.5	59 ± 3.5
> 11	76 ± 5.3	83 ± 6.3	72 ± 4.5	82 ± 6.3	63 ± 3.4	82 ± 6.3	63 ± 3.7
				Bark			
5.0-10.9	51 ± 6.8	47 ± 5.0	46 ± 7.0	47 ± 6.4	56 ± 21.1	48 ± 7.2	62 ± 5.2
> 11.0	46 ± 3.0	43 ± 3.2	43 ± 3.1	43 ± 3.1	51 ± 3.6	43 ± 3.0	51 ± 3.4
				Wood and Bark			
5.0-10.9	66 ± 3.3	70 ± 5.2	67 ± 4.1	68 ± 3.8	62 ± 4.4	68 ± 3.7	60 ± 3.9
≥ 11.0	70 ± 3.7	76 ± 5.0	66 ± 3.1	75 ± 5.1	60 ± 2.9	75 ± 5.2	59 ± 2.3

Continued

Table 3.--Average moisture content of wood, bark, and wood and bark combined, by tree component and size class, for hardwood species in the Upland-South--Continued

Tree size class (inches)	Average and standard deviation						
	Total tree	Stem: Butt to 9-inch top	Stem: 9-inch to 4-inch top	Stem: Butt to 4-inch top	Stem: 4-inch to tip	Stem: Butt to tip	Branches
	Percent						
	WHITE OAK						
	Wood						
1.0- 4.9	57 ± 3.4	--	--	--	--	56 ± 3.5	61 ± 4.4
5.0-10.9	60 ± 4.1	64 ± 4.9	61 ± 4.4	61 ± 4.4	60 ± 4.2	61 ± 4.3	58 ± 4.8
> 11.0	64 ± 2.8	66 ± 3.9	62 ± 2.7	65 ± 3.8	61 ± 1.9	65 ± 3.7	60 ± 1.6
	Bark						
1.0- 4.9	66 ± 10.3		--	--		64 ± 11.0	72 ± 11.0
5.0-10.9	JO ± 11.2	65 i-15.1	65 ± 13.0	65 ± 12.9	74 i-13.6	67 ± 12.5	77 ± 11.1
≥ 11.0	59 ± 7.5	54 ± 9.4	56 ± 7.0	54 ± 8.9	64 ± 5.9	54 ± 8.8	67 ± 8.2
	Wood and Bark						
1.0- 4.9	58 ± 4.2	--	--	--	--	58 ± 4.2	66 ± 6.4
5.0-10.9	62 ± 4.5	65 ± 4.4	61 ± 4.8	61 ± 4.8	63 ± 5.9	61 ± 4.7	65 ± 6.1
≥ 11.0	63 ± 2.8	64 ± 3.6	61 ± 2.8	64 ± 3.5	62 ± 2.0	64 ± 3.5	62 ± 2.7
	ALL SPECIES						
	Wood						
1.0- 4.9	71 ± 15.0	--	--	--	--	71 ± 15.7	JO ± 14.6
5.0-10.9	69 ± 16.7	JO ± 12.0	JO ± 16.7	JO ± 16.7	68 ± 18.7	70 ± 16.9	65 ± 17.2
≥ 11.0	73 ± 15.1	JJ ± 16.0	71 ± 15.1	76 ± 15.9	68 ± 15.7	76 ± 15.8	68 ± 15.5
	Bark						
1.0- 4.9	78 ± 23.6	--	--	--	--	75 ± 24.2	87 ± 30.4
5.0-10.9	75 ± 23.7	64 ± 19.0	JO ± 24.4	70 ± 24.2	79 ± 28.3	72 ± 24.8	83 ± 25.6
≥ 11.0	72 ± 28.5	68 ± 27.0	70 ± 28.9	68 ± 27.7	80 ± 34.9	69 ± 27.9	81 ± 33.9
	Wood and Bark						
1.0- 4.9	72 ± 14.5	--	--	--	--	72 ± 15.2	76 ± 17.1
5.0-10.9	JO ± 16.3	JO ± 11.1	70 ± 16.4	70 ± 16.4	70 ± 18.6	70 ± 16.7	71 ± 18.0
> 11.0	72 ± 14.9	75 ± 15.2	70 ± 15.1	74 ± 15.0	70 ± 17.7	74 ± 15.1	71 ± 18.5

Table 4.--Average proportion of wood and bark yreen weiyht in bark, by tree component and size class, for hardwood species in the Upland-South

Tree size class (inches)	Average and standard deviation						
	Total tree	Stem					Branches
		Butt to 9-inch top	9-inch to 4-inch top	Butt to 4-inch top	4-inch to tip	Butt to tip	
	Percent						
				SOFT HARDWOODS			
1.0- 4.9	20 ± 6.3	--	--	--	--	18 ± 6.8	30 ± 5.0
5.0-10.9	16 ± 2.8	13 ± 3.9	14 ± 4.9	12 ± 3.0	18 ± 3.5	13 ± 3.1	31 ± 5.3
≥ 11.0	13 ± 3.3	10 ± 3.3	14 ± 8.1	11 ± 3.5	20 ± 4.1	11 ± 3.5	25 ± 5.0
				SWEETGUM			
1.0- 4.9	19 ± 2.3	--	--	--	--	17 ± 2.1	32 ± 4.0
5.0-10.9	15 ± 2.7	--	--	12 ± 2.0	19 ± 3.7	13 ± 2.6	32 ± 4.2
≥ 11.0	13 ± 3.3	10 ± 4.6	13 ± 3.6	11 ± 4.3	20 ± 3.1	11 ± 4.3	25 ± 4.6
				YELLDW-PDPLAR			
5.0-10.9	19 ± 2.u	15 ± 2.2	17 ± 1.7	17 ± 1.5	21 ± 3.0	17 ± 1.7	34 ± 4.9
≥ 11.0	15 ± 3.0	12 ± 2.2	18 ± 12.4	13 ± 3.0	22 ± 4.7	13 ± 3.0	27 ± 3.7
				HARD HARDWOODS			
1.0- 4.9	21 ± 7.9	--	--	--	--	19 ± 8.5	30 ± 8.3
5.0-10.9	18 ± 3.4	13 ± 3.5	15 ± 3.1	15 ± 3.7	20 ± 4.3	15 ± 3.6	30 ± 5.0
≥ 11.0	17 ± 3.3	14 ± 3.4	17 ± 4.4	14 ± 3.4	23 ± 3.9	14 ± 3.4	26 ± 4.1
				HICKDRY			
1.0- 4.9	36 ± 5.9	--	--	--	--	35 ± 6.4	40 ± 5.3
5.0-10.9	24 ± 3.7	17 ± 4.4	19 ± 2.4	20 ± 4.3	25 ± 5.5	21 ± 4.3	35 ± 3.6
≥ 11.0	19 ± 1.2	14 ± 1.5	17 ± 0.3	14 ± 1.5	27 ± 6.7	14 ± 1.5	28 ± 2.1
				POST OAK			
5.0-10.9	18 ± 1.5	15 ± 1.9	15 ± 2.1	14 ± 1.6	18 ± 2.9	15 ± 1.5	29 ± 2.4
≥ 11.0	18 ± 3.6	14 ± 4.6	15 ± 5.9	14 ± 4.7	21 ± 2.8	15 ± 4.6	25 ± 5.7
				SCARLET OAK			
1.0- 4.9	27 ± 0.0	--	--	--	--	25 ± 0.0	42 ± 0.0
5.0-10.9	18 ± 2.0	14 ± 1.3	15 ± 1.6	15 ± 1.6	19 ± 2.5	15 ± 1.6	26 ± 4.9
≥ 11.0	16 ± 2.2	13 ± 2.1	16 ± 3.7	14 ± 2.4	22 ± 3.8	14 ± 2.4	23 ± 2.5
				SOUTHERN RED DAK			
5.0-10.9	20 ± 1.7	17 ± 1.6	18 ± 2.0	18 ± 2.0	22 ± 3.0	18 ± 1.9	28 ± 4.0
≥ 11.0	19 ± 1.6	16 ± 1.6	21 ± 2.5	16 ± 1.7	26 ± 3.6	17 ± 1.8	26 ± 2.5
				WHITE OAK			
1.0- 4.9	22 ± 3.0	--	--	--	--	20 ± 2.6	38 ± 4.u
5.0-10.9	17 ± 1.6	10 ± 1.7	12 ± 1.1	12 ± 1.6	20 ± 2.8	13 ± 1.7	31 ± 3.5
> 11.0	15 ± 1.3	11 ± 1.9	14 ± 2.2	11 ± 1.8	23 ± 2.1	11 ± 1.8	24 ± 3.9
				ALL SPECIES			
1.0- 4.9	21 ± 7.4	--	--	--	--	19 ± 8.0	30 ± 7.3
5.0-10.9	18 ± 3.5	13 ± 3.5	15 ± 3.3	14 ± 3.7	20 ± 4.2	15 ± 3.6	30 ± 5.0
≥ 11.0	16 ± 3.7	13 ± 3.7	16 ± 5.8	13 ± 3.7	22 ± 4.3	13 ± 3.7	25 ± 4.4

Table 5.--Average yreen weight per cubic foot of wood, bark, and wood and bark combined, by tree component and size class, for hardwood species in the Upland-South

Tree size class (inches)	Total tree	Stem: Butt to 9-inch top	Stem: 9-inch to 4-inch top	Stem: Butt to 4-inch top	Stem: 4-inch to tip	Stem: Butt to tip	Branches
	Average and standard deviation						
	Pounds per cubic foot						
SOFT HARDWOODS							
Wood							
1.0- 4.9	59 ± 5.2	--	--	--	48 ± 0.0	60 ± 6.3	54 ± 6.2
5.0-10.9	55 ± 6.3	57 ± 10.8	53 ± 13.2	55 ± 7.4	57 ± 5.7	56 ± 6.9	54 ± 6.2
≥ 11.0	54 ± 5.7	54 ± 6.2	53 ± 6.9	54 ± 5.9	55 ± 6.0	54 ± 5.9	55 ± 6.1
Bark							
1.0- 4.9	50 ± 4.5	--	--	--	--	50 ± 6.2	52 ± 6.2
5.0-10.9	51 ± 7.4	52 ± 4.4	56 ± 7.5	49 ± 9.1	55 ± 8.6	50 ± 8.7	56 ± 4.8
≥ 11.0	54 ± 5.1	51 ± 6.4	53 ± 6.5	51 ± 6.3	60 ± 3.8	52 ± 6.3	59 ± 3.Y
Wood and Bark							
1.0- 4.9	57 ± 4.9	--	--	--	--	58 ± 6.3	53 ± 5.2
5.0-10.9	54 ± 5.7	56 ± 9.2	54 ± 12.5	54 ± 6.7	56 ± 5.3	55 ± 6.4	55 ± 4.9
≥ 11.0	54 ± 4.8	53 ± 5.5	53 ± 5.6	53 ± 5.1	56 ± 5.1	53 ± 5.1	56 ± 4.Y
SWEETGUM							
Wood							
1.0- 4.9	60 ± 2.7	--	--	--	48 ± 0.0	59 ± 2.7	61 ± 5.3
5.0-10.9	58 ± 2.6	--	--	58 ± 2.9	61 ± 4.7	58 ± 2.7	59 ± 2.8
> 11.0	59 ± 4.6	58 ± 5.9	60 ± 2.4	58 ± 5.4	59 ± 4.1	58 ± 5.3	62 ± 3.4
Bark							
1.0- 4.9	50 ± 2.2	--	--	--	--	50 ± 3.1	53 ± 4.8
5.0-10.9	49 ± 4.0	--	--	45 ± 4.9	55 ± 5.8	47 ± 4.4	57 ± 3.0
≥ 11.0	49 ± 2.2	46 ± 3.4	48 ± 4.1	46 ± 2.9	59 ± 3.7	46 ± 2.9	58 ± 5.1
Wood and Bark							
1.0- 4.9	58 ± 2.2	--	--	--	--	58 ± 2.3	59 ± 3.9
5.0-10.9	57 ± 2.8	--	--	56 ± 3.1	59 ± 4.6	57 ± 2.9	59 ± 2.5
≥ 11.0	57 ± 4.1	56 ± 5.3	58 ± 2.4	57 ± 4.8	59 ± 3.4	57 ± 4.7	61 ± 3.2
YELLOW-POPLAR							
Wood							
5.0-10.9	50 ± 6.2	58 ± 10.6	46 ± 2.9	49 ± 6.8	53 ± 5.4	50 ± 6.5	49 ± 4.2
≥ 11.0	49 ± 3.4	49 ± 5.7	47 ± 4.5	49 ± 4.8	53 ± 4.7	49 ± 4.8	50 ± 4.1
Bark							
5.0-10.9	52 ± 3.0	49 ± 0.4	51 ± 1.5	52 ± 3.8	57 ± 3.3	52 ± 3.7	55 ± 2.4
> 11.0	52 ± 1.8	49 ± 1.6	52 ± 3.4	49 ± 2.1	58 ± 1.7	49 ± 2.1	57 ± 1.9

Continued

Table 5.--Average yreen weight per cubic foot of wood, bark, and wood and bark combined, by tree component and size class, for hardwood species in the Upland-South--Continued

Tree size class (inches)	Total tree	Stem: Butt to Y-inch top	Stem: 9-inch to 4-inch top	Stem: autt to 4-inch top	Stem: 4-inch to tip	Stem: Butt to tip	Branches
	Average and standard deviation						
	Pounds per cubic foot						
Wood and Bark							
5.0-10.9	50 ± 5.4	56 ± U.6	47 ± 2.6	50 ± 6.U	54 ± 4.4	50 ± 5.8	31 ! 3.0
≥ 11.0	49 ± 2.8	4Y ± 4.9	48 ± 3.1	4Y ± 4.1	54 ± 3.9	4Y ± 4.u	52 ± 3.4
HARD HARDWOODS							
Wood							
1.0- 4.9	bl ± 5.3	--	--	--	48 ± 0.0	61 ± 5.7	60 ± 5.h
5.0-10.9	62 ± 4.Y	62 ± Y.l	61 ± 6.2	62 ± 5.6	bl ± 5.1	62 ± 5.2	63 ± 5.0
> 11.0	62 ± 5.6	62 ± 6.5	b3 ± 6.0	62 ± 6.2	62 ± 4.3	62 ± 6.2	b4 ± 4.H
Bark							
1.0- 4.9	51 ± 5.9	--	--	--	--	53 ± 7.2	49 ± 7.0
5.0-10.9	55 ± 4.5	55 ± 4.Y	57 ± 6.0	56 ± 5.8	57 ± 6.1	56 ± 5.6	55 ± 5.2
> 11.0	57 ± 5.3	57 ± 6.2	58 ± 6.9	57 ± 6.2	58 ± 5.8	57 ± 6.1	56 ± 4.9
Wood and Bark							
1.0- 4.Y	59 ± 3.Y	--	--	--	--	6U ± 4.4	57 ± 4.8
5.0-10.9	61 ± 4.3	61 ± 8.0	61 ± 5.8	61 ± 5.U	60 ± 4.4	61 ± 4.7	60 ± 3.8
> 11.0	61 ± 5.1	61 ± 6.1	62 ± 5.6	61 ± 5.8	61 ± 4.1	61 ± 5.8	62 ± 3.9
HICKORY							
Wood							
1.0- 4.Y	52 ± 3.7		--	--	48 ± 0.0	52 ± 4.0	55 ± 4.4
5.0-10.9	59 ± 4.6	52 i-14.1	55 ± 5.6	5Y ± 6.1	58 ± 4.6	59 ± 5.5	58 ± 4.8
> 11.0	61 ± 2.1	63 ± 1.1	59 ± 0.2	62 ± 0.9	57 ± 8.1	62 ± 1.0	57 ± 3.8
Bark							
1.0- 4.9	58 ± 4.7	--	--	--	--	58 ± 5.3	54 ± 5.5
5.0-10.9	57 ± 2.1	58 ± 2.5	58 ± 3.0	58 ± 2.5	58 ± 2.5	58 ± 2.3	55 ± 2.7
> 11.0	57 ± 1.0	59 ± 1.9	60 ± 0.3	59 ± 1.8	56 ± 6.Y	59 ± 1.7	56 ± 3.3
Wood and Bark							
1.0- 4.9	54 ± 2.8	--	--	--	--	54 ± 2.8	55 ± 3.3
5.0-10.9	58 ± 3.6	53 ± 11.9	56 ± 4.8	59 ± 5.1	58 ± 3.6	59 ± 4.5	57 ± 3.6
> 11.0	60 ± 1.8	62 ± 0.6	59 ± 0.1	62 ± 0.5	57 ± 7.8	62 ± 0.5	56 ± 3.6
POST OAK							
Wood							
5.0-10.9	66 ± 2.0	64 ± 5.3,	64 ± 1.6	65 ± 2.6	64 ± 2.8	65 ± 2.2	70 ± 1.7
≥ 11.u	63 ± 4.4	61 ± 6.3	63 ± 6.0	62 ± 5.9	63 ± 1.4	62 ± 5.8	68 ± 2.6

Continued

Table 5.--Average yreen weight per cubic foot of wood, bark, and wood and bark combined, by tree component and size class, for hardwood species in the Upland-South--Continued

Tree size class (inches)	Total tree	Stem: Butt to 9-inch top	Stem: 9-inch to 4-inch top	Stem: Butt to 4-inch top	Stem: 4-inch to tip	Stem: Butt to tip	Branches
	Average and standard deviation						
	Pounds per cubic foot						
				Bark			
5.0-10.9	50 ± 4.1	53 ± 5.7	54 ± 7.4	50 ± 4.1	50 ± 6.1	50 ± 4.0	50 ± 6.0
≥ 11.0	51 ± 2.6	53 ± 2.8	51 ± 2.8	52 ± 2.6	49 ± 3.2	52 ± 2.6	50 ± 4.1
				Wood and Bark			
5.0-10.9	62 ± 1.8	62 ± 4.9	63 ± 0.3	62 ± 2.2	60 ± 2.2	62 ± 1.9	62 ± 3.3
≥ 11.0	60 ± 3.4	60 ± 5.3	61 ± 4.6	60 ± 4.8	59 ± 1.7	60 ± 4.1	62 ± 2.3
				SCARLET OAK			
				Wood			
1.0- 4.9	59 ± 0.0	--	--	--	48 ± 0.0	59 ± 0.0	56 ± 0.0
5.0-10.9	65 ± 2.4	67 ± 3.7	65 ± 2.6	65 ± 2.7	63 ± 3.0	65 ± 2.5	64 ± 3.8
≥ 11.0	66 ± 3.6	66 ± 4.2	67 ± 5.5	66 ± 4.3	64 ± 2.9	66 ± 4.3	66 ± 2.0
				Bark			
1.0- 4.9	60 ± 0.0	--	--	--	--	61 ± 0.0	54 ± 0.0
5.0-10.9	59 ± 2.1	59 ± 2.9	63 ± 2.7	61 ± 3.2	60 ± 2.2	61 ± 3.0	56 ± 3.9
≥ 11.0	62 ± 2.6	63 ± 2.6	64 ± 2.8	63 ± 2.6	62 ± 3.5	63 ± 2.6	59 ± 3.8
				Wood and Bark			
1.0- 4.9	59 ± 0.0	--	--	--	--	59 ± 0.0	55 ± 0.0
5.0-10.9	64 ± 2.1	66 ± 3.2	64 ± 2.2	64 ± 2.2	62 ± 2.4	64 ± 2.0	62 ± 3.4
≥ 11.0	65 ± 2.8	66 ± 3.4	66 ± 4.3	66 ± 3.4	64 ± 2.0	66 ± 3.4	64 ± 1.9
				SOUTHERN RED OAK			
				Wood			
5.0-10.9	63 ± 2.8	67 ± 1.9	63 ± 1.4	64 ± 3.2	62 ± 2.7	63 ± 3.1	65 ± 2.7
≥ 11.0	66 ± 1.5	66 ± 1.6	66 ± 2.0	66 ± 1.6	65 ± 2.6	66 ± 1.6	66 ± 1.7
				Bark			
5.0-10.9	56 ± 1.8	54 ± 2.7	56 ± 2.4	56 ± 2.5	61 ± 11.2	57 ± 2.3	56 ± 3.2
≥ 11.0	60 ± 1.9	60 ± 1.5	62 ± 1.6	60 ± 1.4	62 ± 3.0	61 ± 1.4	59 ± 3.6
				Wood and Bark			
5.0-10.9	62 ± 2.2	64 ± 1.6	62 ± 1.1	62 ± 2.5	61 ± 3.2	62 ± 2.5	62 ± 2.8
≥ 11.0	65 ± 1.3	65 ± 1.4	65 ± 1.7	65 ± 1.4	64 ± 2.1	65 ± 1.4	64 ± 1.7

Continued

Table 5.--Average yreen weight per cubic foot of wood, bark, and wood and bark combined, by tree component and size class, for hardwood species in the Upland-South--Continued

Tree size class (inches)	Average and standard deviation						
	Total tree	Stem					Branches
		Butt to 9-inch top	9-inch to 4-inch top	Butt to 4-inch top	4-inch to tip	Butt to tip	
	Pounds per cubic foot						
	WHITE OAK						
	Wood						
1.0- 4.9	62 ± 1.8	--	--		48 ± 0.0	62 ± 1.9	60 ± 3.5
5.0-10.9	64 ± 3.8	62 ± 9.3	61 ± 6.3	64 i-4.7	62 ± 4.4	63 ± 4.3	65 ± 3.2
> 11.0	61 ± 3.0	60 ± 4.4	63 ± 2.8	60 ± 3.9	61 ± 3.0	60 ± 3.9	66 ± 2.2
	Bark						
1.0- 4.9	50 ± 3.6	--	--	--	--	49 ± 3.8	51 ± 4.4
5.0-10.9	54 ± 3.1	56 ± 5.4	58 ± 2.9	54 ± 3.7	56 ± 4.3	55 ± 3.6	55 ± 5.5
≥ 11.0	57 ± 2.5	58 ± 2.4	59 ± 2.2	58 ± 2.3	59 ± 2.1	58 ± 2.2	55 ± 3.2
	Wood and Bark						
1.0- 4.9	59 ± 2.2	--	--	--	--	59 ± 2.u	56 ± 3.6
5.0-10.9	62 ± 3.2	61 ± 8.2	61 ± 5.4	62 ± 4.1	61 ± 3.7	62 ± 3.7	61 ± 3.2
> 11.0	61 ± 2.5	60 ± 3.8	62 ± 2.4	60 ± 3.4	60 ± 2.5	60 ± 3.4	63 ± 2.3
	ALL SPECIES						
	Wood						
1.0- 4.9	60 ± 5.4	--	--		48 ± 0.0	61 ± 5.9	58 ± 6.6
5.0-10.9	61 ± 6.0	62 ± 9.3	61 ± 7.3	61 i-6.7	60 ± 5.5	61 ± 6.2	61 ± 6.4
> 11.0	60 ± 6.9	60 ± 7.4	60 ± 7.6	60 ± 7.2	60 ± 5.8	60 ± 7.2	62 ± 6.6
	Bark						
1.0- 4.9	51 ± 5.5	--	--		--	52 ± 6.9	50 ± 7.0
5.0-10.9	54 ± 5.5	55 ± 4.9	57 ± 6.1	54 i-J.2	57 ± 6.8	55 ± 6.8	55 ± 5.1
≥ 11.0	56 ± 5.4	55 ± 6.8	57 ± 7.1	56 ± 6.8	58 ± 5.4	56 ± 6.7	57 ± 4.7
	Wood and Bark						
1.0- 4.9	58 ± 4.3	--	--	--	--	59 ± 5.1	56 ± 5.2
5.0-10.9	60 ± 5.3	61 ± 8.2	60 ± 6.8	60 ± 6.2	60 ± 4.9	6U ± 5.8	59 ± 4.7
≥ 11.0	59 ± 6.1	59 ± 6.9	60 ± 6.9	59 ± 6.7	59 ± 5.0	59 ± 6.7	60 ± 5.0

Tahle 6.--Average green weight of wood and bark per cubic foot of wood, by tree component and size class, for hardwood species in the Upland-South

Tree size class (inches)	Average and standard deviation						
	Total tree	Stem					Branches
		Butt to Y-inch top	9-inch to 4-inch top	Butt to 4-inch top	4-inch to tip	Butt to tip	
	Pounds per cubic foot						
	SOFT HARDWOODS						
1.0- 4.9	73 ± 5.9	--	--	--	50 ± 0.0	73 ± 6.4	77 ± 11.8
5.0-10.9	66 ± 6.5	66 ± 13.5	61 ± 11.6	63 ± 7.2	70 ± 6.4	64 ± 6.8	78 ± 9.2
≥ 11.0	62 ± 5.4	60 ± 5.8	62 ± 7.6	60 ± 5.5	68 ± 7.0	60 ± 5.4	74 ± 9.1
	SWEETGUM						
1.0- 4.9	74 ± 3.1	--	--	--	50 ± 0.0	72 ± 3.1	89 ± 7.1
5.0-10.9	69 ± 3.0	--	--	66 ± 3.1	75 ± 4.7	67 ± 2.9	87 ± 4.6
> 11.0	68 ± 4.1	64 ± 5.0	69 ± 2.2	65 ± 4.5	74 ± 3.5	65 ± 4.4	82 ± 8.8
	YELLOW-POPLAR						
5.0-10.9	61 ± 7.1	69 ± 14.1	55 ± 3.4	59 ± 7.6	68 ± 5.2	60 ± 7.2	75 ± 7.6
≥ 11.0	58 ± 3.6	56 ± 5.9	59 ± 8.5	56 ± 4.7	68 ± 6.4	57 ± 4.6	69 ± 6.8
	HARD HARDWOODS						
1.0- 4.9	77 ± 5.7	--	--	--	50 ± 0.0	76 ± 5.7	86 ± 9.4
5.0-10.9	76 ± 6.1	72 ± 11.2	72 ± 7.6	73 ± 6.7	77 ± 5.4	74 ± 6.2	90 ± 6.8
≥ 11.0	76 ± 7.1	72 ± 7.9	76 ± 7.6	72 ± 7.5	81 ± 6.3	73 ± 7.5	87 ± 7.2
	HICKORY						
1.0- 4.9	82 ± 4.3	--	--	--	50 ± 0.0	81 ± 3.5	93 ± 7.6
5.0-10.9	77 ± 5.8	63 ± 15.0	68 ± 6.5	74 ± 7.3	77 ± 4.8	75 ± 6.7	89 ± 7.5
≥ 11.0	74 ± 3.6	73 ± 2.6	71 ± 0.01	73 ± 2.4	77 ± 4.0	73 ± 2.4	78 ± 7.5
	POST OAK						
5.0-10.9	81 ± 2.5	75 ± 4.7	76 ± 0.9	76 ± 3.0	78 ± 2.6	76 ± 2.4	99 ± 3.4
≥ 11.0	76 ± 3.3	71 ± 4.7	74 ± 3.1	72 ± 4.0	79 ± 2.6	72 ± 3.9	92 ± Y.6
	SCARLET OAK						
1.0- 4.9	80 ± 0.0	--	--	--	50 ± 0.0	79 ± 0.0	96 ± 0.0
5.0-10.9	78 ± 2.1	78 ± 4.0	76 ± 2.7	76 ± 2.1	77 ± 2.9	76 ± 2.6	87 ± 4.8
≥ 11.0	79 ± 2.9	76 ± 3.8	80 ± 4.3	76 ± 3.7	83 ± 3.4	76 ± 3.7	85 ± 3.1
	SOUTHERN RED OAK						
5.0-10.9	79 ± 3.3	80 ± 3.5	78 ± 2.6	78 ± 3.8	79 ± 4.3	78 ± 3.8	91 ± 5.4
≥ 11.0	82 ± 1.9	79 ± 1.8	83 ± 3.6	79 ± 1.8	88 ± 3.9	79 ± 1.8	90 ± 3.1
	WHITE OAK						
1.0- 4.9	80 ± 2.4	--	--	--	50 ± 0.0	78 ± 2.1	96 ± 2.8
5.0-10.9	77 ± 4.7	69 ± 10.8	70 ± 7.2	73 ± 5.4	77 ± 4.7	73 ± 4.9	93 ± 4.2
≥ II .0	72 ± 3.6	67 ± 4.1	73 ± 3.1	68 ± 3.6	79 ± 3.2	68 ± 3.6	87 ± 4.9
	ALL SPECIES						
1.0- 4.Y	76 ± 6.1		--	--	50 ± 0.0	75 ± 6.U	83 ± 11.0
5.0-10.9	74 ± 7.7	71 i-11.4	71 ± 8.6	71 ± 8.0	75 ± 6.4	72 ± 7.5	88 ± 8.9
≥ 11.0	72 ± Y.1	69 ± 9.2	72 ± 9.8	69 ± 8.9	77 ± 8.7	69 ± 8.9	83 ± 9.7

Table 7.--Regression equations for estimating green and dry weight of above-stump total-tree wood, bark, and foliage, wood and bark combined, and wood alone for hardwood species in the Upland-South, with d.b.h. as the independent variable

Species or species group	Weight green or dry	Regression equation coefficients: Trees < 11.0 in d.b.h.[1] a'	b	Trees > 11.0 in d.b.h.[2] a"	b	Coefficient of determination (R^2)	Standard error[3] ($S_{y.x}$)	No. of trees sampled
				TOTAL-TREE YOOD, BARK, AND FOLIAGE				
Soft Hardwoods	Green	4.03305	1.22682	3.76200	1.24133	0.98	0.0957	122
	Dry	2.24316	1.20782	1.58122	1.28073	0.98	0.1023	122
Sweetgum	Green	3.45384	1.26820	3.10274	1.29055	0.99	0.0721	39
	Dry	1.57902	1.28241	1.23675	1.33335	0.99	0.0725	39
Yellow-poplar	Green	1.49817	1.47090	8.55437	1.10762	0.98	0.0678	19
	Dry	0.46515	1.58089	5.84275	1.05322	0.98	0.0764	19
Hard Hardwoods	Green	4.41595	1.21429	3.90893	1.23972	0.99	0.0873	364
	Dry	2.47910	1.23265	3.00118	1.19280	0.99	0.0849	364
Hickory	Green	4.21010	1.19922	0.16719	1.87191	0.99	0.0826	37
	Dry	2.42737	1.22122	0.14027	1.81569	0.99	0.0741	37
Post oak	Green	3.52810	1.24978	11.43392	1.00460	0.98	0.0612	26
	Dry	2.73650	1.24077	6.79066	1.00916	0.98	0.0619	26
Scarlet oak	Green	5.85797	1.18664	3.44343	1.29743	0.98	0.0626	42
	Dry	3.71351	1.16900	2.45847	1.25500	0.98	0.0603	42
South. red oak	Green	3.40229	1.28096	3.77536	1.25927	0.98	0.0552	34
	Dry	1.95177	1.28848	2.60305	1.22844	0.98	0.0580	34
White oak	Green	3.77132	1.24770	11.91623	1.00781	0.99	0.0634	87
	Dry	2.40974	1.23665	7.10021	1.01133	0.99	0.0653	87
All Species	Green	4.31938	1.21728	3.88272	1.23950	0.99	0.0898	486
	Dry	2.40445	1.22954	2.76893	1.20011	0.99	0.0957	486
				TOTAL-TREE YOOD AND BARK				
Soft Hardwoods	Green	3.72086	1.23838	3.57667	1.24662	0.98	0.0988	122
	Dry	2.13830	1.21440	1.53461	1.28357	0.98	0.1042	122

Continued

Table 7.--Regression equations for estimating green and dry weight of above-stump total-tree wood, bark, and foliage, wood and bark combined, and wood alone for hardwood species in the Upland-South, with d.b.h. as the independent variable--Continued

Species or species group	Weight green or dry	Regression equation coefficients: Trees < 11.0 in d.b.h.[1] a'	b	Trees ≥ 11.0 in d.b.h.[2] a"	b	Coefficient of determination (R^2)	Standard error[3] ($S_{y.x}$)	No. of trees sampled
Sweetgum	Green	3.21390	1.27554	2.83100	1.30200	0.99	0.0717	39
	Dry	1.49799	1.28900	1.18827	1.33730	0.99	0.0725	39
Yellow-poplar	Green	1.38087	1.48551	8.44488	1.10792	0.98	0.0671	19
	Dry	0.44159	1.59040	5.80899	1.05310	0.98	0.0764	19
Hard Hardwoods	Green	4.03700	1.22483	3.70662	1.24263	0.99	0.0868	364
	Dry	2.34325	1.23822	2.81946	1.19965	0.99	0.0849	364
Hlckory	Green	3.64420	1.22404	0.18250	1.84836	0.99	0.0755	37
	Dry	2.20539	1.23749	0.14913	1.79919	0.99	0.0705	37
Post oak	Green	3.41839	1.24923	11.08083	1.00401	0.98	0.0619	26
	Dry	2.17824	1.24051	6.65153	1.00744	0.98	0.0624	26
Scarlet oak	Green	5.44452	1.19363	3.10396	1.31080	0.98	0.0637	42
	Dry	3.52314	1.17476	2.25162	1.26812	0.98	0.0613	42
South. red oak	Green	3.20531	1.28487	3.39595	1.27282	0.98	0.0561	34
	Dry	1.88717	1.29016	2.38797	1.24109	0.98	0.0585	34
White oak	Green	3.54192	1.25138	11.44305	1.00685	0.99	0.0649	87
	Dry	2.30393	1.23852	6.86747	1.01079	0.99	0.0669	87
All Species	Green	3.95891	1.22794	3.67112	1.24367	0.99	0.0900	486
	Dry	2.27767	1.23522	2.61138	1.20671	0.99	0.0956	486
TOTAL-TREE WOOD								
Soft Hardwoods	Green	2.87796	1.26330	3.19198	1.24171	0.98	0.1069	122
	Dry	1.65387	1.24218	i.37392	1.28085	0.98	0.1134	122
Sweetgum	Green	2.44440	1.30566	2.84007	1.27437	0.99	0.0738	39
	Dry	1.16893	1.31205	1.16774	1.31226	0.99	0.0741	39
Yellow-poplar	Green	1.01298	1.51067	5.88365	1.14379	0.98	0.0700	19
	Dry	0.31578	1.63008	4.50433	1.07590	0.97	0.0822	19

Continued

Table 7.--Regression equations for estimating green and dry weight of above-stump total-tree wood, bark, and foliage, wood and bark combined, and wood alone for hardwood species in the Upland-South, with d.h.h. as the independent variable--Continued

Species or species group	Weight green or dry	Regression equation coefficients: Trees < 11.0 in d.b.h.[1] a'	b	Trees > 11.0 in d.b.h.[2] a"	b	Coefficient of determination (R^2)	Standard error[3] ($S_{y.x}$)	No. of trees sampled
Hard Hardwoods	Green	3.19206	1.23440	2.96737	1.24962	0.99	0.0953	364
	Dry	1.89910	1.24155	2.42720	1.19039	0.99	0.0899	364
Hickory	Green	2.28746	1.27496	0.12864	1.87510	0.99	0.0804	37
	Dry	1.47650	1.27922	0.10224	1.83597	0.99	0.0789	37
Post oak	Green	2.82547	1.24606	7.90208	1.03161	0.98	0.0653	26
	Dry	1.87993	1.22618	4.60998	1.03914	0.98	0.0699	26
Scarlet oak	Green	4.20032	1.20942	2.37603	1.32822	0.97	0.0721	42
	Dry	2.74142	1.18539	1.71732	1.28292	0.97	0.0705	42
South. red oak	Green	2.70544	1.27310	2.48291	1.29100	0.98	0.0596	34
	Dry	1.66188	1.26209	1.71414	1.25563	0.98	0.0647	34
White oak	Green	2.63180	1.27928	9.69798	1.00733	0.99	0.0635	87
	Dry	1.73147	1.26591	6.33934	0.99529	0.99	0.0649	87
All Species	Green	3.12186	1.24033	2.95515	1.25177	0.99	0.0983	486
	Dry	1.83012	1.24323	2.20297	1.20456	0.99	0.0995	486

[1]Trees < 11.0 inches d.b.h.

$Y = a'(D^2)^b$

[2]Trees > 11 .U inches d.b.h.

$Y = a''(D^2)^b$

Where: Y = component weight in pounds
D = tree d.b.h. in inches
a',a",b = regression coefficients

[3]$\log_{10}$ form

Table 8.--Regression equations for estimating green and dry weight of total-stem wood and bark combined and wood alone for hardwood species in the Upland-South, with d.b.h. as the independent variable

Species or species group	Weight green or dry	Regression equation coefficients: Trees < 11.0 in d.b.h.[1] a'	b	Trees > 11.0 in d.b.h.[2] a"	b	Coefficient of determination (R^2)	Standard error[3] ($S_{y.x}$)	No. of trees sampled
				TOTAL-STEM WOOD AND BARK				
Soft Hardwoods	Green	3.06818	1.25087	6.08427	1.10811	0.98	0.1019	122
	Dry	1.76433	1.22669	2.56326	1.14881	0.98	0.1036	122
Sweetgum	Green	2.99399	1.26356	4.45413	1.18073	0.99	0.0773	3Y
	Dry	1.39136	1.27827	1.90083	1.21321	0.99	0.0776	39
Yellow-poplar	Green	0.99452	1.54032	27.95174	0.84472	0.98	0.0642	19
	Dry	0.30828	1.65371	20.33017	0.78027	0.98	0.0747	19
Hard Hardwoods	Green	3.26963	1.21895	5.42981	1.11318	0.99	0.0879	364
	Dry	1.90929	1.23052	4.47873	1.05274	0.99	0.0863	364
Hickory	Green	3.26299	1.18973	0.27607	1.70471	0.99	0.0650	37
	Dry	1.97974	1.20411	0.24648	1.63853	0.99	0.0584	37
Post oak	Green	2.66234	1.24130	12.23908	0.92322	0.98	0.0584	26
	Dry	1.69741	1.23153	7.48033	0.92226	0.98	0.0567	26
Scarlet oak	Green	5.55694	1.13364	3.18970	1.24940	0.97	0.0695	42
	Dry	3.68422	1.10559	2.38800	1.19600	0.97	0.0655	42
South. red oak	Green	2.75099	1.27903	7.67526	1.06509	0.98	0.0489	34
	Dry	1.60722	1.28419	5.99985	1.00952	0.98	0.050	34
White oak	Green	3.29276	1.20873	11.91547	0.94055	0.98	0.0713	87
	Dry	2.16839	1.19319	7.28460	0.94051	0.98	0.0729	87
All Species	Green	3.23553	1.22507	5.38233	1.11895	0.99	0.0918	486
	Dry	1.86650	1.23090	4.03918	1.06993	0.99	0.0922	486
				TOTAL-STEM YOOD				
Soft Hardwoods	Green	2.42210	1.27710	5.58303	1.10297	0.98	0.1105	122
	Dry	1.38138	1.25733	2.45365	1.13754	0.98	U.1146	122
Sweetgum	Green	2.29915	1.29698	4.65394	1.14994	0.99	0.0794	39
	Dry	1.09577	1.30410	2.00097	1.17854	0.99	0.0793	39

Continued

Table 8.--Regression equations for estimating green and dry weight of total-stem wood and bark combined and wood alone for hardwood species in the Upland-South. with d.b.h. as the independent variable--Continued

Species or species yroup	Weight green or dry	Regression equation coefficients: Trees < 11.0 in d.b.h.[1] a'	b	Trees > 11.0 in d.b.h.[2] a"	b	Coefficient of determination (R^2)	Standard error[3] ($S_{y.x}$)	No. of trees sampled
Yellow-poplar	Green	0.76350	1.55963	17.93171	0.90147	0.98	0.0692	19
	Dry	0.23399	1.68334	14.83040	0.81818	0.97	0.0808	19
Hard Hardwoods	Green	2.63218	1.23229	4.53934	1.11864	0.99	0.0942	364
	Dry	1.57213	1.23710	3.99397	1.04269	0.99	0.0898	364
Hickory	Green	2.05646	1.25043	0.20302	1.73323	0.99	0.0766	37
	Dry	1.32501	1.25430	0.17262	1.67926	0.99	0.0707	37
Post oak	Green	2.29090	1.23866	9.79069	0.93579	0.98	0.0651	26
	Dry	1.53010	1.21644	5.81338	0.93810	0.98	0.0700	26
Scarlet oak	Green	4.32486	1.15311	2.47377	1.26959	0.97	0.0757	42
	Dry	2.86586	1.12118	1.84078	1.21348	0.97	0.0727	42
South. red oak	Green	2.28777	1.27543	5.42999	1.09520	0.98	0.0532	34
	Dry	1.38511	1.26487	4.17916	1.03460	0.98	0.0568	34
White oak	Green	2.49577	1.24221	10.84485	0.93588	0.98	0.0694	87
	Dry	1.66285	1.22473	7.09486	0.92221	0.98	0.0711	87
All Species	Green	2.59891	1.24079	4.52737	1.12506	0.98	0.0993	486
	W Y	1.52322	1.24211	3.56592	1.06475	u.99	0.0973	486

[1]Trees < 11.0 inches d.b.h.

$Y = a'(D^2)^b$

[2]Trees > 11.0 inches d.b.h.

$Y = a''(D^2)^b$

Where: Y = component weight in pounds
D = tree d.b.h. in inches
a', a", b = regression coefficients

[3]$\log_{10}$ form

Table 9.--Regression equations for estimating cubic-foot volume of above-stump total-tree wood and bark combined and wood alone for hardwood species in the Upland-South, with d.b.h. as the independent variable

Species or species group	Volume wood & bark or wood only	Regression equation coefficients: Trees < 11.0 in d.b.h.[1] a'	b	Trees ≥ 11.0 in d.b.h.[2] a"	b	Coefficient of determination (R^2)	Standard error[3] ($S_{y.x}$)	No. of trees sampled
				TOTAL TREE				
Soft Hardwoods	Wd&Bk	0.06522	1.24942	0.06347	1.25510	0.99	0.0898	122
	wood	0.04865	1.28014	0.05379	1.25920	0.99	0.0953	122
Sweetgum	Wd&Bk	0.05751	1.26879	0.04395	1.32488	0.99	0.0681	39
	Wood	0.04157	1.30404	0.04230	1.30039	0.99	0.0694	39
Yellow-poplar	Wd&Bk	0.02713	1.49101	0.18444	1.09136	0.99	0.0527	19
	Wood	0.02078	1.50826	0.12891	1.12772	0.99	0.0535	19
Hard Hardwoods	Wd&Bk	0.06908	1.21558	0.06849	1.21737	0.99	0.0781	364
	wood	0.05287	1.22720	0.05206	1.23040	0.99	0.0845	364
Hickory	Wd&Bk	0.06553	1.21345	0.00340	1.83000	0.99	0.0773	37
	wood	0.04299	1.25016	0.00218	1.87161	0.99	0.0770	37
Post oak	Wd&Bk	0.05424	1.25505	0.17109	1.01552	0.99	0.0569	26
	Wood	0.03866	1.27544	0.12295	1.03417	0.99	0.0540	26
Scarlet oak	Wd&Bk	0.08748	1.18835	0.05709	1.27736	0.98	0.0571	42
	wood	0.06580	1.20640	0.04215	1.29928	0.98	0.0618	42
South. red oak	Wd&Bk	0.05510	1.26919	0.06666	1.22948	0.98	0.0541	34
	Wood	0.04528	1.25821	0.04655	1.25243	0.98	0.0574	34
White oak	Wd&Bk	0.06245	1.22881	0.14279	1.05637	0.99	0.0590	87
	Wood	0.04249	1.27200	0.11701	1.06075	0.99	0.0569	87
All Species	Wd&Bk	0.06851	1.22209	0.06460	1.23433	0.99	0.0822	486
	wood	0.05232	1.23721	0.04915	1.25024	0.99	0.0899	486

[1] Trees < 11.0 inches d.b.h.

$Y = a'(D^2)^b$

[2] Trees > 11.0 inches d.b.h.

$Y = a''(D^2)^b$

Where: Y = component volume in cubic feet
D = trae d.b.h. in inches
a', a", b = regression coefficients

[3] $\log_{10}$ form

Table 10.--Regression equations for estimating cubic-foot volume of total-stem wood and bark combined and wood alone for hardwood species in the Upland-South, with d.b.h. as the independent variable

Species or species group	Volume wood & bark or wood only	Regression equation coefficients: Trees < 11.0 in d.b.h.[1] a'	b	Trees > 11.0 in d.b.h.[2] a"	b	Coefficient of determination (R^2)	Standard error[3] ($S_{y.x}$)	No. of trees sampled
				TOTAL STEM				
SOR Hardwoods	Wd&Bk	0.05285	1.26575	0.10311	1.12640	0.99	0.0960	122
	wood	0.04012	1.29801	0.09175	1.12553	0.98	0.1011	122
Sweetgum	Wd&Bk	0.05325	1.25934	0.06568	1.21561	0.99	0.0735	39
	wood	0.03900	1.29651	0.06551	1.18838	0.99	0.0740	39
Yellow-poplar	Wd&Bk	0.01899	1.55391	0.64612	0.81849	0.98	0.0581	19
	wood	0.01531	1.56345	0.42596	0.86990	0.98	0.0604	19
Hard Hardwoods	Wd&Bk	0.05512	1.21273	0.09808	1.09258	0.99	0.0821	364
	wood	0.04331	1.22761	0.07816	1.10453	0.99	0.0862	364
Hickoty	Wd&Bk	0.05852	1.17801	0.00601	1.65242	0.99	0.0690	37
	wood	0.03863	1.22470	0.00404	1.69525	0.99	0.0723	37
Post oak	Wd&Bk	0.04116	1.25449	0.19370	0.931'55	0.99	0.0556	26
	wood	0.03094	1.27574	0.15933	0.93402	0.99	0.0549	26
Scarlet oak	Wd&Bk	0.09125	1.12148	0.05567	1.22451	0.98	0.0638	42
	wood	0.06949	1.14390	0.04285	1.24474	0.98	0.0657	42
South. red oak	Wd&Bk	0.04733	1.26251	0.15024	1.02168	0.99	0.0465	34
	wood	0.03824	1.26097	0.10149	1.05743	0.98	0.0514	34
White oak	Wd&Bk	0.05719	1.18974	0.13923	1.00422	0.98	0.0673	87
	wood	0.03973	1.23985	0.12270	1.00472	0.99	0.0645	87
All Species	Wd&Bk	0.05522	1.22243	0.09217	1.11561	0.99	0.0903	486
	Wood	0.04319	1.24059	0.07394	1.12846	0.99	0.0962	486

[1] Trees < 11.0 inches d.b.h.

$Y = a'(D^2)^b$

[2] Trees > 11.0 inches d.b.h.

$Y = a''(D^2)^b$

Where: Y = component volume in cubic feet
D = tree d.b.h. in inches
a', a", b = regression coefficients

[3] $\log_{10}$ form

Table 11.--Regression equations for estimating green and dry weight of above-stump total-tree wood, bark, and foliage, wood and bark combined, and wood alone for hardwood species in the Upland-South, with d.b.h. and total height as the indedependent variables

Species or species group	Weight green or dry	Regression equation coefficrents: Trees < 11.0 in d.b.h.[1] a'	b	Trees ≥ 11.0 in d.b.h.[2] a"	b	c	Coefficient of determination (R^2)	Standard error[3] ($S_{y.x}$)	No. of trees sampled
				TOTAL-TREE YOOD, BARK, AND FOLIAGE					
Soft Hard woods	Green	0.36115	0.89632	0.14042	1.09330	0.89632	0.99	0.0875	122
	Dry	0.20927	0.88203	0.06179	1.13639	0.88203	0.98	0.0965	122
Sweetgum	Green	0.23532	0.94646	0.06941	1.20103	0.94646	0.99	0.0526	39
	Dry	0.10413	0.95735	0.02658	1.24205	u.95735	0.99	0.0515	39
Yellow-poplar	Green	0.23024	0.94707	0.12145	1.08044	0.94707	0.98	0.0678	19
	Dry	0.05927	1.02331	0.06152	1.01555	1.02331	0.98	0.0715	19
Hard Hardwoods	Green	0.31320	0.93858	0.10004	1.17655	0.93858	0.99	0.0823	364
	Dry	0.16886	0.95281	0.07269	1.12855	0.95281	0.99	0.0792	364
Hickory	Green	0.36164	0.91033	0.01704	1.54726	0.91033	0.99	0.0854	37
	Dry	0.20243	0.92544	0.01344	1.49088	0.92544	0.99	0.0895	37
Post oak	Green	0.19430	1.00662	0.23601	0.96607	1.00662	0.98	0.0609	26
	Dry	0.12835	0.99690	0.14308	0.97425	0.99690	0.98	0.0647	26
Sca rlet. oa k	Green	0.21961	0.99568	0.18321	1.03347	0.99568	0.99	0.0420	42
	Dry	0.14984	0.97802	0.13591	0.99836	0.97802	0.99	0.0432	42
South. red oak	Green	0.11897	1.04858	0.06815	1.16476	1.04858	0.98	0.0554	34
	Dry	0.06592	1.05647	0.04591)	1.13197	1.05647	0.98	0.0572	34
White oak	Green	0.25611	0.96644	0.18888	1.02993	0.96644	0.99	0.0562	87
	Dry	0.16690	0.95837	0.11699	1.03246	0.95837	0.99	0.0569	87
All Species	Green	0.32574	0.92803	0.11479	1.14552	0.92803	0.99	0.0914	486
	Dry	0.17932	0.93579	0.07785	1.10977	0.93579	0.98	0.1046	486
				TOTAL-TREE WOOD AND BARK					
Soft Hardwoods	Green	0.32357	0.90550	0.13065	1.09460	0.90550	0.99	0.0876	122
	Dry	0.19618	0.88726	0.05924	1.13694	0.88726	0.98	0.0968	122

Continued

Table 11.--Regression equations for estimating green and dry weight of above-stump total-tree wood, bark, and foliage, wood and bark combined, and wood alone for hardwood species in the Upland-South, with d.b.h. and total height as the indedependent variables--Continued

Species or species group	Weight green or dry	Regression equation coefficients: Trees < 11.0 in d.b.h.[1] a'	b	Trees > 11.0 in d.b.h.[2] a"	b	c	Coefficient of determination (R^2)	Standard error[3] ($S_{y.x}$)	No. of trees sampled
Sweetgum	Green	0.21394	0.95284	0.06248	1.20951	0.95284	0.99	0.0478	39
	Dry	0.09695	0.96283	0.02517	1.24401	0.96283	0.99	0.0487	39
Yellow-poplar	Green	0.20548	0.95804	U.11558	1.07802	0.95804	0.98	0.0657	19
	Dry	0.05501	1.03065	0.05976	1.01336	1.03065	0.98	0.0704	19
Hard Hardwoods	Green	0.27912	U.94699	0.09209	1.17821	0.94699	0.99	0.0800	364
	Dry	0.15731	0.95736	0.06728	1.13448	0.95736	0.99	0.0777	364
Hickory	Green	0.29833	0.92890	0.01769	1.51800	0.92890	0.99	0.0809	37
	Dry	0.17792	0.93778	0.01385	1.46999	0.93778	0.99	0.0868	37
Post oak	Green	0.18791	1.00655	0.22936	0.96498	1.00655	0.98	0.0611	26
	Dry	0.12487	II.99690	0.14035	0.97254	0.99690	0.98	0.0649	26
Scarlet oak	Green	0.19944	1.00199	0.16245	1.04476	1.00199	0.99	0.0426	42
	Dry	0.13874	0.98382	0.12294	1.00904	0.98382	0.99	0.0430	42
South. red oa k	Green	0.11014	1.05261	0.06056	1.17735	1.05261	0.98	0.0558	34
	Dry	0.06299	1.05871	0.04188	1.14380	1.05871	0.98	0.0572	34
White oak	Green	0.23948	0.96887	0.17887	1.02972	0.46887	0.99	0.0593	87
	Dry	0.15919	0.95963	0.11236	1.03227	0.95963	0.99	0.0593	87
All Species	Green	0.29055	0.93665	0.10571	1.14747	0.93665	0.99	0.0892	486
	Dry	0.16723	0.94050	0.07249	1.11482	0.94050	0.98	0.1028	486
				TOTAL-TREE WOOD					
Soft Hardwoods	Green	U.23621	0.92468	0.11041	1.08326	0.92468	0.99	0.0923	122
	Dry	u.14172	0.90909	0.05020	1.12550	0.90909	0.98	0.1007	122
Sweetgum	Green	0.15232	0.97556	0.05739	1.17910	0.97556	0.99	0.0485	39
	Dry	0.07191	0.98024	0.02313	1.21678	0.98024	0.99	0.0492	39
Yellow-poplar	Green	U.14161	U.97772	0.07582	1.10797	0.97772	0.98	0.0653	19
	Dry	0.03583	1.06110	0.04203	1.02780	1.06110	0.98	0.0719	19

Continued

Table 11.--Regression equations for estimating green and dry weight of above-stump total-tree wood, bark, and foliage, wood and bark combined, and wood altne for hardwood species in the Upland-South, with d.h.h. and total height as the indedependent variables--Continued

Species or species group	Weight green or dry	Regression equation coefficients: Trees < 11.0 in d.b.h.[1] a'	b	Trees > 11.0 in d.b.h.[2] a"	b	c	Coafficient of determination (R^2)	Standard error[3] ($S_{y.x}$)	No. of trees sampled
Hard Hardwoods	Green	0.21369	0.95558	0.07231	1.18151	0.95558	0.99	0.0822	364
	Dry	0.12532	0.96098	0.05782	1.12226	0.96098	0.99	0.0766	364
Hickory	Green	0.16542	0.96957	0.01160	1.52359	0.96957	0.99	0.0683	37
	Dry	0.10653	0.47215	0.00907	1.48569	0.97215	0.99	0.0727	37
Post oak	Green	0.15498	1.00515	0.16576	0.99114	1.00515	0.98	0.0631	26
	Dry	0.10924	0.98774	0.10243	1.00116	0.98774	0.98	0.0695	26
Scarlet. oak	Green	0.14244	1.01912	0.12045	1.05408	1.01912	0.99	0.0495	42
	Dry	0.10107	0.99699	0.09206	1.01645	0.99699	0.99	0.0504	42
South. red oak	Green	0.09406	1.04520	0.04594	1.19461	1.04520	0.98	0.0581	34
	Dry	0.05847	1.03815	0.03284	1.15847	1.03815	0.98	0.0624	34
White oak	Green	0.16808	0.99011	0.13795	1.03131	0.99011	0.99	0.0587	87
	Dry	0.11322	0.98037	0.09452	1.01802	0.98037	0.99	0.0583	87
All Speries	Green	0.21990	0.94766	0.08329	1.15009	0.94766	0.99	0.0898	486
	Dry	0.12996	0.94835	0.06072	1.10704	0.94835	0.99	0.0986	486

[1]Trees < 11.9 inches d.b.h.

$Y = a'(D^2Th)^b$

[2]Trees ≥ 11.0 inches d.b.h.

$Y = a''(D^2)^b (Th)^c$

Where: Y = component weight in pounds
0 = tree d.b.h. in inches
Th = tree total height in feet
a' ,a",b,c = regression coefficients

[3]$\log_{10}$ form

Table 12.--Regression equations for estimating green and dry weight of total-stem wood and bark combined and wood alone for hardwood species in the Upland-South, with d.b.h. and total height as the independent variables

Species or species group	Weight green or dry	Regression equation coefficients: Trees < 11.0 in d.b.h.[1] a'	b	Trees > 11.0 in d.b.h.[2] a"	b	c	Coefficient of determination (R^2)	Standard error[3] ($S_{y.x}$)	No. of trees sampled
				TOTAL-STEM WOOD AND BARK					
Soft Hardwoods	Green	0.25113	0.91865	0.22629	0.94037	0.91865	0.99	0.0718	122
	Dry	0.15247	0.90026	0.10080	0.98656	0.90026	0.99	0.0787	122
Sweetgum	Green	0.19936	0.94686	0.10475	1.08105	0.94686	0.99	0.0436	39
	Dry	0.08996	0.95762	0.04268	1.11308	0.95762	0.99	0.0443	39
Yellow-poplar	Green	0.12997	1.00023	0.33457	0.80307	1.00023	0.99	0.0550	19
	Dry	0.03353	1.07770	0.17805	0.72957	1.07770	0.98	0.0615	19
Hard Hardwoods	Green	0.22328	0.94509	0.14030	1.04198	0.94509	0.99	0.0634	364
	Dry	0.12731	0.95389	0.11160	0.98135	0.95389	0.99	0.0620	364
Hickory	Green	0.28445	0.90361	0.02884	1.38086	0.90361	0.99	0.0639	31
	Dry	0.16984	0.91313	0.02461	1.31586	0.91313	0.99	0.0709	37
Post oak	Green	0.14156	1.00641	0.26456	0.87602	1.00641	0.99	0.0479	26
	Dry	0.09446	0.99578	0.16531	0.87908	0.99578	0.99	0.0505	26
Scarlet oak	Green	0.21820	0.96294	0.19784	0.98336	U.96294	0.99	0.0396	42
	Dry	0.15824	0.93801	0.15837	0.93784	0.93801	0.99	0.0361	42
South. red oak	'Green	0.06848	1.05729	0.13946	0.96242	1.05729	0.99	0.0420	34
	Dry	0.05008	1.06363	0.10728	0.90476	1.06363	0.99	0.0422	34
White oak	Green	0.23197	0.94188	0.22015	0.95278	0.94188	0.99	0.0462	87
	Dry	0.15699	0.93059	0.14218	0.95124	0.93059	0.99	0.0462	87
All Species	Green	0.23039	0.93834	0.16198	1.01179	0.93834	0.99	0.0687	486
	Dry	0.13342	0.94104	0.11762	0.96734	0.94104	0.99	0.0799	486
				TOTAL-STEM WOOD					
Soft Hardwoods	Green	0.18724	0.93840	0.19494	0.93000	0.93640	0.99	0.0799	122
	Dry	0.11114	0.92387	0.09026	0.96727	0.92387	0.99	0.0865	122
Sweetgum	Green	0.14291	0.97154	0.09876	1.04859	0.97154	0.99	0.0465	39
	Dry	0.06718	0.97669	0.04150	1.07713	0.97669	0.99	0.0467	39

Continued

Table 12.--Regression equations for estimating green and dry weight of total-stem wood and bark combined and wood alone for hardwood species in the Upland-South, with d.b.h. and total height as the independent variables--Continued

Species or species group	Weight green or dry	Regression equation coefficients: Trees < 11.0 in d.b.h.[1] a'	b	Trees ≥ 11.0 in d.b.h.[2] a"	b	c	Coefficient of determination (R^2)	Standard error[3] ($S_{y.x}$)	No. of trees sampled
Yellow-poplar	Green	0.09541	1.01497	0.20464	0.85586	1.01497	0.99	0.0581	19
	Dry	0.02376	1.10030	0.12069	0.76144	1.10030	0.98	0.0647	19
Hard Hardwoods	Green	0.17309	0.95630	0.11347	1.04436	0.95630	0.99	0.0651	364
	Dry	0.10252	0.95980	0.09821	0.96875	0.95980	0.99	0.0602	364
Hickory	Green	0.15515	0.95176	0.01938	1.38542	0.95176	0.99	0.0551	37
	Dry	0.10000	0.95385	0.01619	1.33348	0.95385	0.99	0.0572	37
Post oak	Green	0.12107	1.00577	0.21433	0.88667	1.00577	0.99	0.0538	26
	Dry	0.08582	0.98691	0.13597	0.89096	0.98691	0.98	0.0611	26
Scarlet oak	Green	0.15648	0.98251	0.14710	0.99540	0.98251	0.99	0.0448	42
	Dry	0.11396	0.95503	0.11833	0.94719	0.95503	0.99	0.0423	42
South. red oak	Green	0.07352	1.05553	0.09979	0.99184	1.05553	0.99	0.0461	34
	Dry	0.04475	1.04948	0.07940	0.92992	1.04948	0.98	0.0486	34
White oak	Green	0.16519	0.96663	0.17835	0.95064	0.96663	0.99	0.0473	87
	Dry	0.11349	0.95393	0.12411	0.93528	0.95393	0.99	0.0468	87
All Species	Green	0.17702	0.95148	0.13157	1.01336	0.95148	0.99	0.0709	486
	Dry	0.10491	0.95101	0.10184	0.95720	0.95101	0.99	0.0776	486

[1]Trees < 11.0 inches d.b.h.

$Y = a'(D^2Th)^b$

[2]Trees ≥ 11.0 inches d.b.h.

$Y = a''(D^2)^b (Th)^c$

Where: Y = component weight in pounds
D = tree d.b.h. in inches
Th = tree total height in feet
a',a",b,c = regression coefficients

[3]$\log_{10}$ form

Table 13.--Regression equations for estimating cubic-foot volume of above-stump total-tree wood and bark combined and wood alone for hardwood species in the Upland-South, with d.b.h. and total height as the independent variables

Species or species group	Volume wood & bark or wood only	Regression equation coefficients: Trees < 11.0 in d.b.h.[1] a'	b	Trees > 11.0 in d.b.h.[2] a"	b	c	Coefficient of determination (R^2)	Standard error[3] ($S_{y.x}$)	No. of trees sampled
				TOTAL TREE					
Soft Hardwoods	Wd&Bk	0.00555	0.91352	0.00225	1.10191	0.91352	0.99	0.0774	122
	Wood	0.00385	0.93723	0.00178	1.09782	0.93723	0.99	0.0769	122
Sweetgum	Wd&Bk	0.00390	0.94730	0.00099	1.23425	0.94730	0.99	0.0451	39
	Wood	0.00261	0.97370	0.00085	1.20700	0.97370	0.99	0.0451	39
Yellow-poplar	Wd&Bk	0.00388	0.96524	0.00252	1.05566	0.96524	0.99	0.0462	19
	Wood	0.00282	0.98015	0.00170	1.08579	0.98015	0.99	0.0415	19
Hard Hardwoods	Wd&Bk	0.00486	0.94018	0.00175	1.15251	0.94018	0.99	0.0683	364
	Wood	0.00358	0.95048	0.00130	1.16142	0.95048	0.99	0.0662	364
Hickory	Wd&Bk	0.00554	0.91970	0.00033	1.50669	0.91970	0.99	0.0909	37
	wood	0.00331	0.94932	0.00020	1.53200	0.94932	0.99	0.0776	37
Post oak	Wd&Bk	0.00294	1.01112	0.00348	0.97649	1.01112	0.99	0.0562	26
	wood	0.00202	1.02657	0.00234	0.99582	1.02657	0.99	0.0547	26
Scarlet oak	Wd&Bk	0.00333	0.99473	0.00301	1.01585	0.99473	0.99	0.0371	42
	Wood	0.00233	1.01241	0.00214	1.03074	1.01241	0.99	0.0396	42
South. red oak	Wd&Bk	0.00196	1.04024	0.00125	1.13479	1.04024	0.98	0.0535	34
	Wood	0.00162	1.03396	0.00090	1.15637	1.03396	0.98	0.0554	34
White oak	Wd&Bk	0.00442	0.95184	0.09241	1.07811	0.95184	0.99	0.0513	87
	wood	0.00274	0.98507	0.00171	1.08362	0.98507	0.99	0.0492	87
All Species	Wd&Bk	0.00502	0.93368	0.00192	1.13430	0.93368	0.99	0.0724	486
	Wood	0.00365	0.94707	0.00142	1.14365	0.94707	0.99	0.0691	486

[1] Trees < 11.0 inches d.b.h.

$Y = a'(D^2Th)^b$

[2] Trees ≥ 11.0 inches d.b.h.

$Y = a''(D^2)^b(Th)^c$

Where: Y = component volume in cubic feet
D = tree d.b.h. in inches
Th = tree total height in feet
a', a", b, c = regression coefficients

[3] $\log_{10}$ form

Table 14.--Regression equations for estimating cubic-foot volume of total-stem wood and bark combined and wood alone for hardwood species in the Upland-South, with d.h.h. and total height as the independent variables

Species or species group	Volume wood 8 bark or wood only	Regression equation coefficients: Trees < 11.0 in d.b.h.[1] a'	b	Trees > 11.0 in d.h.h.[2] a"	b	c	Coefficient of determination (R^2)	Standard error[3] ($S_{y.x}$)	No. of trees sampled
				TOTAL STEM					
Soft Hardwoods	Wd&Bk	0.00420	0.92948	0.00368	0.95702	0.92948	0.99	0.0628	122
	Wood	0.00297	0.95403	0.00304	0.94878	0.95403	0.99	0.0632	122
Sweetgum	Wd&Bk	0.00360	0.94307	0.00156	1.11796	0.94307	0.99	0.0403	39
	Wood	0.00244	0.97048	0.00138	1.08898	0.97048	0.99	0.0407	39
Yellow-poplar	Wd&Bk	0.00237	1.01242	0.00753	0.77123	1.01242	0.99	0.0427	19
	wood	0.00184	1.02105	0.00487	0.81860	1.02105	0.99	0.0418	19
Hard Hardwoods	Wd&Bk	0.00381	0.94038	0.00258	1.02144	0.94038	0.99	0.0545	364
	wood	0.00287	0.95283	0.00198	1.03009	0.95283	0.99	0.0516	364
Hickory	Wd&Bk	0.00529	0.89334	0.00063	1.33677	0.89334	0.99	0.0795	37
	Wood	0.00312	0.93041	0.00039	1.36100	0.93041	0.99	0.0690	37
Post oak	Wd&Bk	0.00215	1.01535	0.00400	0.88621	1.01535	0.99	0.0474	26
	wood	0.00154	1.03216	0.00308	0.88845	1.03216	0.99	0.0469	26
Scarlet oak	Wd&Bk	0.00382	0.94928	0.00354	0.96525	0.94928	0.99	0.0352	42
	Wood	0.00270	0.96937	0.00258	0.97899	0.96937	0.99	0.0354	42
South. red oak	Wd&Bk	0.00159	1.04400	0.00288	0.92004	1.04400	0.99	0.0390	34
	Wood	0.00126	1.04474	0.00195	0.95429	1.04474	0.99	0.0433	34
White oak	Wd&Bk	0.00418	0.92756	0.00274	1.01548	0.92756	0.99	0.0388	87
	wood	0.00264	0.96507	0.00204	1.01899	0.96507	0.99	0.0334	87
All Species	Wd&Bk	0.00391	0.93764	0.00283	1.00487	0.93764	0.99	0.0568	486
	wood	0.00290	0.95282	0.00218	1.01248	0.95282	0.99	0.0549	486

[1] Trees < 11.0 inches d.b.h.

$$Y = a'(D^2Th)^b$$

[2] Trees > 11.0 inches d.b.h.

$$Y = a''(D^2)^b(Th)^c$$

Where': Y = component volume in cubic feet
0 = tree d.b.h. in inches
Th = tree total height in feet
a' ,a" ,b ,c = regression coefficients

[3] $\log_{10}$ foml

Table 15.--Regression equations for estimating green and dry weight of above-stump total-tree wood. bark, and foliage, wood and bark combined, and wood alone for hardwood species in the Upland-South, with d.b.h. and height to a 4-inch top as independent variables

Species or species group	Weight green or dry	Regression equation coefficients: Trees < 11.0 in d.b.h.[1] a'	b	Trees > 11.0 in d.b.h.[2] a''	b	c	Coefficient of determination (R^2)	Standard error[3] ($S_{y.x}$)	No. of trees sampled
				TOTAL-TREE WOOD, BARK, AND FOLIAGE					
Soft Hardwoods	Green	3.54118	0.66535	0.32725	1.16192	0.66535	0.97	0.0836	82
	Dry	1.76873	0.67019	0.16990	1.15871	0.67019	0.97	0.0860	82
Sweetgum	Green	2.89896	0.68989	0.19264	1.25524	0.68989	0.99	0.0552	29
	Dry	1.33772	0.69653	0.07635	1.29360	0.69653	0.99	0.0500	29
Yellow-poplar	Green	1.64985	0.75147	0.22730	1.16479	0.75147	0.98	0.0699	19
	Dry	0.48641	U.81473	0.12289	1.10159	0.81473	0.98	0.0706	19
Hard Hardwoods	Green	3.90351	0.67938	0.30159	1.21330	0.67938	0.97	0.0792	262
	Dry	2.44712	0.67450	0.20537	1.19117	0.67450	0.97	0.0749	262
Hickory	Green	4.74083	0.65169	0.07900	1.50544	0.65169	0.98	0.0715	22
	Dry	3.02318	0.64985	0.05637	1.48016	0.64985	0.98	0.0734	22
Post oak	Green	2.65935	0.73349	0.85732	U.96954	0.73349	0.99	0.0561	26
	Dry	1.70907	0.72670	0.51422	0.97714	0.72670	0.98	0.0598	26
Scarlet oak	Green	2.62263	0.74803	0.52781	1.08232	0.74803	0.98	0.0593	41
	Dry	1.65131	0.73922	0.38845	1.04097	0.73922	0.98	0.0573	41
South. red oak	Green	3.76756	0.686'37	0.27921	1.22957	0.68697	0.98	0.0636	34
	Dry	2.11764	0.69359	0.19065	1.19562	0.69359	0.98	0.0642	34
White oak	Green	3.31255	0.69981	0.58930	1.05982	0.69981	0.98	0.0603	75
	Dry	2.27314	0.68385	0.34213	1.07873	0.68385	0.98	0.0638	75
All Species	Green	4.04651	0.66876	0.31363	1.20201	0.66876	0.96	0.0897	344
	Dry	2.48892	0.66273	0.20442	1.18390	0.66273	0.94	0.1032	344
				TOTAL-TREE WOOD AND BARK					
Soft Hardwoods	Green	3.07487	0.67891	0.31725	1.15252	0.67891	0.97	0.0808	82
	Dry	1.62822	0.67795	0.16680	1.15304	U.67795	0.97	0.0845	82

Continued

Table 15.--Regression equations for estimating green and dry weight of above-stump total-tree wood, bark, and foliage, wood and bark combined, and wood alone for hardwood species in the Upland-South, with d.b.h. and height to a 4-inch top as independent variables--Continued

Species or species group	Weight green or dry	Regression equation coefficients: Trees < 11.0 in d.b.h.[1] a'	b	Trees > 11.0 in d.b.h.[2] a"	b	c	Coefficient of determination (R^2)	Standard error[3] ($S_{y.x}$)	No. of trees sampled
Sweetgum	Green	2.59048	0.69929	0.18286	1.25204	0.69929	0.99	0.0520	29
	Dry	1.23894	0.70331	0.07481	1.28862	0.70331	0.99	0.0485	2Y
Yellow-poplar	Green	1.50540	0.76027	0.21799	1.163211	0.76027	0.98	0.0678	19
	Dry	0.45786	0.82067	0.12004	1.05982	0.82067	0.98	0.0693	19
Hard Hardwoods	Green	3.68781	0.68079	0.27341	1.22330	0.68079	0.97	0.0795	262
	Dry	2.32058	0.67712	0.19005	1.19889	0.67712	0.97	0.0754	262
Hickory	Green	4.28859	0.65886	0.07706	1.49689	0.65886	0.98	0.0710	22
	Dry	2.82527	0.65455	0.05547	1.47412	0.65455	0.98	0.0740	22
Post oak	Green	2.56866	0.73359	0.83382	0.96819	0.73359	0.99	0.0561	26
	Dry	1.66112	0.72683	0.50476	0.97521	0.72683	0.98	0.0598	26
Scarlet oak	Green	2.40363	U.75357	0.47158	1.09317	0.75357	0.98	0.0600	41
	Dry	1.55375	U.74338	0.35318	1.05229	0.74338	0.98	0.0578	41
South. red oak	Green	3.57751	0.68813	0.24867	1.24409	0.68813	0.98	0.0650	34
	Dry	2.07055	0.69313	0.17379	1.20977	0.69313	0.98	0.0656	34
White oak	Green	3.26277	0.69530	0.54277	1.06931	0.69530	0.98	0.0641	75
	Dry	2.22303	0.68177	0.32403	1.08332	0.68177	0.97	0.0664	75
All Species	Green	3.73809	0.67333	0.28657	1.20887	0.67333	0.96	0.0886	344
	Dry	2.33910	0.66674	0.19087	1.18927	0.66674	u.95	0.1021	344
				TOTAL-TREE WOOD					
Soft Hardwoods	Green	2.38544	0.69084	0.25886	1.15392	0.69084	0.97	0.0832	82
	Dry	1.24036	0.69379	0.13922	1.14984	0.69379	0.97	0.0865	82
Sweetgum	Green	1.80713	0.72679	0.19016	1.10629	0.72679	0.99	0.0518	29
	Dry	0.86769	11.72999	0.07943	1.22855	0.72999	0.99	0.0466	29
Yellow-poplar	Green	1.08824	0.77505	0.14425	1.19642	0.77505	0.98	0.0685	19
	Dry	0.31915	0.84430	0.08591	1.11796	0.84430	0.98	0.0716	19

Continued

Table 15.--Regression equations for estimating green and dty weight of above-stump total-tree wood. bark, and foliage, wood and bark combined. and wood alone for hardwood species in the Upland-South, with d.b.h. and height. to a 4-inch top as independent variables--Continued

Species or species group	Weight green or dry	Regression equation coefficients: Trees < 11.0 in d.b.h.[1] a'	b	Trees > 11.0 in d.b.h.[2] a"	b	c	Coefficient of determination (R^2)	Standard error[3] ($S_{y.x}$)	No. of trees sampled
Hard Hardwoods	Green	2.91534	0.68545	0.21197	1.23203	0.68545	0.97	0.0803	262
	Dry	1.88728	0.67810	1.16124	1.19105	0.67810	0.97	0.0742	262
Hickory	Green	3.35041	0.65467	0.03611	1.59929	0.65467	0.98	0.0743	22
	Dry	2.24925	0.65183	0.02757	1.56961	0.65183	0.98	0.0749	22
Post oak	Green	2.12724	0.73157	0.59799	0.99618	0.73157	0.98	0.0601	26
	Dry	1.43117	0.71905	0.36175	1.00583	0.71905	0.98	0.0667	26
Scarlet oak	Green	1.94158	0.75654	0.35071	1.11337	0.75654	0.98	0.0656	41
	Dry	1.26702	0.74342	0.26448	1.07010	0.74342	0.98	0.0634	41
South. red oak	Green	3.02525	0.68147	0.18607	1.26294	u.68147	0.98	0.0682	34
	Dry	1.79660	0.67962	0.13251	1.22322	0.67962	0.97	0.0699	34
White oak	Green	2.59281	0.70141	0.41247	1.08473	0.70141	0.98	0.0632	75
	Dry	1.78950	0.68733	0.26814	1.08314	0.68733	0.97	0.0643	75
All Species	Green	2.91422	0.68080	0.22312	1.21661	0.68080	0.96	0.0869	344
	Dry	1.84077	0.67317	0.15944	1.18325	0.67317	0.95	0.0961	344

[1]Trees < 11.0 inches d.b.h.

$$Y = a'(D^2H4)^b$$

[2]Trees > 11.0 inches d.b.h.

$$Y = a''(D^2)^b(H4)^c$$

Where: Y = component weight in pounds
D = tree d.b.h. in inches
H4 = tree height to 4-inch top in feet
a',a",b,c = regression coefficients

[3]$\log_{10}$ form

Table 16.--Regression equations for estimating green and dry weiyht of total-stem wood and bark combined and wocd alone for hardwood species in the Upland-South, with d.b.h. and height to a 4-inch top as the independent variables

Species or species yroup	Weight green or dry	Regresnon equation coefficients: Trees < 11.0 in d.b.h.[1] a'	b	Trees > 11.0 in d.b.h.[2] a"	b	c	Coefficient of determination (R^2)	Standard error[3] ($S_{y.x}$)	No. of trees sampled
				TOTAL-STEM WOOO AND BARK					
Soft Hardwoods	Green	2.07910	0.71004	0.60943	0.96593	0.71004	0.98	0.0625	82
	Dry	1.09182	0.71037	0.32012	0.96620	0.71037	0.98	0.0641	82
Sweetgum	Green	2.28022	0.70028	0.31865	1.11062	0.70028	0.99	0.0421	29
	Dry	1.09326	0.70418	0.13041	1.14754	0.70418	0.99	0.0398	29
Yellow-poplar	Green	1.03987	0.79370	0.64878	0.89207	0.79370	0.98	0.0578	19
	Dry	0.30693	0.85834	0.36959	0.81960	0.85834	0.98	0.0599	19
Hard Hardwoods	Green	2.77076	0.68663	0.41666	1.08168	0.68663	0.97	0.0671	262
	Dry	1.76422	0.68111	0.31325	1.04152	0.68111	0.98	0.0615	262
Hickory	Green	3.97910	0.63209	0.09718	1.40614	0.63209	0.98	0.0610	22
	Dry	2.65333	0.62698	0.07544	1.36932	0.62698	0.98	0.0643	2%
Post oak	Green	1.98856	0.72994	0.94179	0.88578	0.72994	0.99	0.0500	26
	Dry	1.28931	0.72233	0.58096	0.88855	0.72233	u.99	0.0523	26
Scarlet oak	Green	2.18326	0.73512	0.55923	1.01912	U.73512	0.98	0.0565	41
	Dry	1.43303	0.72101	0.44084	0.96682	0.72101	0.98	0.0504	41
South. red oak	Green	3.10349	0.68362	0.56705	1.03806	0.68362	0.98	0.0600	34
	Dry	1.77778	0.68887	0.44099	0.97955	0.68887	0.98	0.0594	34
White oak	Green	2.79743	0.68171	0.64114	0.98889	0.68171	0.99	0.0465	75
	Dry	1.92818	0.66675	0.39235	0.99875	0.66675	0.98	0.0484	75
All Species	Green	2.68331	0.68754	0.44987	1.05991	0.68754	u.97	0.0699	344
	Dry	1.67917	0.68044	0.31739	1.02781	0.68044	0.96	0.0794	344
				TOTAL-STEM WOOD					
Soft Hardwoods	Green	1.70902	0.71769	0.49111	0.97771	U.71769	0.98	0.0659	82
	Dry	0.87647	0.72227	0.27134	0.96677	0.72227	0.98	0.0676	82
Sweetyum	Green	1.63635	0.72702	0.33459	1.05801	0.72702	0.99	0.0444	29
	Dry	0.78081	0.73093	0.14543	i.08137	0.73093	0.99	0.0388	29

Continued

Table 16.--Regression equations for estimating green and dry weight of total-stem wood and bark combined and wood alone for hardwood species in the Upland-South, with d.b.h. and height to a 4-inch top as the independent variables--Continued

Species or species group	Weight green or dry	Regression equation coefficients: Trees < 11.0 in d.b.h.[1] a'	b	Trees > 11.0 in d.b.h.[2] a"	b	c	Coefficient of determination (R^2)	Standard error[3] ($S_{y.x}$)	No. of trees sampled
Yellow-poplar	Green	0.79244	0.80460	0.39902	0.94766	0.80460	0.98	0.0619	19
	Dry	0.22935	0.87556	0.25336	0.85480	0.87556	0.98	0.0642	19
Hard Hardwoods	Green	2.26533	0.69150	0.33301	1.09129	0.69150	0.97	0.0688	262
	Dry	1.47634	0.68238	0.27223	1.03492	0.68238	0.98	0.0619	262
Hickoty	Green	3.08399	0.63520	0.04897	1.49902	0.635213	0.98	0.0662	22
	Dry	2.09622	0.63019	0.03908	1.46054	0.63019	0.98	0.0658	22
Post oak	Green	1.70733	0.72875	0.75914	0.89775	n.72875	0.98	0.0571	76
	Dry	1.15250	0.71499	0.47005	0.90200	0.71499	0.98	0.0641	26
Scarlet oak	Green	1.78669	0.73961	0.41832	1.04235	0.73961	0.98	0.0615	41
	Dry	1.16989	n.72363	0.33083	0.98699	n.72363	0.98	0.0560	41
South. red oak	Green	2.57606,	0.68189	11.40428	1.06804	0.68189	0.97	0.0633	34
	Dry	1.50390	0.68060	0.32090	1.00269	0.68060	0.97	0.0631	34
White oak	Green	2.56062	0.69888	0.34498	0.99661	0.69286	0.99	0.0490	75
	Dry	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	75
Al1 Species	Green	7.18122	0.69393	0.35901	1.07015	0.69393	0.97	0.0704	344
	Dry	1.37237	0.68583	0.77205	1.02328	0.68583	0.97	0.0760	344

[1] Trees < 11.0 inches d.h.h.

$Y = a'(D^2H4)^b$

[2] Trees ≥ 11.0 inches d.h.h.

$Y = a''(D^2)^b (H4)^c$

Where: Y = component weight in pounds
D = tree d.b.h. in inches
H4 = tree height to 4-inch top in feet
a', a", b, c = regression coefficients

[3] $\log_{10}$ form

Table 17.--Regression equations for estimating cubic-foot volume of above-stump total-tree wood and bark combined and wood alone for nardwood species in the Upland-South, with d.b.h. and height to a 4-inch top as the independent variables

Species or species glvup	Volume wocd & bark or wood only	Regression equation coefficients: Trees < 11.0 in d.b.h.[1] a'	b	Trees ≥ 11.0 in d.b.h.[2] a"	b	c	Coefficient of determination (R^2)	Standard error[3] ($S_{y.x}$)	No. of trees sampled
				TOTAL TREE					
Soft Hardwoods	Wd&Bk	0.05350	0.68685	0.00599	1.14337	0.68685	0.98	0.0685	82
	wood	0.03968	0.70315	0.00467	1.14913	0.70315	0.98	0.0664	82
Sweetgum	Wd&Bk	0.05322	0.67794	0.00258	1.30930	0.67794	0.99	0.0508	29
	Wood	0.03478	0.71015	0.00261	1.24995	0.71015	0.99	0.0458	29
Yellow-poplar	Wd&Bk	0.02783	0.77042	0.00488	1.13325	0.77042	0.99	0.0413	19
	Wood	0.02094	0.78151	0.00331	1.16607	0.78151	0.99	0.0377	19
Hard Hardwoods	Wd&Bk	0.05255	0.69995	0.00583	1.15859	0.69995	0.98	0.0645	262
	Wood	0.03885	0.71057	0.00441	1.16440	0.71057	0.98	0.0642	262
Hickory	Wd&Bk	0.06340	0.68114	0.00194	1.40827	0.68114	0.98	0.0711	22
	wood	0.04683	0.68409	0.00099	1.48745	0.68409	0.98	0.0722	22
Post oak	Wd&Bk	0.04075	0.73688	0.01271	0.97978	0.73688	0.99	0.0507	26
	wood	0.02952	0.74613	0.00862	1.00286	0.74613	0.99	0.0534	26
Scarlet oak	Wd&Bk	0.03689	0.75632	0.00880	1.05509	0.75632	0.98	0.0540	41
	wood	0.02860	0.76247	0.00630	1.07781	0.76247	0.98	0.0561	41
South. red oak	Wd&Bk	0.05978	0.68306	0.00507	1.19731	0.68306	0.98	0.0606	34
	Wood	0.04892	0.67755	0.00362	1.22009	0.67755	0.98	0.0632	34
White oak	Wd&Bk	0.05370	0.69238	0.00753	1.10213	0.69238	0.98	0.0526	75
	wood	0.03963	0.70485	0.00527	1.12570	0.70485	0.99	0.0508	75
All Species	Wd&Bk	0.05405	0.69375	0.00592	1.15471	0.69375	0.98	0.0673	344
	Wood	0.03952	0.70720	0.00448	1.16091	0.70720	0.98	0.0649	344

[1] Trees < 11.0 inches d.b.h.

$$Y = a'(D^2H4)^b$$

[2] Trees > 11.0 inches d.b.h.

$$Y = a''(D^2)^b(H4)^c$$

Where: Y = component volume in cubic feet
D = tree d.b.h. in inches
H4 = tree height to 4-inch top in feet
a', a", b, c = regression coefficients

[3] $\log_{10}$ foml

Table 18.--Regression equations for estimating cubic-foot volume of total-stem wood and bark combined and wood alone for hardwood species in the Upland-South, with d.b.h. and height to a 4-inch top as the independent variables

Species or species group	Volume wood & bark or wood only	Regression equation coefficients: Trees < 11.0 in d.b.h.[1] a'	b	Trees ≥ 11.0 in d.b.h.[2] a"	b	c	Coefficient of determination (R^2)	Standard error[3] ($S_{y.x}$)	No. of trees sampled
				TOTAL STEM					
Soft Hardwoods	Wd&Bk	0.03536	0.72107	0.01109	0.96293	0.72107	0.99	0.0572	82
	wood	0.02779	0.73273	0.00865	0.97607	0.73273	0.99	0.0530	82
Sweetgum	Wd&Bk	0.04685	0.67939	0.00419	1.18259	0.67939	0.99	0.0404	29
	wood	0.03134	0.71125	0.00433	1.12420	0.71125	0.99	0.0340	29
Yellow-poplar	Wd&Bk	0.01870	0.80795	0.01508	0.85284	0.80795	0.99	0.0371	19
	Wood	0.01494	0.81393	0.00977	0.90258	0.81393	0.99	0.0380	19
Hard Hardwoods	Wd&Bk	0.03875	0.70805	0.00867	1.02015	0.70805	0.98	0.0534	262
	Wood	0.03026	0.71687	0.00674	1.03010	0.71687	0.98	0.0545	262
Hickory	Wd&Bk	0.05571	0.66135.	0.00308	1.26495	0.66135	0.98	0.0683	22
	wood	0.04034	0.67322	0.00174	1.32929	0.67322	0.98	0.0703	22
Post oak	Wd&Bk	0.03103	0.73612	0.01437	0.89661	0.73612	0.99	0.0502	26
	Wood	0.02348	0.74714	0.01122	0.90116	0.74714	0.99	0.0525	26
Scarlet oak	Wd&Bk	0.03454	0.73300	0.01001	0.99129	0.73300	0.98	0.0495	41
	wood	0.02744	0.74010	0.00739	1.01374	0.74010	0.98	0.0507	41
South. red oak	Wd&Bk	0.05216	0.67748	0.01154	0.99194	0.67748	0.98	0.0556	34
	wood	0.04169	0.67796	0.00784	1.02624	0.67796	0.98	0.0586	34
White oak	Wd&Bk	0.04575	0.67960	0.00820	1.03809	0.67960	0.99	0.0348	75
	Wood	0.03448	0.69609	0.00611	1.05686	0.69609	0.99	0.0363	75
All Species	Wd&Bk	0.03809	0.71052	0.00907	1.00957	0.71052	0.98	0.0541	344
	Wood	0.02957	0.72099	0.00704	1.02036	0.72099	0.98	0.0542	344

[1] Trees < 11.0 inches d.b.h.

$Y = a'(D^2H4)^b$

[2] Trees > 11.0 inches d.b.h.

$Y = a''(D^2)^b(H4)^c$

Where : Y = component volume in cubic feet
D = tree d.b.h. in inches
H4 = tree height to 4-inch top in feet
a', a", b, c = regression coefficients

[3] $\log_{10}$ form

Table 19.--Regression equations for estimating green and dry weight of above-stump total-tree wood, bark, and foliage, wood and bark combined, and wood alone for hardwood species in the Upland-South, with d.b.h. and saw-log merchantable height as the independent variables

Species or species group	Weight green or dry	Regression equation coefficients[1] a	b	c	Coefficient of determination (R^2)	Standard error[2] ($S_{y.x}$)	No. of trees sampled
			TOTAL-TREE WOOD, BARK, AND FOLIAGE				
Soft Hardwoods	Green	5.91933	0.96698	0.28273	0.76	0.0827	27
	Dry	4.89337	0.96429	0.16103	0.78	0.0725	27
Hard Hardwoods	Green	4.34257	1.10688	0.19424	0.79	0.0906	64
	Dry	3.29859	1.06372	0.19016	0.82	0.0812	64
Scarlet oak	Green	4.50008	1.26048	-0.01801	0.90	0.0671	16
	Dry	3.48482	1.22997	-0.06071	0.90	0.0664	16
South. red oak	Green	4.25548	1.06916	0.29694	0.95	0.0430	17
	Dry	2.83728	1.04561	0.29471	0.94	0.0485	17
All Species	Green	5.39733	1.11055	0.11443	0.78	0.0897	91
	Dry	5.14974	1.10864	-0.03275	0.78	0.0869	91
			TOTAL-TREE WOOD AND BARK				
Soft Hardwoods	Green	5.71324	0.96349	0.2914	0.76	0.0834	27
	Dry	4.76444	0.96090	0.16921	0.78	0.0730	27
Hard Hardwoods	Green	4.23125	1.10605	0.19293	0.79	JJ.0924	64
	Dry	3.24135	1.06483	0.18669	0.81	0.0834	64
Scarlet oak	Green	4.37179	1.26034	-0.01798	0.90	0.0671	16
	Dry	3.40532	1.23184	-0.06136	0.89	0.0671	16
South. red oak	Green	4.13143	1.06916	0.29694	0.95	0.0430	17
	Dry	2.79562	1.04562	0.29468	0.94	0.0485	17
All Species	Green	5.13749	1.10571	0.12745	0.77	0.0907	91
	Dry	4.96493	1.10631	-0.02442	0.77	0.0878	91
			TOTAL-TREE WOOD				
Soft Hardwoods	Green	5.44089	0.96642	0.26127	0.75	0.0849	27
	Dry	4.42698	0.95742	0.15880	0.78	0.0717	27
Hard Hardwoods	Green	2.71907	1.12091	0.24511	0.79	0.0945	64
	Dry	2.00532	1.06563	0.26913	0.80	0.0872	64
Scarlet oak	Green	3.20591	1.28066	-0.00997	0.87	0.0779	16
	Dry	2.51719	1.25444	-0.06459	0.86	0.0793	16
South. red oak	Green	2.96362	1.07662	0.32177	0.95	0.0472	17
	Dry	1.89340	1.05079	0.32947	0.92	t-J.0571	17
All Species	Green	3.55229	1.10768	0.18087	0.77	0.0915	91
	Dry	3.23781	1.09063	0.07210	0.78	0.0868	91

[1] $Y = a(D^2)^b (Mh)^c$

Where: Y = component weight in pounds
D = tree d.b.h. in inches
Mh = tree saw-log merchantable height in feet
a,b,c = regression coefficients

[2] $\log_{10}$ form

Table 20.--Regression equations for estimating green and dry weight of saw-log merchantable-stem wood and bark combined and wood alone for hardwood species in the Upland-South, with d.b.h. and saw-log merchantable height as the independent variables

Species or species group	Weight green or dry	Regression equation coefficients[1] a	b	c	Coefficient of determination (R^2)	Standard error[2] ($S_{y.x}$)	No. of trees sampled
			SAW-LOG STEM WOOD AND BARK				
Soft Hardwoods	Green	0.67303	0.84073	0.90211	0.90	0.0666	27
	Dry	0.56427	0.83732	0.78145	0.90	0.0611	27
Hard Hardwoods	Green	-0.20187	0.98322	0.76167	0.88	0.0712	63
	Dry	0.50667	0.92670	0.76344	0.91	0.0571	63
Scarlet oak	Green	0.74621	0.96120	0.78381	0.99	0.0177	15
	Dry	0.55653	0.93154	0.74518	0.99	0.0204	15
South. red oak	Green	0.99274	0.72002	1.09571	0.96	0.0394	17
	Dry	0.69032	0.68510	1.09425	0.95	0.0447	17
All Species	Green	0.81418	1.01247	0.62653	0.85	0.0777	90
	Dry	0.78474	0.99729	0.49733	0.84	0.0766	90
			SAW-LOG STEM YOOD				
Soft Hardwoods	Green	0.67706	0.83804	0.87425	0.88	0.0699	27
	Dry	0.57297	0.82271	0.76992	0.90	0.0592	27
Hard Hardwoods	Green	0.46094	[illegible]	[illegible]	0.88	0.0709	63
	Dry	0.35069	0.91487	0.84065	0.91	0.0608	63
Scarlet oak	Green	0.63282	0.96894	0.77919	0.99	0.0182	15
	Dry	0.47509	0.93755	0.73525	0.99	0.0223	15
South. red oak	Green	0.73337	0.73219	1.11587	0.96	0.0425	17
	Dry	0.49109	0.69192	1.12206	0.94	0.0516	17
All Species	Green	0.63334	1.00616	0.66992	0.86	0.0761	90
	Dry	0.58154	0.97246	0.58073	0.85	0.0736	90

[1] $Y = a(D^2)^b(Mh)^c$

Where: Y = component weight in pounds
D = tree d.b.h. in inches
Mh = tree saw-log merchantable height in feet
a,b,c = regression coefficients

[2] $\log_{10}$ form

Table 21.--Regression equations for estimating cubic-foot wlume of above-stump total-tree wood and bark combined and wocd alone for hardwood species in the Upland-South, with d.b.h. and saw-log merchantable height as the independent variables

Species or species group	Volume wood & bark or wood ally	Regression equation coefficients[1] a	b	c	Coefficient of determination (R^2)	Standard error[2] ($S_{y.x}$)	No. of trees sampled
			TOTAL TREE				
Soft Hardwoods	Wd&Bk	0.10825	0.86495	0.40355	0.76	0.0773	27
	wood	0.10687	0.87712	0.37884	0.80	0.071'2	27
Hard Hardwoods	Wd&Bk	0.08048	1.04004	0.25118	0.84	0.0741	64
	Wood	0.04838	1.05517	0.31805	0.84	0.0771	64
Scarlet oak	Wd&Bk	0.08075	1.24411	-0.04762	0.93	0.0537	16
	wood	0.05731	1.26574	-0.03565	0.92	0.0596	16
South. red oak	Wd&Bk	0.08059	1.05753	0.24323	0.95	0.0441	17
	Wood	0.05694	1.06597	0.26516	0.94	0.0481	17
All Species	Wd&Bk	0.08150	1.00491	0.30523	0.82	0.0745	91
	wood	0.05324	1.00093	0.38141	0.83	0.0754	91

[1] $Y = a(D^2)^b(Mh)^c$

Where: Y = component volume in cubic feet
0 = tree d.b.h. in inches
Mh = saw-log merchantable height in feet
a,b,c = regression coefficients

[2] $\log_{10}$ form

Table 22.--Regression equations for estimating cubic-foot volume of saw-log merchantable-stem wood and bark combined and wood alone for hardwood species in the Upland-South, with c!.b.h. and saw-log merchantable height as the independent variables

Species or species grcup	Volume wood & bark or wood only	Regression equation coefficients[1] a	b	c	Coefficient of determination (R^2)	Standard error[2] ($S_{y.x}$)	No. of trees sampled
			SAW-LOG STEM				
Soft Hardwoods	Wd&Bk	0.01137	0.77554	1.03036	0.92	0.0586	27
	Wood	0.01208	0.76056	1.00385	0.94	0.0518	27
Hard Hardwoods	Wd&Bk	0.01098	0.93232	0.82611	0.95	0.0455	63
	Wood	0.00739	0.94477	0.87744	0.94	0.0368	64
Scarlet oak	Wd&Bk	0.01014	0.99544	0.76001	0.99	0.0218	15
	Wood	0.00739	1.03445	0.74622	0.99	0.0259	16
South. red oak	Wd&Bk	0.01813	0.72081	1.03950	0.96	0.0420	17
	Wood	0.01313	0.73957	1.04975	0.95	0.0443	17
All Species	Wd&Bk	0.01156	0.92196	0.82244	0.93	0.0525	90
	wood	0.00854	0.91810	0.87447	0.94	0.0495	91

[1] $Y = a(D^2)^b(Mh)^c$

Where: Y = component volume in cubic feet
D = tree d.b.h. in inches
Mh = saw-log merchantable height in feet
a,b,c = regression coefficients

[2] $\log_{10}$ form

Table 23.--Regression coefficients for estimating above-stump stem weight to a specified d.o.b. top diameter as a proportion of the total-stem weight for hardwood species in the Upland-South

Species	Regression equation and coefficients[1] $Y_R = e^{a(d)^b(D)^c}$					
	Green weight			Dry weight		
	a	b	c	a	b	c
			WOOD AND BARK			
Soft Hardwoods	-1.66655	4.50927	-4.50649	-1.59620	4.52339	-4.50157
Sweetgum	-2.19544	4.75749	-4.82010	-2.07716	4.77234	-4.80657
Yellow-poplar	-2.07710	4.79969	-4.93471	-1.97288	4.84199	-4.95434
Hard Hardwoods	-2.28360	4.46072	-4.68636	-2.23719	4.46112	-4.67358
Hickory	-3.09629	4.28856	-4.67482	-3.10193	4.32745	-4.70710
Post oak	-1.91840	4.08257	-4.33818	-1.91071	4.10398	-4.35362
Scarlet oak	-1.95138	4.47389	-4.71628	-2.00681	4.41270	-4.66309
South. red oak	-3.77533	4.00045	-4.43757	-3.83036	3.96024	-4.39942
White oak	-2.07303	4.96243	-5.09445	-2.03925	4.97981	-5.10296
All Species	-2.15806	4.41291	-4.60247	-2.10097	4.42002	-4.59413
			WOOD ONLY			
Soft Hardwoods	-1.58330	4.63552	-4.60547	-1.52136	4.63089	-4.58383
Sweetgun	-2.03043	4.91715	-4.93948	-1.93715	4.91375	-4.91348
Yellow-poplar	-2.15028	4.95273	-5.09859	-1.99918	4.96877	-5.08179
Hard Hardwoods	-2.22363	4.57247	-4.78530	-2.20462	4.55367	-4.75886
Hickory	-3.08555	4.39543	-4.77578	-3.13482	4.40292	-4.78594
Post oak	-1.83092	4.17275	-4.40532	-1.83838	4.18398	-4.41261
Scarlet oak	-1.88930	4.56232	-4.78981	-1.97765	4.48821	-4.73111
South. red oak	-3.72423	4.09132	-4.52401	-3.85832	4.02836	-4.47336
White oak	-1.96767	5.13852	-5.24179	-1.95384	5.13262	-5.23190
All Species	-2.09586	4.52930	-4.70413	-2.05976	4.51731	-4.68120

[1]Where: Y_R = stem weight to top d.o.b./total-stem weight ratio
d = stem specified top d.o.b. in inches
D = tree diameter at breast height in inches
a,b,c = regression coefficients
e = 2.71828 (base of log E)

Table 24.--Regression coefficients for estimating above-stump stem volume to a specified d.o.b. top diameter as a proportion of the total-stem volume for hardwood species in the Upland-South

Species	Regression equation and coefficients[1] $Y_R = e^{a(d)^b (D)^c}$					
	Wood and bark			Wood only		
	a	b	c	a	b	c
Soft Hardwoods	-1.58948	4.60349	-4.57456	-0.90981	4.67922	-4.40753
Sweetgum	-2.20137	4.95909	-5.01335	-1.16784	5.03261	-4.82031
Yellow-poplar	-1.91229	5.07695	-5.14439	-1.89547	5.27203	-5.32153
Hard Hardwoods	-2.36727	4.44955	-4.69286	-1.34780	4.43890	-4.44676
Hickory	-3.14288	4.29374	-4.69551	-1.13635	3.41966	-3.45810
Post oak	-2.10199	4.06511	-4.36727	-2.04081	4.20585	-4.49028
Scarlet oak	-2.27238	4.33991	-4.65336	-2.05227	4.47319	-4.73863
South. red oak	-4.33279	3.90648	-4.40305	-4.55488	3.96664	-4.48531
White oak	-2.16374	4.91449	-5.07177	-1.62505	4.97019	-5.00555
All Species	-2.19552	4.43283	-4.62984	-1.20804	4.44103	-4.38550

[1]Where: Y_R = stem volume to top d.o.b./total-stem volume ratio

d = stem specified top d.o.b. in inches

D = tree diameter at breast height in inches

a,b,c = regression coefficients

e = 2.71828 (base of log E)

Table 25.--Regression coefficients for estimating stem weight to a specified d.o.b. top diameter as a proportion of the saw-log stem weight for hardwood species in the Upland-South

Species	Ratio equation and coefficients[1] $Y_R = e^{a(Mh)^b}((1-(\frac{d}{.78D})^2)^2)^c$					
	Green weight			Dry weight		
	a	b	c	a	b	c
			WOOD AND BARK			
Soft Hardwoods	8.47209	-0.87551	0.38432	11.59248	-0.96035	0.36964
Hard Hardwoods	38.51019	-1.42602	0.31682	41.82526	-1.44736	0.32237
Scarlet oak	4.91463	-0.76090	0.29384	5.88406	-0.80828	0.30559
South. red oak	10.40046	-0.98021	0.30150	11.98108	-1.01939	0.30963
All Species	17.10465	-1.14320	0.33495	20.83442	-1.19897	0.33719
			WOOD ONLY			
Soft Hardwoods	8.18203	-0.87109	0.38393	11.13685	-0.95361	0.37066
Hard Hardwoods	37.96981	-1.42608	0.31456	37.98114	-1.42243	0.31609
Scarlet oak	4.72979	-0.75216	0.29180	4.70978	-0.74676	0.29296
South. red oak	10.13408	-0.97664	0.29890	10.08205	-0.97124	0.30035
All Species	17.42472	-1.16221	0.33146	19.26726	-1.18010	0.33297

[1]Where: Y_R = ratio of stem weight to top d.o.b. saw-stem

Mh = saw-log merchantable height in feet

d = stem specified top diameter in inches

D = tree diameter at breast height in inches

.78 = constant based on average form class

a,b,c = regression coefficients

e = 2.71828 (base of log E)

Table 26.--Regression coefficients for estimating stem volume to a specified d.o.b. top diameter as a proportion of the saw-log stem volume for hardwood species in the Upland-South

Species	Katio equation and coefficients[1]					
	$Y_R = e^{a(Mh)^b}\left(\left(1-\left(\frac{d}{.78D}\right)^2\right)^2\right)^c$					
	Wood and bark			Wood only		
	a	b	c	a	b	c
Soft Hardwoods	7.80439	-0.86234	LI.38757	7.35628	-0.85166	0.38766
Hard Hardwoods	35.95983	-1.41022	0.31304	39.34780	-1.45316	0.30980
Scarlet oak	3.88915	-0.6'1449	0.28986	3.82096	-0.69744	0.29027
South. red oak	7.42641	-0.87619	0.29843	6.88938	-0.85730	0.29543
Al1 Species	16.22161	-1.13382	0.33255	15.94696	-1.13532	0.33040

[1]Where: Y_R = ratio of stem volume to top d.o.b. saw-stem

Mh = saw-log merchantable height in feet

d = stem syecified top diameter in inches

D = tree diameter at breast height in inches

.78 = constant based on average form class

a,b,c = regression coefficients

e = 2.71828 (base of log E)

Clark, Alexander, III; Phillips, Douglas R.; Frederick, Douglas J. Weight, volume, and physical properties of major hardwood species in the Upland-South. Res. Pap. SE-257. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southeastern Forest Experiment Station; 1986. 55 pp.

The weight, volume, and physical properties of trees 1 to 20 inches d.b.h. were determined for sweetgum, yellow-poplar, hickory, post oak, scarlet oak, southern red oak, and white oak in northern Alabama and Mississippi, eastern Arkansas, southern Kentucky and Tennessee. Hard hardwoods, soft hardwoods, and individual species equations are presented for predicting green and dry weight and green volume of the total tree above stump and its components. Input variables are d.b.h. and total height, d.h.h. and height to a 4-inch top, d.b.h. and saw-log merchdntable height, and d.h.h. alone. Average specific gravity, moisture content, and weight per cubic foot of wood, hark, and wood and bark combined are presented for each species by tree size class and component. Bark percentage is also presented for each species by tree size class and component.

Keywords: Biomass, equations, specific gravity, moisture content, bark percentage, weight per cubic foot.

Clark, Alexander, III; Phillips, Douglas
Weight, volume, and physical propert
in the Upland-South. Res. Pap. SE-2
ment of Agriculture, Forest Service
Station; 1986. 55 pp.

The weight. volume, and physical pro
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The Forest Service, U.S. Department of Agriculture, is dedicated to the principle of multiple use management of the Nation's forest resources for sustained yields of wood, water, forage, wildlife, and recreation. Through forestry research, cooperation with the States and private forest owners, and management of the National Forests and National Grasslands, it strives -as directed by Congress-to provide increasingly greater service to a growing Nation.

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