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Weight, Volume, and Physical Properties of Major Hardwood Species in the Southern Appalachian Mountains

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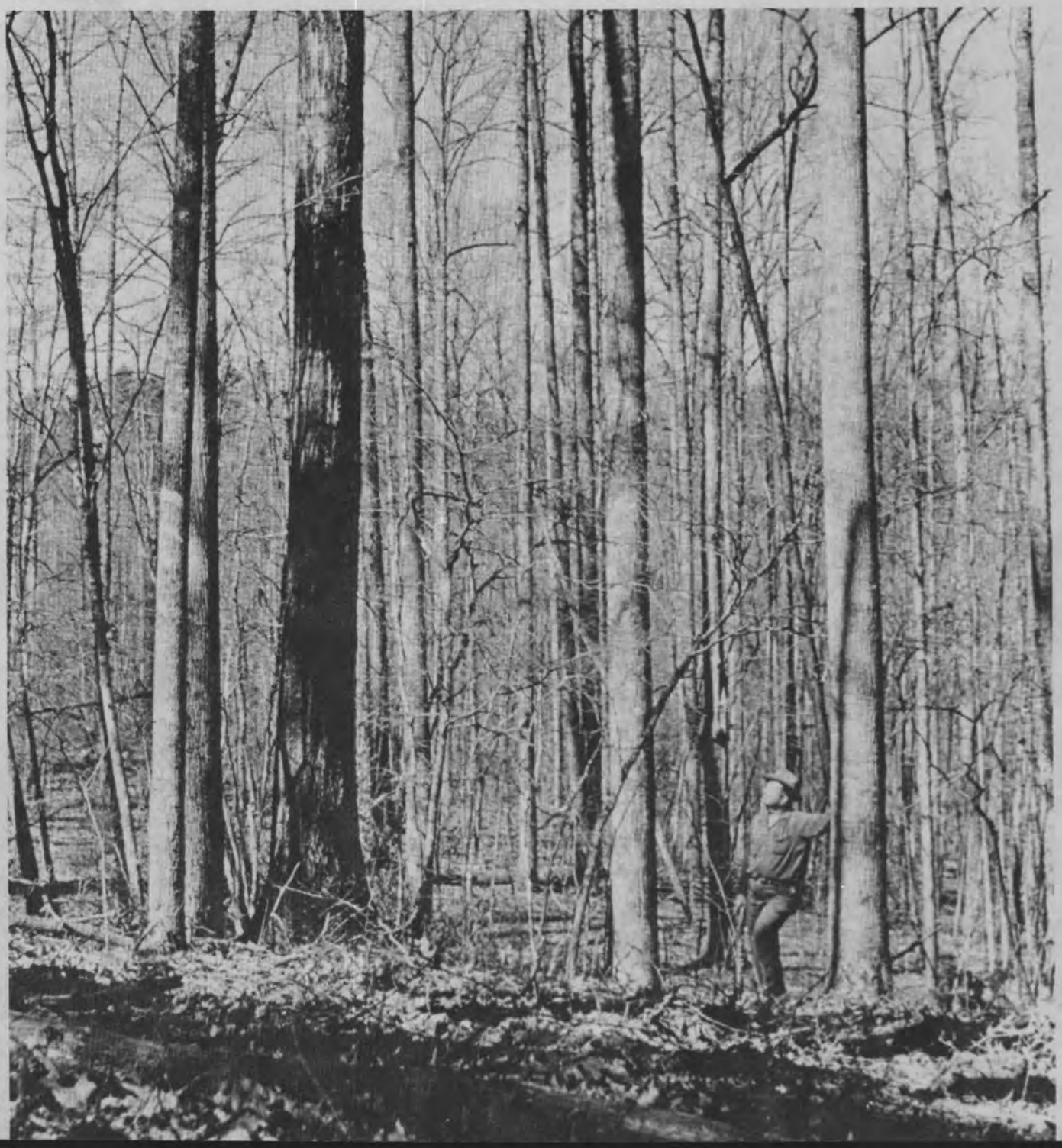

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Weight, Volume, and Physical Properties of Major Hardwood Species in the Southern Appalachian Mountains

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ABSTRACT

The weight, volume, and physical properties of trees 1 to 20 inches d.b.h. were determined for basswood, blackgum (upland), red maple, yellow-poplar, white oak, sweet birch, black locust, hickory, black oak, chestnut oak, northern red oak, scarlet oak, and white oak in the Southern Appalachian Mountains. 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 by using d.b.h. and total height, d.b.h. and height to a 4-inch top, d.b.h. and saw-log merchantable height, and d.b.h. alone. 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.

The hardwood forests of the Southern Appalachian Mountains can contribute significantly to supplies of solid wood, fiber, and energy wood through improved utilization and forest management. Few data, however, exist on the weight, volume, and physical properties of the total tree and its components for hardwood species of this region.

To meet this need, the USDA Forest Service collected tree weight and volume data for the important hardwood species growing in this region. These data were used to develop equations for estimating the weight and volume of individual trees and tree components. The specific gravity, moisture content, and bark content of the trees sampled were also determined.

This Paper presents green volume and green and dry weight equations for the total tree and tree components of 13 species--basswood (*Tilia americana* L.), upland blackgum (*Nyssa sylvatica* Marsh.), red maple (*Acer rubrum* L.), yellow-poplar (*Liriodendron tulipifera* L.), white ash (*Fraxinus americana* L.), sweet birch (*Betula lenta* L.), black locust (*Robinia pseudoacacia* L.), hickory species (*Carya* spp.), black oak (*Quercus velutina* Lam.), chestnut oak (*Q. prinus* L.), northern red oak (*Q. rubra* L.), scarlet oak (*Q. coccinea* Muenchh.), and white oak (*Q. alba* L.). Equations were developed from tree data collected in the Southern Appalachian Mountains of western North Carolina and northeastern Georgia. These species account for more than 85 percent of the commercial hardwood volume in this region. Equations were also developed for the combined hard hardwoods, combined soft hardwoods, and all 13 species.

Equations are given for estimating the weight and volume of wood and bark and wood only in the total tree, total stem, and the saw-log component of the stem. Ratio equations are also included for estimating saw-log stem weight or volume to any specified top diameter outside bark (d.o.b.). 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.

Procedure

Field

Trees were selected from fully stocked, uneven-aged hardwood stands on the Chattahoochee National Forest in Georgia and the Pisgah and Nantahala National Forests in North Carolina. A stratified random sample of three to five trees per 2-inch d.b.h. class was selected at each sample location. Sample trees generally ranged from 5 to 20 or 22 inches d.b.h. Means and ranges in age and tree dimensions measured are shown in table 1 for each species and species group sampled. Stump height averaged 0.5 foot for trees 5.0 to 10.9 inches d.b.h. and 0.6 foot for trees $\geq$ 11.0 inches d.b.h. Form class of the sawtimber-size trees ($\geq$ 11.0 inches d.b.h.) ranged from 64 to 91 and averaged 80 for the soft hardwoods, and ranged from 61 to 90 and averaged 78 for the hard hardwoods.

Each tree was felled and measured for d.o.b. at 4-foot intervals up the stem. Total height, and height to the saw-log top, 9-, 4-, and 2-inch d.o.b., and 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 $\geq$ 5.0 inches d.b.h. except sawtimber-quality trees ($\geq$ 11.0 inches d.b.h. with a minimum of one 16-foot grade 3 log), disks were cut at the butt, d.b.h., and 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 location where d.o.b. measured 9, 4, and 2 inches.

The branches of each tree were cut from the stem and weighed in four size categories: extra large ($\geq$ 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 ($\leq$ 0.5 inch d.o.b.). Three cross-sectional disks were cut from randomly selected branches in each size category for analysis in the laboratory.

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 on green volume and ovendry weight. Moisture content was computed on ovendry weight 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 percentage 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 weights to ovendry weight.

By using species diameter inside bark (d.i.b.) prediction equations, 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, 2-inch, and tip were calculated by Smalian's formula. Green weight per cubic foot of stem bark and of 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 volume of stem bark and branch wood and bark were computed by dividing green component weight 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 and green volume of wood and bark in the total tree above stump, stem from butt to tip, and 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 a 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 $\geq$ 11.0 inches d.b.h. The 11-inch point was not the optimum point to shift from one equation to the other for all species or tree components, but it was the most desirable from a practical standpoint. Hardwood trees < 11 inches in diameter are classified as sapling or poletimber, and trees $\geq$ 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 $\geq$ 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 gives 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 1985). Equations (9) and (10) are more complex than a single equation, but the improved accuracy justified their use.

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

$$Y_R = e^a (d^b D^c) \quad (11)$$

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.

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

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

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 = base of natural log

Results

Physical Properties of Sample Trees

The average specific gravity of wood and bark by tree component is shown in table 2 for individual species, soft hardwoods, hard hardwoods, and all trees combined. The average total-tree wood specific gravity of the soft hardwood species was 0.439 for poletimber (5.0 to 10.9 inches) and 0.440 for sawtimber ($\geq$ 11.0 inches d.b.h.) compared with hard hardwood species, which averaged 0.598 for poletimber and 0.604 for sawtimber. Basswood had the lowest average total-tree wood specific gravity and blackgum the highest for the soft hardwoods group. In the hard hardwoods group, sweet birch had the lowest average total-tree wood specific gravity and hickory had the highest.

The average moisture content of wood and bark by tree component and size class is shown in table 3 for the species and species groups sampled. Total-tree wood moisture content for the soft hardwoods averaged 105 percent for poletimber and 99 percent for sawtimber compared with hard hardwoods, which averaged 62 percent for poletimber and 67 percent for sawtimber. In the soft hardwoods group, basswood had the highest average total-tree moisture content compared with red maple, which had the lowest. In the hard hardwoods group, white oak had the lowest total-tree wood moisture content and northern red oak had the highest.

Table 4 shows the average proportion of bark in the tree, based on green weight of wood and bark, by tree component and size class for the species sampled.

Basswood had the highest bark percentage of the soft hardwoods and chestnut oak had the highest for the hard hardwoods. The percentage of stem weight in bark increased as stem d.o.b. decreased. Thus, poletimber trees generally had a higher proportion of the green weight in bark than did sawtimber trees, and branches had the highest proportion of green weight in bark.

The average green weight per cubic foot of wood, bark, and wood and bark combined, by tree component, for poletimber and sawtimber are shown in table 5. Because of the soft hardwood and hard hardwood species grouping, the average range of green weight for cubic foot of wood for the two groups is similar--49 to 67 pounds for the soft hardwoods and 52 to 67 pounds for the hard hardwoods. This is caused by the relatively high moisture content and specific gravity of blackgum in the soft hardwoods group and the low moisture content of white ash in the hard hardwoods group. The average green weight per cubic foot of wood for the soft hardwood species was 56 pounds for poletimber and 54 pounds for sawtimber compared with 62 pounds for pole and sawtimber hard hardwoods.

The average green weight of wood and bark per cubic foot of wood by tree component for poletimber and sawtimber-size trees is shown 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 68 pounds for poletimber and 65 pounds for sawtimber soft hardwoods compared with 75 pounds for poletimber and sawtimber 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 weight and volume for each species, the soft hardwood and hard hardwood groups, and all species combined. Equations were developed for predicting the green and dry weight of 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 organizations, 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 5.0 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, and all species, and for yellow-poplar, white oak, hickory, black oak, chestnut oak, northern red oak, scarlet oak, and white oak.

Equation (11) was used to estimate the proportion of total-stem weight or volume in the stem to any d.o.b. top 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 expanding estimated saw-log merchantable-stem weight or volume to any d.o.b. top 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. Equations that use D and Mh 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 height 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.

Regression coefficients for estimating weight and volume are listed below, by independent variable and table number:

Independent variable	Weight	Volume
D alone	tables 7, 8	tables 9, 10
D and Th	tables 11, 12	tables 13, 14
D and H4	tables 15, 16	tables 17, 18
D and Mh	tables 19, 20	tables 21, 22

In addition to the regression coefficients, tables 7 through 22 contain the coefficients of determination and standard error ($\log_{10}$) 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 saw-log merchantable-stem weight and volume are shown in tables 25 and 26, respectively.

How to Use Prediction Equations

The following examples illustrate how to use the equations in tables 7 through 26 to estimate the weight or volume of the total tree and its components.

This tabulation presents the tree data needed to estimate weight and volume when d.b.h. and Th are measured and equations (9) and (10) are used:

Example of trees < 11.0 inches d.b.h.

D = 10.0 inches

Th = 70 feet

Example of trees $\geq$ 11.0 inches

D = 14.0 inches

Th = 90 feet

To estimate total-stem wood and bark green weight (Y_{STEMWB}) of a soft hardwood with these dimensions, the following equations would be selected from table 12 and solved as follows:

Trees < 11.0 inches d.b.h.--use equation (9)

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

$$= 0.19934 ((10^2) (70))^{0.94973}$$

$$= 0.19934 (7000)^{0.94973}$$

$$= 0.19934 (4,485.44)$$

$$Y_{STEMWB} = 894 \text{ pounds}$$

Trees $\geq$ 11 inches d.b.h.--use equation (10)

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

$$= 0.16133 (14^2)^{0.99384} (90)^{0.94973}$$

$$= 0.16133 (196)^{0.99384} (90)^{0.94973}$$

$$= 0.16133 (189.73) (71.78)$$

$$Y_{STEMWB} = 2,197 \text{ pounds}$$

The same mathematical procedure shown above would be used to solve equations (9) or (10) for any of the tree component equations in tables 7 through 22.

To estimate the proportion of total-stem green weight of wood and bark in the stem of a 10-inch d.b.h. tree to a 4-inch d.o.b. top (Y_R), the following soft hardwood ratio regression coefficients would be selected from table 23 and solved by using equation (11) as shown below. The same equation is used for all size trees.

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

$$= 2.71828 \left[-2.21340 (4)^{3.69663} (10)^{-4.00734}\right]$$

$$= 2.71828 \left[-2.21340 (168.11) (0.000098)\right]$$

$$= 2.71828^{-0.03647}$$

$$Y_R = 0.964$$

Stem weight to 4-inch top = $(Y_{STEMWB})\ (Y_R)$

$= 894\ (0.964)$

Stem weight to 4-inch top = 862 pounds

The procedure shown above can be used to estimate the proportion of total stem in the stem to any d.o.b. top by substituting for d in equation (11).

The following tabulation shows the tree data needed to estimate weights and volumes when d.b.h. and Mh are measured and equation (8) is used.

D = 14.0 inches d.b.h.

Mh = 2.0 logs

To use equation (8), Mh must be in feet, thus:

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

To estimate the green weight of wood and bark in the saw-log merchantable stem (Y_{SAWWB}) of a soft hardwood tree, by using equation (8) the following coefficients would be selected from table 20 and solved as follows:

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

$$= 0.55968\ (14^2)^{0.97608}\ (33.1)^{0.76439}$$

$$= 0.55968\ (172.75)\ (14.51)$$

$$Y_{SAWWB} = 1{,}403 \text{ pounds}$$

The same mathematical procedure shown above would be used to solve equation (8) for any sawtimber tree component equation 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 tree to weight to a 4-inch d.o.b. top, the following soft hardwood ratio equation would be selected from table 25 and solved by using equation (12) as shown below:

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

$$= 2.71828^{20.03667} \left[(33.1)^{-1.15011}\ ((1-(\frac{4}{.78(14)})^2)^2)^{0.50738} \right]$$

$$= 2.71828^{20.03667(0.01787)(0.91524)}$$

$$= 2.71828^{0.32764}$$

$$Y_R = 1.388$$

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

= 1,403 (1.388)

Stem weight to 4-inch top = 1,947 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 applied 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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TABLES

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							
5.0-10.9	60	55	16-146	8.1	5.1-10.7	67	34-102	38	12-73	--	--	--	--
>11.0	68	77	50-198	15.8	11.0-25.6	98	58-147	77	39-129	50	16-99	10.5	7.8-18.0
All trees	128	67	16-198	12.2	5.1-25.6	84	34-147	58	12-129	50	16-99	10.5	7.8-18.0
						BASSWOOD							
5.0-10.9	9	60	46-75	8.0	5.6-10.5	72	63-82	41	23-59	--	--	--	--
>11.0	9	76	52-100	14.1	11.8-16.5	91	80-106	69	57-82	27	16-37	12.0	9.4-15.4
All trees	18	68	46-100	11.1	5.6-16.5	82	63-106	55	23-82	27	16-37	12.0	9.4-15.4
						BLACKGUM							
5.0-10.9	9	97	80-146	8.0	5.7-10.0	49	34-58	27	14-41	--	--	--	--
>11.0	9	140	72-198	14.6	12.0-17.8	73	58-100	54	39-78	42	30-67	9.3	9.0-10.9
All trees	18	119	72-198	11.3	5.7-17.8	61	34-100	40	14-78	42	30-67	9.3	9.0-10.9
						RED MAPLE							
5.0-10.9	18	59	42-73	8.0	5.1-10.7	65	47-86	36	12-60	--	--	--	--
>11.0	12	65	50-89	14.2	12.0-16.8	83	63-104	58	43-80	28	9-50	11.0	8.0-14.9
All trees	30	61	42-89	10.5	5.1-16.8	72	47-104	45	12-80	28	9-50	11.0	8.0-14.9
						YELLOW-POPLAR							
5.0-10.9	24	36	16-75	8.1	5.6-10.7	73	51-102	42	17-73	--	--	--	--
>11.0	38	66	50-76	17.0	11.0-25.6	111	84-147	90	59-129	64	28-99	10.2	7.8-18.2
All trees	62	54	16-76	13.6	5.6-25.6	97	51-147	71	17-129	64	28-99	10.2	7.8-18.2
						HARD HARDWOODS							
5.0-10.9	143	60	19-114	8.1	5.0-10.9	65	36-92	39	9-67	--	--	--	--
>11.0	204	91	45-175	16.3	11.0-24.7	90	61-120	70	40-104	42	16-78	11.6	8.1-19.0
All trees	347	78	19-175	12.9	5.0-24.7	80	36-120	57	9-104	42	16-78	11.6	8.1-19.0
						WHITE ASH							
5.0-10.9	27	57	25-85	8.0	5.0-10.3	67	44-84	42	15-67	--	--	--	--
>11.0	25	87	54-147	15.1	11.0-21.8	91	73-119	71	52-103	35	16-73	12.4	9.0-19.0
All trees	52	72	25-147	11.4	5.0-21.8	79	44-119	56	15-103	35	16-73	12.2	9.0-19.0

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	
		Average	Range	Average	Range	Average	Range	Average	Range	Average	Range
	Number			Inches		Feet					
						SWEET BIRCH					
5.0-10.9	9	47	32-73	8.1	5.8-10.5	62	53-74	33	20-46	--	--
>11.0	12	74	51-105	15.0	11.9-18.5	79	67-98	56	46-73	23	16-39
All trees	21	62	32-105	12.1	5.8-18.5	72	53-98	46	20-73	23	16-39
						BLACK LOCUST					
5.0-10.9	9	24	19-39	8.1	5.6-10.2	57	36-68	34	22-48	--	--
>11.0	9	50	45-79	13.8	11.6-16.4	81	65-99	61	45-86	35	25-45
All trees	18	37	19-79	11.0	5.6-16.4	69	36-99	48	22-86	35	25-45
						HICKORY					
5.0-10.9	20	75	26-114	8.1	5.1-10.9	67	42-92	40	12-65	--	--
>11.0	34	115	74-175	16.3	11.6-23.1	93	72-120	74	53-104	44	17-74
All trees	54	99	26-175	13.3	5.1-23.1	84	42-120	62	12-104	44	17-74
						BLACK OAK					
5.0-10.9	9	72	41-109	8.3	6.2-10.5	63	44-80	37	16-55	--	--
>11.0	18	106	68-170	17.0	11.8-21.8	84	74-97	64	48-77	38	26-57
All trees	26	94	41-170	13.8	6.2-21.8	77	44-97	55	16-77	38	26-57
						CHESTNUT OAK					
5.0-10.9	18	80	46-107	8.2	5.6-10.9	62	47-85	38	18-57	--	--
>11.0	32	104	68-151	16.4	11.5-22.3	87	61-115	70	46-94	45	28-66
All trees	50	95	46-151	13.4	5.6-22.3	78	47-115	58	18-94	45	28-66
						NORTHERN RED OAK					
5.0-10.9	33	48	35-55	8.3	5.9-10.9	70	53-86	43	18-65	--	--
>11.0	38	74	50-114	17.1	11.1-24.7	96	67-118	74	50-98	50	25-78
All trees	71	62	35-114	13.0	5.9-24.7	84	53-118	60	18-98	50	25-78
						SCARLET OAK					
5.0-10.9	9	65	47-81	8.0	5.7-10.2	56	44-72	32	13-53	--	--
>11.0	18	87	52-124	17.0	11.7-22.2	87	63-105	66	40-87	44	24-54
All trees	27	80	47-124	14.0	5.7-22.2	76	44-105	55	13-87	44	24-54

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	
						WHITE OAK							
5.0-10.9	9	70	54-86	7.9	5.1-10.3	61	38-84	36	9-60	--	--	--	--
>11.0	19	91	62-130	16.7	11.6-21.7	94	72-110	72	53-85	46	34-64	11.9	8.4-18.0
All trees	28	84	54-130	13.9	5.1-21.7	84	38-110	60	9-85	46	34-64	11.9	8.4-18.0
						ALL SPECIES							
5.0-10.9	203	59	16-146	8.1	5.0-10.9	66	34-102	39	9-73	--	--	--	--
>11.0	272	87	22-198	16.2	11.0-25.6	92	58-147	71	39-129	44	16-99	11.3	7.8-19.0
All trees	475	75	16-198	12.7	5.0-25.6	81	34-147	57	9-129	44	16-99	11.3	7.8-19.0

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

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	
				SOFT HARDWOODS			
				Wood			
5.0-10.9	0.439 ± 0.073	--	--	0.442 ± 0.075	0.436 ± 0.070	0.440 ± 0.074	0.440 ± 0.070
≥11.0	0.440 ± 0.062	0.440 ± 0.064	0.451 ± 0.061	0.440 ± 0.063	0.456 ± 0.063	0.440 ± 0.063	0.4[illegible] ± 0.063
				Bark			
5.0-10.9	0.441 ± 0.094	--	--	0.457 ± 0.101	0.437 ± 0.104	0.462 ± 0.094	0.379 ± 0.121
≥11.0	0.400 ± 0.088	0.404 ± 0.099	0.425 ± 0.086	0.407 ± 0.097	0.413 ± 0.087	0.408 ± 0.095	0.371 ± 0.092
				Wood and Bark			
5.0-10.9	0.440 ± 0.072	--	--	0.443 ± 0.073	0.436 ± 0.068	0.444 ± 0.073	0.421 ± 0.073
≥11.0	0.434 ± 0.061	0.434 ± 0.063	0.446 ± 0.058	0.434 ± 0.062	0.448 ± 0.059	0.435 ± 0.063	0.426 ± 0.062
				BASSWOOD			
				Wood			
5.0-10.9	0.353 ± 0.022	--	--	0.359 ± 0.024	0.345 ± 0.017	0.357 ± 0.024	0.324 ± 0.008
≥11.0	0.364 ± 0.033	0.371 ± 0.040	0.362 ± 0.022	0.368 ± 0.035	0.354 ± 0.030	0.368 ± 0.034	0.339 ± 0.031
				Bark			
5.0-10.9	0.418 ± 0.023	--	--	0.421 ± 0.023	0.421 ± 0.026	0.423 ± 0.023	0.406 ± 0.022
≥11.0	0.411 ± 0.015	0.422 ± 0.018	0.413 ± 0.017	0.419 ± 0.017	0.407 ± 0.025	0.418 ± 0.017	0.396 ± 0.018
				Wood and Bark			
5.0-10.9	0.369 ± 0.017	--	--	0.370 ± 0.021	0.366 ± 0.013	0.370 ± 0.020	0.354 ± 0.010
≥11.0	0.374 ± 0.027	0.378 ± 0.034	0.372 ± 0.019	0.376 ± 0.029	0.369 ± 0.026	0.376 ± 0.029	0.359 ± 0.024
				BLACKGUM			
				Wood			
5.0-10.9	0.524 ± 0.027	--	--	0.528 ± 0.034	0.518 ± 0.028	0.526 ± 0.032	0.521 ± 0.015
≥11.0	0.509 ± 0.054	0.514 ± 0.056	0.497 ± 0.054	0.511 ± 0.056	0.523 ± 0.057	0.511 ± 0.056	0.500 ± 0.049
				Bark			
5.0-10.9	0.471 ± 0.029	--	--	0.455 ± 0.039	0.465 ± 0.038	0.457 ± 0.037	0.494 ± 0.031
≥11.0	0.448 ± 0.048	0.437 ± 0.074	0.435 ± 0.083	0.435 ± 0.076	0.464 ± 0.054	0.436 ± 0.074	0.460 ± 0.024

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 Southern Appalachian Mountains--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
				Wood and Bark			
5.0-10.9	0.513 ± 0.023	--	--	0.512 ± 0.026	0.503 ± 0.024	0.516 ± 0.027	0.511 ± 0.015
≥11.0	0.502 ± 0.041	0.504 ± 0.041	0.486 ± 0.038	0.500 ± 0.041	0.508 ± 0.035	0.505 ± 0.046	0.488 ± 0.036
				RED MAPLE			
				Wood			
5.0-10.9	0.507 ± 0.022	--	--	0.512 ± 0.025	0.496 ± 0.024	0.509 ± 0.024	0.497 ± 0.026
≥11.0	0.515 ± 0.032	0.516 ± 0.036	0.518 ± 0.032	0.516 ± 0.034	0.517 ± 0.031	0.516 ± 0.034	0.515 ± 0.031
				Bark			
5.0-10.9	0.559 ± 0.038	--	--	0.594 ± 0.036	0.566 ± 0.045	0.590 ± 0.035	0.482 ± 0.051
≥11.0	0.544 ± 0.033	0.572 ± 0.039	0.573 ± 0.043	0.572 ± 0.039	0.555 ± 0.026	0.571 ± 0.038	0.504 ± 0.039
				Wood and Bark			
5.0-10.9	0.516 ± 0.020	--	--	0.523 ± 0.023	0.508 ± 0.020	0.520 ± 0.022	0.491 ± 0.024
≥11.0	0.520 ± 0.026	0.522 ± 0.032	0.526 ± 0.025	0.522 ± 0.031	0.524 ± 0.024	0.523 ± 0.030	0.511 ± 0.027
				YELLOW-POPLAR			
				Wood			
5.0-10.9	0.389 ± 0.028	--	--	0.388 ± 0.028	0.393 ± 0.034	0.387 ± 0.028	0.410 ± 0.024
≥11.0	0.418 ± 0.030	0.414 ± 0.030	0.440 ± 0.042	0.415 ± 0.030	0.445 ± 0.034	0.416 ± 0.030	0.438 ± 0.033
				Bark			
5.0-10.9	0.350 ± 0.029	--	--	0.367 ± 0.029	0.336 ± 0.037	0.382 ± 0.032	0.248 ± 0.057
≥11.0	0.341 ± 0.047	0.340 ± 0.047	0.379 ± 0.046	0.344 ± 0.047	0.358 ± 0.050	0.346 ± 0.045	0.312 ± 0.059
				Wood and Bark			
5.0-10.9	0.383 ± 0.025	--	--	0.385 ± 0.026	0.385 ± 0.029	0.387 ± 0.026	0.360 ± 0.024
≥11.0	0.406 ± 0.028	0.403 ± 0.028	0.429 ± 0.038	0.405 ± 0.028	0.428 ± 0.032	0.405 ± 0.028	0.400 ± 0.036
				HARD HARDWOODS			
				Wood			
5.0-10.9	0.598 ± 0.048	--	--	0.596 ± 0.053	0.619 ± 0.037	0.598 ± 0.047	0.606 ± 0.039
≥11.0	0.604 ± 0.041	0.596 ± 0.046	0.616 ± 0.044	0.598 ± 0.045	0.630 ± 0.037	0.598 ± 0.045	0.622 ± 0.040

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 Southern Appalachian Mountains--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
				Bark			
5.0-10.9	0.502 ± 0.096	--	--	0.510 ± 0.119	0.514 ± 0.087	0.510 ± 0.113	0.476 ± 0.070
≥11.0	0.536 ± 0.093	0.545 ± 0.109	0.558 ± 0.107	0.548 ± 0.108	0.532 ± 0.077	0.548 ± 0.107	0.516 ± 0.079
				Wood and Bark			
5.0-10.9	0.582 ± 0.043	--	--	0.578 ± 0.053	0.592 ± 0.034	0.584 ± 0.044	0.563 ± 0.036
≥11.0	0.594 ± 0.033	0.586 ± 0.039	0.601 ± 0.040	0.587 ± 0.038	0.600 ± 0.034	0.591 ± 0.038	0.588 ± 0.038
				WHITE ASH			
				Wood			
5.0-10.9	0.589 ± 0.031	--	--	0.589 ± 0.035	0.613 ± 0.035	0.590 ± 0.034	0.590 ± 0.028
≥11.0	0.579 ± 0.040	0.572 ± 0.043	0.603 ± 0.043	0.576 ± 0.042	0.622 ± 0.044	0.576 ± 0.042	0.598 ± 0.044
				Bark			
5.0-10.9	0.407 ± 0.041	--	--	0.375 ± 0.056	0.441 ± 0.039	0.383 ± 0.053	0.461 ± 0.032
≥11.0	0.407 ± 0.044	0.384 ± 0.043	0.405 ± 0.055	0.387 ± 0.044	0.446 ± 0.047	0.388 ± 0.044	0.440 ± 0.046
				Wood and Bark			
5.0-10.9	0.562 ± 0.031	--	--	0.551 ± 0.036	0.569 ± 0.033	0.558 ± 0.034	0.549 ± 0.027
≥11.0	0.556 ± 0.037	0.544 ± 0.038	0.562 ± 0.045	0.546 ± 0.037	0.567 ± 0.046	0.552 ± 0.039	0.549 ± 0.044
				SWEET BIRCH			
				Wood			
5.0-10.9	0.531 ± 0.095	--	--	0.541 ± 0.107	0.608 ± 0.023	0.555 ± 0.080	0.571 ± 0.021
≥11.0	0.602 ± 0.025	0.601 ± 0.027	0.611 ± 0.027	0.602 ± 0.026	0.618 ± 0.029	0.602 ± 0.026	0.601 ± 0.026
				Bark			
5.0-10.9	0.556 ± 0.084	--	--	0.619 ± 0.144	0.633 ± 0.030	0.624 ± 0.105	0.511 ± 0.026
≥11.0	0.663 ± 0.027	0.716 ± 0.025	0.719 ± 0.030	0.717 ± 0.025	0.679 ± 0.026	0.716 ± 0.025	0.594 ± 0.039
				Wood and Bark			
5.0-10.9	0.536 ± 0.092	--	--	0.550 ± 0.112	0.612 ± 0.020	0.564 ± 0.082	0.551 ± 0.019
≥11.0	0.614 ± 0.020	0.616 ± 0.023	0.628 ± 0.022	0.617 ± 0.022	0.630 ± 0.022	0.618 ± 0.021	0.598 ± 0.025

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 Southern Appalachian Mountains--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
				BLACK LOCUST			
				Wood			
5.0-10.9	0.600 ± 0.059	--	--	0.583 ± 0.087	0.648 ± 0.016	0.596 ± 0.070	0.621 ± 0.046
≥11.0	0.655 ± 0.032	0.648 ± 0.037	0.664 ± 0.033	0.652 ± 0.035	0.676 ± 0.033	0.652 ± 0.035	0.666 ± 0.026
				Bark			
5.0-10.9	0.289 ± 0.026	--	--	0.266 ± 0.040	0.328 ± 0.018	0.277 ± 0.032	0.329 ± 0.021
≥11.0	0.305 ± 0.027	0.282 ± 0.024	0.317 ± 0.030	0.293 ± 0.025	0.346 ± 0.030	0.295 ± 0.025	0.335 ± 0.031
				Wood and Bark			
5.0-10.9	0.554 ± 0.055	--	--	0.508 ± 0.079	0.564 ± 0.029	0.551 ± 0.068	0.514 ± 0.037
≥11.0	0.605 ± 0.025	0.561 ± 0.020	0.568 ± 0.021	0.565 ± 0.017	0.570 ± 0.026	0.606 ± 0.027	0.542 ± 0.024
				HICKORY			
				Wood			
5.0-10.9	0.657 ± 0.033	--	--	0.660 ± 0.031	0.666 ± 0.044	0.659 ± 0.033	0.640 ± 0.051
≥11.0	0.648 ± 0.033	0.646 ± 0.039	0.661 ± 0.038	0.649 ± 0.037	0.657 ± 0.047	0.649 ± 0.036	0.647 ± 0.037
				Bark			
5.0-10.9	0.503 ± 0.027	--	--	0.523 ± 0.028	0.493 ± 0.031	0.519 ± 0.027	0.445 ± 0.040
≥11.0	0.531 ± 0.036	0.550 ± 0.039	0.561 ± 0.037	0.552 ± 0.036	0.520 ± 0.032	0.552 ± 0.036	0.497 ± 0.044
				Wood and Bark			
5.0-10.9	0.632 ± 0.030	--	--	0.636 ± 0.030	0.625 ± 0.036	0.636 ± 0.032	0.574 ± 0.040
≥11.0	0.629 ± 0.029	0.631 ± 0.034	0.642 ± 0.031	0.634 ± 0.031	0.615 ± 0.037	0.635 ± 0.031	0.599 ± 0.033
				BLACK OAK			
				Wood			
5.0-10.9	0.579 ± 0.025	--	--	0.570 ± 0.026	0.606 ± 0.024	0.572 ± 0.025	0.623 ± 0.034
≥11.0	0.573 ± 0.038	0.556 ± 0.044	0.579 ± 0.039	0.560 ± 0.044	0.623 ± 0.029	0.560 ± 0.044	0.613 ± 0.033
				Bark			
5.0-10.9	0.533 ± 0.035	--	--	0.552 ± 0.038	0.538 ± 0.042	0.550 ± 0.038	0.433 ± 0.048
≥11.0	0.573 ± 0.032	0.584 ± 0.032	0.601 ± 0.035	0.587 ± 0.030	0.565 ± 0.037	0.586 ± 0.030	0.542 ± 0.052

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 Southern Appalachian Mountains--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
				Wood and Bark			
5.0-10.9	0.570 ± 0.022	--	--	0.566 ± 0.022	0.591 ± 0.023	0.569 ± 0.021	0.557 ± 0.036
≥11.0	0.574 ± 0.030	0.561 ± 0.036	0.583 ± 0.025	0.564 ± 0.035	0.608 ± 0.021	0.564 ± 0.035	0.591 ± 0.020
				CHESTNUT OAK			
				Wood			
5.0-10.9	0.608 ± 0.022	--	--	0.612 ± 0.022	0.603 ± 0.026	0.610 ± 0.022	0.592 ± 0.033
≥11.0	0.620 ± 0.023	0.620 ± 0.023	0.622 ± 0.031	0.620 ± 0.023	0.620 ± 0.033	0.620 ± 0.023	0.620 ± 0.052
				Bark			
5.0-10.9	0.500 ± 0.039	--	--	0.508 ± 0.045	0.488 ± 0.041	0.505 ± 0.044	0.474 ± 0.033
≥11.0	0.506 ± 0.035	0.515 ± 0.042	0.507 ± 0.042	0.513 ± 0.042	0.497 ± 0.037	0.513 ± 0.041	0.488 ± 0.031
				Wood and Bark			
5.0-10.9	0.585 ± 0.025	--	--	0.586 ± 0.028	0.567 ± 0.026	0.589 ± 0.026	0.549 ± 0.029
≥11.0	0.598 ± 0.021	0.599 ± 0.021	0.589 ± 0.028	0.598 ± 0.022	0.576 ± 0.025	0.602 ± 0.021	0.572 ± 0.040
				NORTHERN RED OAK			
				Wood			
5.0-10.9	0.581 ± 0.020	--	--	0.577 ± 0.020	0.606 ± 0.025	0.578 ± 0.019	0.600 ± 0.031
≥11.0	0.580 ± 0.021	0.568 ± 0.022	0.608 ± 0.026	0.571 ± 0.022	0.609 ± 0.009	0.571 ± 0.022	0.610 ± 0.022
				Bark			
5.0-10.9	0.610 ± 0.022	--	--	0.624 ± 0.025	0.607 ± 0.026	0.623 ± 0.024	0.561 ± 0.037
≥11.0	0.623 ± 0.032	0.634 ± 0.038	0.658 ± 0.038	0.636 ± 0.036	0.590 ± 0.006	0.635 ± 0.036	0.596 ± 0.066
				Wood and Bark			
5.0-10.9	0.586 ± 0.018	--	--	0.583 ± 0.018	0.606 ± 0.021	0.585 ± 0.017	0.590 ± 0.029
≥11.0	0.587 ± 0.019	0.576 ± 0.021	0.616 ± 0.025	0.579 ± 0.022	0.608 ± 0.007	0.579 ± 0.022	0.607 ± 0.024
				SCARLET OAK			
				Wood			
5.0-10.9	0.576 ± 0.029	--	--	0.563 ± 0.035	0.594 ± 0.026	0.565 ± 0.035	0.619 ± 0.011
≥11.0	0.578 ± 0.024	0.558 ± 0.025	0.564 ± 0.027	0.559 ± 0.025	0.635 ± 0.025	0.560 ± 0.025	0.629 ± 0.027

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 Southern Appalachian Mountains--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
				Bark			
5.0-10.9	0.555 ± 0.045	--	--	0.595 ± 0.028	0.555 ± 0.043	0.590 ± 0.030	0.476 ± 0.067
≥11.0	0.613 ± 0.037	0.635 ± 0.035	0.639 ± 0.037	0.636 ± 0.034	0.581 ± 0.037	0.635 ± 0.034	0.575 ± 0.044
				Wood and Bark			
5.0-10.9	0.572 ± 0.021	--	--	0.568 ± 0.029	0.587 ± 0.024	0.569 ± 0.028	0.572 ± 0.027
≥11.0	0.584 ± 0.019	0.568 ± 0.021	0.575 ± 0.022	0.569 ± 0.021	0.623 ± 0.021	0.570 ± 0.021	0.614 ± 0.022
				WHITE OAK			
				Wood			
5.0-10.9	0.629 ± 0.026	--	--	0.630 ± 0.028	0.633 ± 0.021	0.630 ± 0.026	0.623 ± 0.039
≥11.0	0.608 ± 0.026	0.595 ± 0.028	0.623 ± 0.034	0.596 ± 0.028	0.637 ± 0.031	0.596 ± 0.028	0.637 ± 0.033
				Bark			
5.0-10.9	0.477 ± 0.038	--	--	0.492 ± 0.043	0.490 ± 0.045	0.490 ± 0.044	0.443 ± 0.036
≥11.0	0.518 ± 0.033	0.533 ± 0.045	0.555 ± 0.040	0.536 ± 0.040	0.531 ± 0.029	0.536 ± 0.040	0.494 ± 0.036
				Wood and Bark			
5.0-10.9	0.607 ± 0.025	--	--	0.610 ± 0.027	0.598 ± 0.022	0.612 ± 0.025	0.562 ± 0.034
≥11.0	0.594 ± 0.022	0.587 ± 0.023	0.609 ± 0.029	0.588 ± 0.023	0.605 ± 0.024	0.589 ± 0.024	0.594 ± 0.029
				ALL SPECIES			
				Wood			
5.0-10.9	0.550 ± 0.092	--	--	0.550 ± 0.093	0.565 ± 0.097	0.551 ± 0.092	0.557 ± 0.091
≥11.0	0.563 ± 0.085	0.557 ± 0.085	0.574 ± 0.087	0.558 ± 0.085	0.586 ± 0.088	0.551 ± 0.091	0.579 ± 0.089
				Bark			
5.0-10.9	0.484 ± 0.099	--	--	0.494 ± 0.116	0.491 ± 0.099	0.496 ± 0.110	0.447 ± 0.098
≥11.0	0.502 ± 0.109	0.510 ± 0.123	0.524 ± 0.118	0.513 ± 0.122	0.502 ± 0.095	0.513 ± 0.120	0.481 ± 0.102
				Wood and Bark			
5.0-10.9	0.540 ± 0.084	--	--	0.538 ± 0.086	0.546 ± 0.085	0.542 ± 0.084	0.521 ± 0.082
≥11.0	0.554 ± 0.081	0.547 ± 0.081	0.562 ± 0.081	0.549 ± 0.080	0.562 ± 0.078	0.552 ± 0.081	0.547 ± 0.084

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

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			
5.0-10.9	105 ± 19.1	--	--	105 ± 19.9	103 ± 19.0	105 ± 19.1	107 ± 22.0
≥11.0	99 ± 15.8	98 ± 15.8	95 ± 16.6	98 ± 15.6	104 ± 18.3	98 ± 15.6	107 ± 21.2
				Bark			
5.0-10.9	109 ± 48.7	--	--	96 ± 42.6	125 ± 66.5	106 ± 55.4	164 ± 99.4
≥11.0	96 ± 27.7	87 ± 26.6	84 ± 22.6	86 ± 25.7	125 ± 48.1	88 ± 26.7	145 ± 61.6
				Wood and Bark			
5.0-10.9	104 ± 20.5	--	--	103 ± 20.7	105 ± 21.3	105 ± 21.6	124 ± 37.7
≥11.0	98 ± 14.9	96 ± 15.0	93 ± 14.8	95 ± 14.6	106 ± 20.1	96 ± 14.7	119 ± 27.8
				BASSWOOD			
				Wood			
5.0-10.9	126 ± 16.2	--	--	125 ± 17.9	123 ± 12.7	125 ± 17.2	136 ± 13.6
≥11.0	119 ± 11.7	120 ± 12.9	111 ± 13.5	118 ± 12.1	115 ± 13.2	118 ± 12.0	129 ± 14.8
				Bark			
5.0-10.9	97 ± 6.6	--	--	90 ± 4.8	101 ± 9.8	91 ± 4.3	113 ± 9.9
≥11.0	96 ± 6.8	85 ± 9.9	86 ± 10.3	85 ± 9.7	104 ± 11.8	85 ± 9.6	119 ± 11.6
				Wood and Bark			
5.0-10.9	118 ± 12.0	--	--	118 ± 15.1	117 ± 8.2	118 ± 14.1	127 ± 8.0
≥11.0	114 ± 9.9	115 ± 11.6	106 ± 11.2	113 ± 10.6	112 ± 11.9	113 ± 10.6	126 ± 12.9
				BLACKGUM			
				Wood			
5.0-10.9	107 ± 7.8	--	--	106 ± 9.1	110 ± 7.5	106 ± 8.8	112 ± 6.3
≥11.0	98 ± 14.2	94 ± 12.2	98 ± 18.0	95 ± 13.9	101 ± 16.4	95 ± 14.0	109 ± 16.5
				Bark			
5.0-10.9	54 ± 7.6	--	--	49 ± 8.3	56 ± 6.4	49 ± 8.2	63 ± 6.0
≥11.0	52 ± 9.1	49 ± 13.5	50 ± 13.0	49 ± 13.2	61 ± 9.7	49 ± 12.9	59 ± 7.7
				Wood and Bark			
.0-10.9	95 ± 6.2	--	--	93 ± 6.3	94 ± 5.5	97 ± 7.1	96 ± 7.2
≥11.0	87 ± 7.4	85 ± 6.2	87 ± 11.6	86 ± 7.5	88 ± 7.8	88 ± 9.1	93 ± 11.2
				RED MAPLE			
				Wood			
5.0-10.9	83 ± 5.3	--	--	83 ± 6.5	83 ± 6.9	83 ± 6.2	82 ± 11.9
≥11.0	76 ± 7.3	77 ± 7.2	73 ± 7.6	76 ± 7.1	76 ± 8.8	76 ± 7.1	77 ± 10.4

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 Southern Appalachian Mountains--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	74 ± 9.4	--	--	64 ± 7.0	77 ± 11.9	66 ± 6.9	95 ± 14.4
≥11.0	72 ± 7.3	61 ± 7.6	64 ± 9.3	62 ± 7.2	78 ± 8.4	62 ± 7.1	85 ± 11.5
				Wood and Bark			
5.0-10.9	81 ± 4.8	--	--	81 ± 5.2	82 ± 6.2	81 ± 5.1	85 ± 12.3
≥11.0	76 ± 6.8	76 ± 6.9	72 ± 7.7	75 ± 6.9	76 ± 7.7	75 ± 6.8	79 ± 9.1
				YELLOW-POPLAR			
				Wood			
5.0-10.9	113 ± 13.5	--	--	115 ± 14.8	109 ± 17.0	113 ± 13.7	112 ± 13.9
≥11.0	101 ± 9.4	100 ± 10.0	98 ± 12.0	100 ± 9.8	111 ± 12.4	100 ± 9.8	111 ± 15.4
				Bark			
5.0-10.9	160 ± 33.1	--	--	140 ± 29.6	196 ± 44.5	162 ± 43.7	271 ± 66.8
≥11.0	115 ± 17.8	104 ± 18.4	99 ± 14.2	103 ± 17.4	160 ± 32.6	105 ± 18.6	190 ± 40.3
				Wood and Bark			
5.0-10.9	120 ± 14.5	--	--	118 ± 15.0	121 ± 17.1	121 ± 16.4	162 ± 22.2
≥11.0	103 ± 8.5	101 ± 9.1	98 ± 10.2	100 ± 8.7	119 ± 11.6	101 ± 9.0	135 ± 18.4
				HARD HARDWOODS			
				Wood			
5.0-10.9	62 ± 14.4	--	--	64 ± 15.7	59 ± 11.8	63 ± 15.2	58 ± 10.7
≥11.0	67 ± 14.0	71 ± 15.7	63 ± 13.5	70 ± 15.5	59 ± 10.0	70 ± 15.5	60 ± 10.2
				Bark			
5.0-10.9	69 ± 15.1	--	--	64 ± 16.0	72 ± 15.5	66 ± 16.5	81 ± 17.2
≥11.0	65 ± 10.6	62 ± 11.0	60 ± 11.8	62 ± 10.7	70 ± 12.3	62 ± 10.5	71 ± 13.8
				Wood and Bark			
5.0-10.9	63 ± 11.7	--	--	64 ± 12.7	62 ± 8.2	64 ± 12.3	66 ± 8.2
≥11.0	67 ± 11.2	69 ± 12.9	63 ± 10.5	69 ± 12.7	62 ± 7.2	69 ± 12.9	63 ± 7.7
				WHITE ASH			
				Wood			
5.0-10.9	45 ± 2.3	--	--	45 ± 2.5	43 ± 2.3	45 ± 2.5	43 ± 3.0
≥11.0	46 ± 3.0	47 ± 4.1	44 ± 2.7	46 ± 3.2	45 ± 3.3	46 ± 3.2	45 ± 3.8
				Bark			
5.0-10.9	84 ± 19.5	--	--	82 ± 22.1	86 ± 18.5	84 ± 22.8	86 ± 19.0
≥11.0	78 ± 11.2	77 ± 11.8	77 ± 17.0	77 ± 12.3	80 ± 16.5	77 ± 11.9	78 ± 16.4

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 Southern Appalachian Mountains--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	51 ± 3.5	--	--	52 ± 5.2	53 ± 4.8	51 ± 4.4	57 ± 6.5
≥11.0	51 ± 3.6	52 ± 4.4	50 ± 5.1	51 ± 3.9	55 ± 6.2	51 ± 3.8	55 ± 6.1
				SWEET BIRCH			
				Wood			
5.0-10.9	62 ± 11.3	--	--	64 ± 11.6	70 ± 2.6	66 ± 8.5	62 ± 5.7
≥11.0	71 ± 4.0	72 ± 4.3	71 ± 2.6	72 ± 3.5	70 ± 3.9	72 ± 3.4	69 ± 7.2
				Bark			
5.0-10.9	66 ± 6.7	--	--	53 ± 11.1	66 ± 3.3	56 ± 6.8	84 ± 8.0
≥11.0	58 ± 4.7	53 ± 3.9	52 ± 4.1	53 ± 3.9	57 ± 4.5	53 ± 3.8	65 ± 6.4
				Wood and Bark			
5.0-10.9	62 ± 10.3	--	--	62 ± 11.5	69 ± 2.5	64 ± 8.2	69 ± 5.1
≥11.0	69 ± 3.0	70 ± 3.7	68 ± 2.5	70 ± 3.2	67 ± 2.9	70 ± 3.1	68 ± 3.8
				BLACK LOCUST			
				Wood			
5.0-10.9	44 ± 6.5	--	--	42 ± 8.2	46 ± 3.5	43 ± 6.9	50 ± 6.6
≥11.0	49 ± 10.5	52 ± 12.2	46 ± 10.3	50 ± 11.5	44 ± 7.6	50 ± 11.4	44 ± 6.1
				Bark			
5.0-10.9	57 ± 20.5	--	--	56 ± 19.4	63 ± 19.2	54 ± 22.9	67 ± 20.2
≥11.0	55 ± 11.4	57 ± 14.5	54 ± 11.7	56 ± 13.2	57 ± 9.5	56 ± 13.0	56 ± 9.6
				Wood and Bark			
5.0-10.9	46 ± 6.9	--	--	45 ± 10.2	51 ± 6.0	45 ± 7.5	57 ± 8.1
≥11.0	50 ± 9.5	53 ± 10.8	48 ± 7.9	51 ± 9.9	48 ± 6.1	51 ± 10.4	48 ± 5.4
				HICKORY			
				Wood			
5.0-10.9	51 ± 3.1	--	--	52 ± 3.5	47 ± 2.8	51 ± 3.4	47 ± 2.5
≥11.0	55 ± 5.5	58 ± 6.6	52 ± 6.2	57 ± 6.4	50 ± 3.9	57 ± 6.4	50 ± 3.9
				Bark			
5.0-10.9	72 ± 11.1	--	--	67 ± 9.0	80 ± 14.8	68 ± 9.8	88 ± 15.0
≥11.0	70 ± 11.1	66 ± 10.5	62 ± 10.6	65 ± 10.0	76 ± 15.1	65 ± 10.0	77 ± 15.1
				Wood and Bark			
5.0-10.9	54 ± 3.4	--	--	54 ± 3.8	55 ± 4.8	54 ± 3.6	61 ± 5.6
≥11.0	58 ± 4.9	59 ± 5.5	54 ± 5.2	58 ± 5.3	58 ± 6.7	58 ± 5.4	59 ± 7.2

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 Southern Appalachian Mountains--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						
				BLACK OAK			
				Wood			
5.0-10.9	75 ± 6.7	--	--	78 ± 8.4	67 ± 4.0	77 ± 7.8	62 ± 3.8
≥11.0	81 ± 10.2	87 ± 12.2	79 ± 10.0	86 ± 12.2	66 ± 6.7	86 ± 12.1	67 ± 7.2
				Bark			
5.0-10.9	69 ± 5.5	--	--	61 ± 5.4	75 ± 8.4	63 ± 6.2	103 ± 12.6
≥11.0	62 ± 9.3	57 ± 8.4	55 ± 8.3	57 ± 8.0	69 ± 11.2	57 ± 8.1	73 ± 15.3
				Wood and Bark			
5.0-10.9	74 ± 4.7	--	--	75 ± 6.4	68 ± 2.7	75 ± 6.1	76 ± 5.8
≥11.0	77 ± 7.8	82 ± 9.8	74 ± 7.0	81 ± 9.6	66 ± 5.3	81 ± 9.7	69 ± 5.1
				CHESTNUT OAK			
				Wood			
5.0-10.9	67 ± 3.4	--	--	67 ± 4.3	64 ± 3.1	67 ± 4.0	66 ± 5.5
≥11.0	68 ± 4.4	70 ± 4.7	62 ± 4.9	69 ± 4.7	62 ± 4.3	69 ± 4.7	62 ± 4.6
				Bark			
5.0-10.9	53 ± 7.6	--	--	49 ± 6.6	55 ± 9.3	50 ± 6.0	70 ± 14.2
≥11.0	59 ± 6.5	58 ± 7.9	55 ± 7.7	58 ± 6.6	63 ± 9.7	58 ± 6.6	64 ± 11.0
				Wood and Bark			
5.0-10.9	64 ± 3.6	--	--	63 ± 4.6	61 ± 3.6	64 ± 3.9	68 ± 5.3
≥11.0	66 ± 3.9	67 ± 4.4	60 ± 4.5	67 ± 4.2	62 ± 4.7	67 ± 4.2	63 ± 5.3
				NORTHERN RED OAK			
				Wood			
5.0-10.9	79 ± 4.0	--	--	81 ± 4.5	69 ± 3.7	80 ± 4.5	68 ± 3.6
≥11.0	81 ± 5.5	86 ± 5.8	72 ± 4.7	84 ± 5.8	68 ± 4.5	84 ± 5.8	69 ± 4.6
				Bark			
5.0-10.9	65 ± 4.7	--	--	64 ± 5.3	67 ± 4.9	64 ± 5.0	71 ± 7.9
≥11.0	60 ± 5.6	58 ± 6.0	55 ± 4.8	58 ± 5.7	70 ± 4.4	59 ± 5.7	64 ± 10.4
				Wood and Bark			
5.0-10.9	76 ± 3.6	--	--	79 ± 4.1	69 ± 3.2	78 ± 4.0	69 ± 4.0
≥11.0	78 ± 5.0	82 ± 5.6	69 ± 4.5	81 ± 5.5	68 ± 4.3	81 ± 5.5	68 ± 4.5
				SCARLET OAK			
				Wood			
5.0-10.9	76 ± 2.9	--	--	80 ± 3.1	71 ± 2.7	80 ± 3.2	64 ± 3.5
≥11.0	80 ± 5.3	87 ± 6.0	81 ± 6.3	86 ± 6.0	64 ± 3.9	85 ± 6.1	65 ± 4.0

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 Southern Appalachian Mountains--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	71 ± 11.6	--	--	63 ± 7.8	72 ± 11.0	64 ± 8.4	87 ± 16.9
≥11.0	63 ± 5.6	60 ± 5.2	60 ± 5.0	60 ± 4.9	66 ± 6.3	60 ± 4.9	69 ± 7.2
				Wood and Bark			
5.0-10.9	75 ± 3.2	--	--	77 ± 3.4	71 ± 3.8	77 ± 3.3	72 ± 5.3
≥11.0	77 ± 4.2	83 ± 5.3	78 ± 5.3	82 ± 5.3	65 ± 3.3	82 ± 5.3	66 ± 3.1
				WHITE OAK			
				Wood			
5.0-10.9	65 ± 4.3	--	--	66 ± 4.6	65 ± 4.5	66 ± 4.5	64 ± 5.0
≥11.0	72 ± 4.8	76 ± 5.8	65 ± 4.1	75 ± 6.0	63 ± 4.0	75 ± 6.0	63 ± 3.4
				Bark			
5.0-10.9	71 ± 7.0	--	--	62 ± 5.3	73 ± 9.0	64 ± 5.6	91 ± 10.7
≥11.0	74 ± 5.9	69 ± 8.1	65 ± 7.8	68 ± 6.8	71 ± 6.2	68 ± 6.7	81 ± 7.4
				Wood and Bark			
5.0-10.9	66 ± 4.4	--	--	65 ± 4.3	66 ± 4.5	66 ± 4.3	73 ± 5.3
≥11.0	72 ± 3.7	75 ± 4.7	65 ± 3.5	74 ± 4.9	65 ± 3.6	74 ± 4.9	68 ± 3.4
				ALL SPECIES			
				Wood			
5.0-10.9	75 ± 25.3	--	--	76 ± 25.6	72 ± 24.9	76 ± 25.1	72 ± 26.8
≥11.0	75 ± 19.8	78 ± 19.7	71 ± 20.0	77 ± 19.6	70 ± 23.1	77 ± 19.6	72 ± 24.8
				Bark			
5.0-10.9	81 ± 34.6	--	--	74 ± 30.3	88 ± 45.3	78 ± 37.8	105 ± 67.2
≥11.0	73 ± 21.4	69 ± 19.4	66 ± 18.5	68 ± 18.9	83 ± 35.5	69 ± 19.5	89 ± 46.0
				Wood and Bark			
5.0-10.9	75 ± 24.0	--	--	76 ± 23.7	74 ± 23.8	76 ± 24.5	83 ± 34.3
≥11.0	74 ± 18.1	76 ± 17.8	70 ± 17.6	76 ± 17.5	73 ± 22.5	76 ± 17.9	77 ± 28.5

Table 4.--Average proportion of wood and bark green weight in bark, by tree component and size class, for hardwood species in the Southern Appalachian Mountains

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
	Percent						
				SOFT HARDWOODS			
5.0-10.9	18 ± 3.1	--	--	15 ± 2.8	20 ± 4.6	16 ± 2.8	31 ± 6.2
≥11.0	17 ± 2.4	13 ± 3.0	18 ± 4.1	14 ± 2.8	22 ± 6.7	15 ± 2.8	30 ± 5.0
				BASSWOOD			
5.0-10.9	22 ± 2.3	--	--	18 ± 2.1	27 ± 3.4	19 ± 2.4	39 ± 4.6
≥11.0	19 ± 2.1	14 ± 1.6	19 ± 1.4	15 ± 1.7	29 ± 1.9	15 ± 1.7	36 ± 4.1
				BLACKGUM			
5.0-10.9	18 ± 1.1	--	--	15 ± 1.5	22 ± 3.6	16 ± 1.4	26 ± 3.3
≥11.0	16 ± 4.5	13 ± 5.1	16 ± 5.3	14 ± 5.0	23 ± 5.4	14 ± 5.0	25 ± 4.0
				RED MAPLE			
5.0-10.9	16 ± 2.1	--	--	12 ± 2.1	18 ± 3.2	13 ± 2.4	27 ± 4.4
≥11.0	15 ± 1.0	11 ± 1.7	17 ± 4.9	11 ± 1.6	22 ± 3.5	11 ± 1.6	27 ± 3.3
				YELLOW-POPLAR			
5.0-10.9	19 ± 2.6	--	--	16 ± 2.1	17 ± 2.4	16 ± 1.9	33 ± 4.2
≥11.0	17 ± 1.7	14 ± 1.6	20 ± 2.8	15 ± 1.7	19 ± 7.0	15 ± 1.7	31 ± 3.9
				HARD HARDWOODS			
5.0-10.9	18 ± 3.3	--	--	15 ± 3.5	22 ± 5.1	16 ± 3.6	29 ± 5.2
≥11.0	17 ± 2.8	13 ± 2.5	18 ± 4.6	14 ± 2.6	26 ± 8.9	14 ± 2.6	27 ± 4.5
				WHITE ASH			
5.0-10.9	18 ± 3.5	--	--	15 ± 3.3	25 ± 6.2	15 ± 3.5	32 ± 4.5
≥11.0	16 ± 2.2	12 ± 1.9	18 ± 3.8	13 ± 1.9	30 ± 6.6	13 ± 2.0	30 ± 3.9
				SWEET BIRCH			
5.0-10.9	18 ± 1.2	--	--	12 ± 1.4	19 ± 2.3	13 ± 1.4	33 ± 3.0
≥11.0	18 ± 3.0	14 ± 2.6	17 ± 4.2	14 ± 2.8	22 ± 4.3	14 ± 2.8	28 ± 5.1
				BLACK LOCUST			
5.0-10.9	16 ± 4.9	--	--	13 ± 5.6	19 ± 5.4	14 ± 5.5	25 ± 4.2
≥11.0	15 ± 1.9	12 ± 1.4	16 ± 2.1	13 ± 1.4	24 ± 3.3	13 ± 1.5	25 ± 4.5
				HICKORY			
5.0-10.9	19 ± 2.9	--	--	16 ± 3.0	24 ± 5.1	17 ± 3.5	32 ± 5.7
≥11.0	18 ± 3.0	13 ± 2.6	17 ± 3.6	14 ± 2.6	32 ± 8.6	14 ± 2.6	29 ± 4.2

Continued

Table 4.--Average proportion of wood and bark green weight in bark, by tree component and size class, for hardwood species in the Southern Appalachian Mountains--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						
				BLACK OAK			
5.0-10.9	19 ± 2.3	--	--	17 ± 2.3	24 ± 2.4	18 ± 2.4	31 ± 2.7
≥11.0	18 ± 2.1	14 ± 2.1	18 ± 2.4	15 ± 2.1	27 ± 3.6	15 ± 2.0	28 ± 2.6
				CHESTNUT OAK			
5.0-10.9	21 ± 3.5	--	--	19 ± 3.7	27 ± 4.8	20 ± 3.5	31 ± 7.0
≥11.0	20 ± 2.7	16 ± 2.6	24 ± 5.1	17 ± 2.7	34 ± 8.4	17 ± 2.7	31 ± 3.6
				NORTHERN RED OAK			
5.0-10.9	16 ± 1.3	--	--	14 ± 1.2	19 ± 2.3	14 ± 1.3	25 ± 2.1
≥11.0	15 ± 1.3	12 ± 1.4	16 ± 2.8	12 ± 1.3	15 ± 2.0	12 ± 1.3	23 ± 2.1
				SCARLET OAK			
5.0-10.9	20 ± 2.8	--	--	26 ± 2.1	22 ± 1.6	17 ± 2.1	29 ± 2.2
≥11.0	15 ± 1.1	12 ± 1.1	15 ± 1.8	12 ± 1.2	22 ± 2.8	13 ± 1.2	24 ± 2.8
				WHITE OAK			
5.0-10.9	16 ± 2.6	--	--	12 ± 2.2	22 ± 3.5	13 ± 2.0	30 ± 2.6
≥11.0	16 ± 2.0	12 ± 1.8	18 ± 3.8	12 ± 1.8	29 ± 7.0	12 ± 1.8	26 ± 3.8
				ALL SPECIES			
5.0-10.9	18 ± 3.2	--	--	15 ± 3.3	22 ± 5.1	16 ± 3.4	30 ± 5.6
≥11.0	17 ± 2.7	13 ± 2.6	18 ± 4.5	14 ± 2.6	25 ± 8.7	14 ± 2.6	28 ± 4.8

Table 5.--Average green weight per cubic foot of wood, bark, and wood and bark combined, by tree component and size class, for hardwood species in the Southern Appalachian Mountains

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						
				SOFT HARDWOODS			
				Wood			
5.0-10.9	56 ± 6.3	--	--	56 ± 6.2	56 ± 7.4	56 ± 6.2	56 ± 7.1
≥11.0	54 ± 5.1	55 ± 5.5	55 ± 5.3	53 ± 5.1	58 ± 8.6	53 ± 5.1	57 ± 6.3
				Bark			
5.0-10.9	55 ± 6.0	--	--	54 ± 7.4	57 ± 6.6	53 ± 7.0	57 ± 4.7
≥11.0	48 ± 6.3	48 ± 7.2	50 ± 8.3	46 ± 7.3	54 ± 5.6	46 ± 7.3	56 ± 5.7
				Wood and Bark			
5.0-10.9	55 ± 4.7	--	--	55 ± 4.8	54 ± 5.3	55 ± 4.8	56 ± 4.7
≥11.0	53 ± 4.4	54 ± 4.7	54 ± 4.3	52 ± 4.6	54 ± 5.3	52 ± 4.6	57 ± 4.5
				BASSWOOD			
				Wood			
5.0-10.9	51 ± 1.5	--	--	53 ± 1.8	46 ± 3.1	52 ± 1.7	47 ± 2.6
>11.0	49 ± 3.7	50 ± 4.2	49 ± 2.1	50 ± 3.8	46 ± 3.0	49 ± 3.7	48 ± 4.3
				Bark			
5.0-10.9	51 ± 2.4	--	--	50 ± 2.5	52 ± 3.2	50 ± 2.4	54 ± 2.8
≥11.0	50 ± 1.5	49 ± 2.7	48 ± 2.7	48 ± 2.7	51 ± 2.2	49 ± 2.6	54 ± 2.0
				Wood and Bark			
5.0-10.9	51 ± 1.1	--	--	52 ± 1.3	47 ± 2.1	52 ± 1.2	50 ± 2.3
≥11.0	49 ± 3.2	49 ± 3.8	48 ± 1.5	49 ± 3.3	47 ± 2.0	49 ± 3.3	50 ± 3.3
				BLACKGUM			
				Wood			
5.0-10.9	67 ± 4.0	--	--	66 ± 5.0	64 ± 3.2	66 ± 4.7	69 ± 1.6
≥11.0	61 ± 5.6	60 ± 6.4	60 ± 4.3	60 ± 6.0	62 ± 5.0	60 ± 6.0	65 ± 3.8
				Bark			
5.0-10.9	45 ± 2.4	--	--	42 ± 2.3	45 ± 2.7	42 ± 2.2	50 ± 3.9
≥11.0	42 ± 3.6	40 ± 4.8	40 ± 6.6	40 ± 5.1	46 ± 4.7	40 ± 4.9	45 ± 2.9
				Wood and Bark			
5.0-10.9	61 ± 3.3	--	--	61 ± 4.0	59 ± 2.9	61 ± 3.7	63 ± 2.7
≥11.0	57 ± 4.5	57 ± 5.4	55 ± 3.7	57 ± 5.0	58 ± 4.0	57 ± 5.0	59 ± 3.1
				RED MAPLE			
				Wood			
5.0-10.9	58 ± 2.7	--	--	59 ± 2.9	55 ± 3.1	58 ± 2.8	56 ± 4.8
≥11.0	57 ± 2.5	57 ± 2.9	55 ± 4.1	57 ± 2.6	54 ± 3.1	57 ± 2.6	56 ± 3.0

Continued

Table 5.--Average green weight per cubic foot of wood, bark, and wood and bark combined, by tree component and size class, for hardwood species in the Southern Appalachian Mountains--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						
				Bark			
5.0-10.9	60 ± 3.3	--	--	61 ± 4.4	61 ± 3.2	61 ± 4.0	58 ± 3.5
≥11.0	58 ± 4.2	58 ± 5.0	59 ± 7.5	58 ± 5.2	60 ± 3.2	58 ± 5.1	57 ± 5.3
				Wood and Bark			
5.0-10.9	58 ± 2.4	--	--	59 ± 2.7	56 ± 2.8	58 ± 2.6	56 ± 3.6
≥11.0	57 ± 2.3	57 ± 2.7	55 ± 3.8	57 ± 2.5	55 ± 2.6	57 ± 2.4	57 ± 3.1
				YELLOW-POPLAR			
				Wood			
5.0-10.9	51 ± 3.7	--	--	52 ± 3.7	57 ± 7.6	52 ± 4.3	54 ± 3.7
≥11.0	52 ± 3.7	53 ± 3.1	57 ± 4.2	52 ± 3.6	62 ± 12.9	52 ± 3.7	58 ± 5.3
				Bark			
5.0-10.9	56 ± 4.0	--	--	55 ± 4.6	59 ± 3.5	52 ± 3.7	59 ± 3.7
≥11.0	46 ± 4.1	46 ± 2.5	51 ± 3.4	43 ± 4.1	54 ± 4.3	43 ± 4.2	59 ± 3.3
				Wood and Bark			
5.0-10.9	52 ± 3.4	--	--	52 ± 3.4	52 ± 5.4	52 ± 3.6	56 ± 3.0
≥11.0	51 ± 3.4	52 ± 2.6	56 ± 3.6	50 ± 3.3	55 ± 5.3	50 ± 3.4	58 ± 4.1
				HARD HARDWOODS			
				Wood			
5.0-10.9	62 ± 5.9	--	--	62 ± 6.4	61 ± 9.7	62 ± 6.4	60 ± 4.7
≥11.0	62 ± 4.5	63 ± 4.9	63 ± 5.5	63 ± 4.8	60 ± 5.5	63 ± 4.8	62 ± 4.2
				Bark			
5.0-10.9	53 ± 9.3	--	--	53 ± 11.0	54 ± 8.8	53 ± 10.7	53 ± 7.2
≥11.0	55 ± 8.6	55 ± 9.8	56 ± 9.4	55 ± 9.7	56 ± 7.6	55 ± 9.6	54 ± 7.5
				Wood and Bark			
5.0-10.9	60 ± 5.9	--	--	60 ± 6.6	59 ± 7.6	60 ± 6.5	57 ± 4.5
≥11.0	61 ± 5.0	61 ± 5.3	61 ± 5.9	61 ± 5.3	59 ± 5.2	61 ± 5.2	59 ± 4.9
				WHITE ASH			
				Wood			
5.0-10.9	53 ± 2.7	--	--	53 ± 3.0	54 ± 5.4	53 ± 3.1	53 ± 2.2
≥11.0	52 ± 3.2	52 ± 3.8	55 ± 6.4	52 ± 3.6	58 ± 9.2	52 ± 3.6	54 ± 3.4
				Bark			
5.0-10.9	46 ± 5.3	--	--	43 ± 5.2	51 ± 4.9	44 ± 5.4	53 ± 4.8
≥11.0	45 ± 5.4	42 ± 5.1	45 ± 5.8	42 ± 5.0	49 ± 6.5	43 ± 5.0	49 ± 7.1

Continued

Table 5.--Average green weight per cubic foot of wood, bark, and wood and bark combined, by tree component and size class, for hardwood species in the Southern Appalachian Mountains--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						
				Wood and Bark			
5.0-10.9	52 ± 2.7	--	--	51 ± 2.9	53 ± 4.9	51 ± 3.1	53 ± 2.0
≥11.0	51 ± 2.8	50 ± 3.2	53 ± 5.8	50 ± 2.9	55 ± 7.7	50 ± 3.0	52 ± 4.0
				SWEET BIRCH			
				Wood			
5.0-10.9	60 ± 1.7	--	--	60 ± 2.6	63 ± 1.6	61 ± 2.4	58 ± 3.1
≥11.0	63 ± 3.2	63 ± 3.7	64 ± 3.1	63 ± 3.3	63 ± 3.2	63 ± 3.3	63 ± 3.7
				Bark			
5.0-10.9	62 ± 1.9	--	--	68 ± 1.1	65 ± 2.9	67 ± 1.1	58 ± 2.4
≥11.0	64 ± 1.7	68 ± 1.5	68 ± 2.4	69 ± 1.5	66 ± 1.9	68 ± 1.5	60 ± 2.7
				Wood and Bark			
5.0-10.9	60 ± 1.2	--	--	61 ± 2.3	64 ± 1.2	62 ± 2.1	58 ± 2.3
≥11.0	63 ± 2.8	64 ± 3.3	65 ± 2.6	64 ± 2.9	63 ± 2.6	64 ± 2.8	62 ± 3.4
				BLACK LOCUST			
				Wood			
5.0-10.9	59 ± 4.5	--	--	59 ± 5.5	58 ± 4.5	59 ± 5.1	58 ± 2.2
≥11.0	60 ± 2.9	60 ± 3.2	60 ± 3.6	60 ± 2.9	62 ± 4.3	60 ± 2.9	60 ± 2.7
				Bark			
5.0-10.9	30 ± 3.2	--	--	29 ± 4.0	33 ± 3.5	29 ± 3.8	34 ± 4.8
≥11.0	29 ± 2.5	28 ± 2.4	30 ± 3.0	28 ± 2.6	34 ± 2.4	28 ± 2.6	33 ± 2.7
				Wood and Bark			
5.0-10.9	51 ± 3.7	--	--	52 ± 4.9	51 ± 3.4	52 ± 4.6	49 ± 2.4
≥11.0	52 ± 2.4	52 ± 2.7	52 ± 2.9	52 ± 2.5	52 ± 3.8	52 ± 2.5	49 ± 2.3
				HICKORY			
				Wood			
5.0-10.9	67 ± 6.7	--	--	68 ± 7.0	74 ± 18.8	68 ± 7.9	59 ± 4.6
≥11.0	62 ± 2.0	63 ± 2.7	65 ± 5.0	63 ± 2.3	63 ± 7.0	63 ± 2.3	60 ± 2.7
				Bark			
5.0-10.9	53 ± 2.1	--	--	54 ± 1.7	55 ± 2.9	54 ± 1.7	52 ± 4.6
≥11.0	56 ± 1.9	57 ± 2.1	57 ± 2.1	57 ± 2.0	57 ± 3.0	57 ± 2.0	54 ± 3.0
				Wood and Bark			
5.0-10.9	64 ± 5.3	--	--	65 ± 5.9	68 ± 13.2	66 ± 6.5	56 ± 3.7
≥11.0	61 ± 1.8	62 ± 2.4	63 ± 3.9	62 ± 2.1	61 ± 5.2	62 ± 2.0	58 ± 2.2

Continued

Table 5.--Average green weight per cubic foot of wood, bark, and wood and bark combined, by tree component and size class, for hardwood species in the Southern Appalachian Mountains--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						
				BLACK OAK			
				Wood			
5.0-10.9	62 ± 3.1	--	--	62 ± 3.7	62 ± 3.3	62 ± 3.3	63 ± 2.1
≥11.0	63 ± 1.8	63 ± 2.1	65 ± 3.4	63 ± 2.2	57 ± 4.5	63 ± 2.1	64 ± 1.6
				Bark			
5.0-10.9	56 ± 3.0	--	--	56 ± 3.5	58 ± 3.4	56 ± 3.4	54 ± 5.3
≥11.0	57 ± 2.6	57 ± 2.9	58 ± 2.8	57 ± 2.8	59 ± 3.3	57 ± 2.7	57 ± 3.5
				Wood and Bark			
5.0-10.9	61 ± 2.7	--	--	61 ± 3.2	61 ± 2.5	61 ± 2.9	60 ± 2.5
≥11.0	62 ± 1.7	62 ± 2.1	64 ± 3.0	62 ± 2.1	58 ± 3.4	62 ± 2.0	62 ± 1.6
				CHESTNUT OAK			
				Wood			
5.0-10.9	62 ± 4.0	--	--	63 ± 5.0	60 ± 3.9	63 ± 4.3	61 ± 2.0
≥11.0	64 ± 2.4	65 ± 2.5	62 ± 3.7	65 ± 2.6	57 ± 3.9	64 ± 2.6	63 ± 3.0
				Bark			
5.0-10.9	48 ± 5.2	--	--	47 ± 5.3	47 ± 4.9	47 ± 5.2	50 ± 4.9
≥11.0	50 ± 3.7	51 ± 4.0	49 ± 3.9	51 ± 4.0	50 ± 3.8	51 ± 3.9	50 ± 3.9
				Wood and Bark			
5.0-10.9	59 ± 4.2	--	--	59 ± 5.1	56 ± 3.4	59 ± 4.5	57 ± 2.7
≥11.0	61 ± 2.6	62 ± 2.7	58 ± 3.4	62 ± 2.7	55 ± 3.1	62 ± 2.7	58 ± 3.2
				NORTHERN RED OAK			
				Wood			
5.0-10.9	65 ± 1.9	--	--	65 ± 1.8	61 ± 2.7	65 ± 2.0	63 ± 2.2
≥11.0	65 ± 1.2	66 ± 1.5	66 ± 1.8	66 ± 1.5	62 ± 1.6	66 ± 1.5	64 ± 1.8
				Bark			
5.0-10.9	63 ± 2.0	--	--	64 ± 2.1	63 ± 3.2	64 ± 2.2	60 ± 2.4
≥11.0	62 ± 1.9	63 ± 2.5	64 ± 2.2	63 ± 2.4	62 ± 2.0	63 ± 2.4	61 ± 2.8
				Wood and Bark			
5.0-10.9	64 ± 1.7	--	--	65 ± 1.6	61 ± 2.5	65 ± 1.8	62 ± 2.0
≥11.0	65 ± 1.1	65 ± 1.5	65 ± 1.7	65 ± 1.4	62 ± 1.3	65 ± 1.4	63 ± 1.7

Continued

Table 5.--Average green weight per cubic foot of wood, bark, and wood and bark combined, by tree component and size class, for hardwood species in the Southern Appalachian Mountains--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						
				SCARLET OAK			
				Wood			
5.0-10.9	65 ± 1.8	--	--	66 ± 2.4	62 ± 1.9	65 ± 2.1	63 ± 1.7
≥11.0	65 ± 1.5	64 ± 1.7	67 ± 3.5	65 ± 1.7	61 ± 2.8	64 ± 1.7	65 ± 2.0
				Bark			
5.0-10.9	58 ± 2.3	--	--	60 ± 2.0	59 ± 2.9	60 ± 1.8	54 ± 4.2
≥11.0	62 ± 2.5	63 ± 2.3	64 ± 2.0	63 ± 2.2	60 ± 2.7	63 ± 2.2	60 ± 3.4
				Wood and Bark			
5.0-10.9	63 ± 1.8	--	--	65 ± 2.3	61 ± 1.8	64 ± 2.0	60 ± 1.9
≥11.0	64 ± 1.3	64 ± 1.4	67 ± 3.1	64 ± 1.5	61 ± 2.3	64 ± 1.4	63 ± 1.7
				WHITE OAK			
				Wood			
5.0-10.9	65 ± 1.8	--	--	65 ± 2.2	63 ± 2.3	65 ± 1.9	63 ± 2.3
≥11.0	65 ± 1.7	65 ± 1.7	64 ± 5.6	65 ± 1.6	61 ± 3.1	65 ± 1.6	65 ± 2.8
				Bark			
5.0-10.9	51 ± 3.3	--	--	50 ± 3.7	52 ± 3.2	50 ± 3.6	53 ± 2.5
≥11.0	56 ± 2.7	56 ± 3.9	57 ± 2.7	56 ± 3.6	57 ± 2.1	56 ± 3.5	55 ± 2.8
				Wood and Bark			
5.0-10.9	62 ± 1.7	--	--	63 ± 2.0	60 ± 2.2	63 ± 1.8	60 ± 2.2
≥11.0	63 ± 1.7	64 ± 1.5	62 ± 4.5	64 ± 1.6	60 ± 2.4	64 ± 1.6	62 ± 2.5
				ALL SPECIES			
				Wood			
5.0-10.9	60 ± 6.6	--	--	60 ± 6.9	60 ± 9.4	60 ± 6.9	58 ± 5.7
≥11.0	60 ± 6.0	61 ± 5.9	62 ± 6.2	60 ± 6.3	60 ± 7.5	60 ± 6.2	61 ± 5.2
				Bark			
5.0-10.9	53 ± 8.5	--	--	53 ± 10.0	55 ± 8.2	53 ± 9.7	54 ± 6.7
≥11.0	53 ± 8.6	54 ± 9.7	55 ± 9.4	53 ± 9.9	55 ± 7.2	53 ± 9.9	55 ± 7.1
				Wood and Bark			
5.0-10.9	58 ± 6.0	--	--	59 ± 6.5	58 ± 7.5	59 ± 6.5	57 ± 4.6
≥11.0	59 ± 6.0	60 ± 6.0	60 ± 6.3	59 ± 6.5	58 ± 5.5	59 ± 6.4	59 ± 4.9

Table 6.--Average green weight of wood and bark per cubic foot of wood, by tree component and size class, for hardwood species in the Southern Appalachian Mountains

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						
				SOFT HARDWOODS			
5.0-10.9	68 ± 7.5	--	--	66 ± 7.2	69 ± 9.1	66 ± 7.3	81 ± 8.3
≥11.0	65 ± 5.5	63 ± 5.4	68 ± 6.4	62 ± 5.1	73 ± 8.4	63 ± 5.1	82 ± 6.6
				BASSWOOD			
5.0-10.9	66 ± 1.5	--	--	65 ± 2.3	63 ± 3.3	65 ± 2.2	78 ± 7.6
≥11.0	61 ± 4.5	58 ± 5.1	60 ± 2.6	58 ± 4.6	64 ± 3.3	58 ± 4.6	75 ± 6.9
				BLACKGUM			
5.0-10.9	81 ± 4.0	--	--	78 ± 5.0	82 ± 1.9	78 ± 4.9	92 ± 4.0
≥11.0	73 ± 4.6	70 ± 4.6	71 ± 1.7	70 ± 4.2	81 ± 2.4	70 ± 4.1	86 ± 5.5
				RED MAPLE			
5.0-10.9	69 ± 4.1	--	--	67 ± 4.2	68 ± 5.0	67 ± 4.3	78 ± 9.6
≥11.0	67 ± 3.4	64 ± 3.3	66 ± 4.5	64 ± 3.1	69 ± 4.0	64 ± 3.1	77 ± 3.1
				YELLOW-POPLAR			
5.0-10.9	63 ± 5.6	--	--	61 ± 5.2	67 ± 10.0	62 ± 5.6	81 ± 4.4
≥11.0	63 ± 4.3	61 ± 2.9	72 ± 6.3	61 ± 4.0	75 ± 8.5	61 ± 4.1	83 ± 5.8
				HARD HARDWOODS			
5.0-10.9	75 ± 7.3	--	--	73 ± 7.5	78 ± 7.6	74 ± 7.8	85 ± 7.1
≥11.0	75 ± 5.8	72 ± 5.9	77 ± 6.7	72 ± 5.7	82 ± 9.0	73 ± 5.7	85 ± 6.7
				WHITE ASH			
5.0-10.9	65 ± 4.0	--	--	62 ± 3.7	72 ± 6.2	63 ± 4.0	77 ± 5.4
≥11.0	63 ± 3.9	59 ± 3.8	67 ± 6.8	60 ± 3.8	82 ± 9.5	60 ± 3.8	75 ± 6.0
				SWEET BIRCH			
5.0-10.9	74 ± 2.2	--	--	69 ± 2.5	78 ± 1.3	70 ± 2.5	86 ± 6.0
≥11.0	77 ± 3.4	73 ± 4.1	77 ± 3.4	73 ± 3.6	80 ± 4.1	73 ± 3.5	88 ± 6.3
				BLACK LOCUST			
5.0-10.9	70 ± 3.3	--	--	68 ± 4.2	71 ± 3.0	69 ± 3.8	78 ± 4.5
≥11.0	70 ± 2.6	68 ± 3.4	71 ± 4.1	69 ± 2.8	82 ± 4.3	69 ± 2.8	79 ± 4.6
				HICKORY			
5.0-10.9	83 ± 8.0	--	--	81 ± 7.4	87 ± 10.5	82 ± 9.1	86 ± 5.6
≥11.0	76 ± 2.9	73 ± 2.7	78 ± 6.5	73 ± 2.5	91 ± 8.1	73 ± 2.5	86 ± 5.7

Continued

Table 6.--Average green weight of wood and bark per cubic foot of wood, by tree component and size class, for hardwood species in the Southern Appalachian Mountains

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
	Pounds per cubic foot						
				BLACK OAK			
5.0-10.9	77 ± 2.5	--	--	75 ± 3.3	81 ± 3.6	76 ± 2.9	91 ± 4.5
≥11.0	77 ± 2.4	74 ± 2.3	80 ± 3.0	74 ± 2.2	79 ± 4.2	74 ± 2.1	88 ± 3.9
				CHESTNUT OAK			
5.0-10.9	79 ± 5.0	--	--	78 ± 5.0	82 ± 5.8	78 ± 4.8	89 ± 9.0
≥11.0	80 ± 3.4	77 ± 2.8	81 ± 6.6	78 ± 3.1	86 ± 8.9	78 ± 3.1	91 ± 4.8
				NORTHERN RED OAK			
5.0-10.9	77 ± 2.0	--	--	76 ± 2.0	75 ± 3.0	75 ± 2.0	83 ± 3.5
≥11.0	77 ± 1.8	75 ± 1.8	78 ± 3.2	75 ± 1.8	72 ± 1.6	75 ± 1.8	84 ± 3.0
				SCARLET OAK			
5.0-10.9	81 ± 2.5	--	--	78 ± 2.6	79 ± 1.7	78 ± 2.2	90 ± 3.7
≥11.0	76 ± 1.9	73 ± 2.1	79 ± 3.5	74 ± 2.1	78 ± 3.4	74 ± 2.1	85 ± 3.7
				WHITE OAK			
5.0-10.9	77 ± 3.4	--	--	74 ± 2.7	81 ± 3.3	75 ± 2.8	91 ± 3.8
≥11.0	78 ± 2.2	74 ± 1.9	78 ± 5.2	74 ± 1.8	88 ± 7.0	74 ± 1.8	88 ± 5.4
				ALL SPECIES			
5.0-10.9	73 ± 8.0	--	--	71 ± 8.1	75 ± 9.0	72 ± 8.3	84 ± 7.6
≥11.0	73 ± 7.2	70 ± 6.8	75 ± 7.6	70 ± 7.1	80 ± 9.6	70 ± 7.1	84 ± 6.8

Table 7.--Regression equations for estimating green and dry weight of the above-stump total-tree wood and bark combined and wood alone for hardwood species in the Southern Appalachian Mountains, 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 WOOD AND BARK				
Soft Hardwoods	Green	3.55211	1.25948	4.02745	1.23329	0.98	0.0642	128
	Dry	1.56282	1.28807	1.88621	1.24885	0.97	0.0758	128
Basswood	Green	3.71029	1.24226	5.02472	1.17902	0.98	0.0552	18
	Dry	1.94274	1.21008	1.47600	1.26737	0.98	0.0630	18
Blackgum (upland)	Green	3.32017	1.25136	4.90406	1.17002	0.98	0.0619	18
	Dry	1.54160	1.27590	2.01627	1.21993	0.97	0.0679	18
Red maple	Green	4.02365	1.25353	10.63281	1.05091	0.98	0.0602	30
	Dry	2.02338	1.27612	5.28790	1.07581	0.98	0.0558	30
Yellow-poplar	Green	2.53157	1.33741	4.17992	1.23285	0.99	0.0581	62
	Dry	0.87948	1.40401	1.65215	1.27254	0.99	0.0568	62
Hard Hardwoods	Green	3.20171	1.30631	3.74095	1.27386	0.97	0.0794	347
	Dry	1.99067	1.30291	2.66968	1.24172	0.97	0.0738	347
White ash	Green	4.26515	1.21919	5.51740	1.16551	0.98	0.0617	52
	Dry	2.71163	1.22990	3.96491	1.15068	0.98	0.0633	52
Sweet birch	Green	7.26568	1.14114	6.22976	1.17321	0.99	0.0419	21
	Dry	4.29408	1.14203	3.80734	1.16711	0.99	0.0418	21
Black locust	Green	6.12062	1.08931	1.36924	1.40154	0.96	0.0780	18
	Dry	4.13741	1.08876	1.04649	1.37539	0.95	0.0831	18
Hickory	Green	1.37649	1.50566	4.68499	1.25027	0.99	0.0595	54
	Dry	0.93747	1.49389	3.30276	1.23130	0.98	0.0637	54
Black oak	Green	2.21828	1.36803	3.65717	1.26378	0.99	0.0556	27
	Dry	1.29270	1.36723	2.54650	1.22586	0.98	0.0607	27
Chestnut oak	Green	1.34863	1.48845	5.41481	1.19861	0.98	0.0690	51
	Dry	0.86674	1.47585	3.40602	1.19049	0.98	0.0667	51
North. red oak	Green	5.08421	1.23759	5.81355	1.20964	0.99	0.0452	71
	Dry	3.06739	1.22338	3.28071	1.20936	0.99	0.0488	71
Scarlet oak	Green	2.81706	1.34308	4.69089	1.23675	0.99	0.0444	27
	Dry	1.62952	1.34103	2.94915	1.21733	0.99	0.0481	27
White oak	Green	2.82506	1.34053	2.51286	1.36495	0.99	0.0566	28
	Dry	1.73738	1.33404	1.69511	1.33917	0.99	0.0594	28
All Species	Green	3.29754	1.29311	3.65829	1.27146	0.97	0.0790	475
	Dry	1.83051	1.30348	2.24309	1.26110	0.96	0.0948	475

Continued

Table 7.--Regression equations for estimating green and dry weight of the above-stump total-tree wood and bark combined and wood alone for hardwood species in the Southern Appalachian Mountains, 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
				TOTAL-TREE WOOD				
Soft Hardwoods	Green	2.65877	1.28067	3.26758	1.23767	0.98	0.0681	128
	Dry	1.20522	1.30165	1.45172	1.26285	0.97	0.0854	128
Basswood	Green	2.58221	1.26827	3.14665	1.22705	0.98	0.0551	18
	Dry	1.26050	1.24541	0.86609	1.32366	0.97	0.0670	18
Blackgum (upland)	Green	2.55358	1.26884	4.23002	1.16360	0.97	0.0724	18
	Dry	1.14382	1.28857	1.50453	1.23141	0.96	0.0888	18
Red maple	Green	3.05121	1.27840	9.88085	1.03339	0.97	0.0597	30
	Dry	1.45160	1.31226	5.01312	1.05382	0.98	0.0557	30
Yellow-poplar	Green	1.86103	1.36142	3.33413	1.23984	0.99	0.0592	62
	Dry	0.74862	1.40085	1.36501	1.27560	0.99	0.0585	62
Hard Hardwoods	Green	2.36129	1.33180	3.11979	1.27371	0.97	0.0834	347
	Dry	1.51263	1.32307	2.34759	1.23142	0.97	0.0790	347
White ash	Green	2.87027	1.26533	4.70464	1.16229	0.98	0.0612	52
	Dry	2.07306	1.25505	3.41692	1.15086	0.98	0.0637	52
Sweet birch	Green	5.91898	1.14179	4.85269	1.18321	0.98	0.0507	21
	Dry	3.66009	1.13191	3.11384	1.16562	0.98	0.0510	21
Black locust	Green	5.20919	1.08668	0.95293	1.44088	0.95	0.0864	18
	Dry	3.59150	1.08426	0.77942	1.40281	0.95	0.0855	18
Hickory	Green	0.97960	1.53720	3.93165	1.24743	0.98	0.0660	54
	Dry	0.69361	1.52150	2.90230	1.22305	0.98	0.0708	54
Black oak	Green	1.45544	1.41790	3.38847	1.24169	0.98	0.0590	27
	Dry	0.85607	1.41438	2.64971	1.17879	0.98	0.0660	27
Chestnut oak	Green	1.02336	1.49892	4.11244	1.20889	0.98	0.0693	51
	Dry	0.62578	1.49459	2.57329	1.19976	0.98	0.0688	51
North. red oak	Green	3.94331	1.25731	4.95616	1.20964	0.99	0.0463	71
	Dry	2.36123	1.24202	2.86474	1.20171	0.99	0.0499	71
Scarlet oak	Green	1.80365	1.39869	3.70487	1.24859	0.99	0.0443	27
	Dry	1.10326	1.38254	2.36997	1.22310	0.99	0.0497	27
White oak	Green	2.42774	1.33511	2.07560	1.36779	0.99	0.0578	28
	Dry	1.48789	1.33079	1.45208	1.33587	0.99	0.0617	28
All Species	Green	2.44274	1.31733	3.02592	1.27269	0.97	0.0829	475
	Dry	1.39612	1.32195	1.90236	1.25744	0.95	0.1008	475

[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 8.--Regression equations for estimating green and dry weight of the total-stem wood and bark combined and wood alone for hardwood species in the Southern Appalachian Mountains, 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	3.22563	1.23876	2.88886	1.26175	0.97	0.0785	128
	Dry	1.40805	1.27033	1.34203	1.28034	0.97	0.0801	128
Basswood	Green	3.34246	1.22154	5.22567	1.12836	0.98	0.0485	18
	Dry	1.74995	1.19103	1.49368	1.22405	0.98	0.0575	18
Blackgum (upland)	Green	1.64629	1.34504	3.43542	1.19165	0.97	0.0727	18
	Dry	0.77244	1.36853	1.40359	1.24400	0.97	0.0790	18
Red maple	Green	4.94211	1.14841	6.87118	1.07970	0.97	0.0679	30
	Dry	2.41282	1.17937	3.56511	1.09796	0.97	0.0631	30
Yellow-poplar	Green	2.18263	1.34804	4.43647	1.20013	0.98	0.0596	62
	Dry	0.76237	1.41643	1.76476	1.24142	0.99	0.0599	62
Hard Hardwoods	Green	3.09026	1.27061	4.67860	1.18413	0.97	0.0776	347
	Dry	1.93666	1.26546	3.53278	1.14011	0.97	0.0730	347
White ash	Green	4.84664	1.13887	3.97350	1.18029	0.97	0.0682	52
	Dry	3.12185	1.14771	2.84169	1.16732	0.97	0.0704	52
Sweet birch	Green	5.76494	1.12244	4.79623	1.16080	0.98	0.0521	21
	Dry	3.34713	1.27356	3.06473	1.14574	0.98	0.0511	21
Black locust	Green	5.82355	1.05973	0.89294	1.45073	0.94	0.0904	18
	Dry	4.06014	1.05285	0.72201	1.41295	0.94	0.0945	18
Hickory	Green	1.73761	1.41142	5.78715	1.16054	0.98	0.0576	54
	Dry	1.17992	1.40117	4.27343	1.13282	0.98	0.0614	54
Black oak	Green	2.14218	1.34513	7.56363	1.08208	0.99	0.0529	27
	Dry	1.27041	1.34023	5.90002	1.02003	0.98	0.0585	27
Chestnut oak	Green	1.38351	1.45567	8.16034	1.08563	0.98	0.0653	51
	Dry	0.89495	1.44204	5.38410	1.06787	0.98	0.0625	51
North. red oak	Green	5.08849	1.19370	6.64281	1.13812	0.99	0.0452	71
	Dry	3.11987	1.17348	3.82608	1.13093	0.99	0.0467	71
Scarlet oak	Green	1.54710	1.42294	6.43469	1.12574	0.99	0.0471	27
	Dry	0.90818	1.41531	4.32971	1.08964	0.99	0.0507	27
White oak	Green	2.54174	1.32196	4.71951	1.19292	0.98	0.0646	28
	Dry	1.59285	1.31179	3.42725	1.15202	0.98	0.0682	28
All Species	Green	3.11290	1.26260	4.03992	1.20824	0.97	0.0790	475
	Dry	1.73051	1.27261	2.58728	1.18874	0.96	0.0895	475

Continued

Table 8.--Regression equations for estimating green and dry weight of the total-stem wood and bark combined and wood alone for hardwood species in the Southern Appalachian Mountains, 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] ($S_{Y \cdot X}$)	No. of trees sampled
				TOTAL-STEM WOOD				
Soft Hardwoods	Green	2.46606	1.26259	2.51860	1.25819	0.97	0.0793	128
	Dry	1.06273	1.29440	1.10764	1.28577	0.96	0.0894	128
Basswood	Green	2.30938	1.25892	3.31591	1.18348	0.98	0.0514	18
	Dry	1.12481	1.23786	0.90690	1.28276	0.98	0.0635	18
Blackgum (upland)	Green	1.24921	1.37279	3.29438	1.17059	0.97	0.0820	18
	Dry	0.55552	1.39637	1.18172	1.23898	0.95	0.0981	18
Red maple	Green	3.54641	1.19449	6.97484	1.05346	0.97	0.0659	30
	Dry	1.62534	1.23722	3.67497	1.06711	0.97	0.0619	30
Yellow-poplar	Green	1.80879	1.35110	3.57285	1.20916	0.98	0.0607	62
	Dry	0.66009	1.41104	1.43045	1.24978	0.99	0.0609	62
Hard Hardwoods	Green	2.28723	1.30180	3.88139	1.19153	0.97	0.0813	347
	Dry	1.46631	1.29169	3.05149	1.13887	0.97	0.0778	347
White ash	Green	3.25897	1.19382	3.63629	1.17098	0.97	0.0686	52
	Dry	2.37705	1.18055	2.58557	1.16301	0.97	0.0697	52
Sweet birch	Green	5.03040	1.12103	4.30529	1.15349	0.98	0.0588	21
	Dry	2.97489	1.11933	2.78946	1.13275	0.98	0.0587	21
Black locust	Green	4.83873	1.06808	0.70544	1.46959	0.94	0.0955	18
	Dry	3.41664	1.06056	0.60942	1.42002	0.94	0.0948	18
Hickory	Green	1.17748	1.46100	4.78689	1.16855	0.98	0.0648	54
	Dry	0.83461	1.44423	3.67039	1.13540	0.98	0.0684	54
Black oak	Green	1.41717	1.39770	6.43849	1.08208	0.98	0.0569	27
	Dry	0.83649	1.39137	5.50646	0.99842	0.98	0.0642	27
Chestnut oak	Green	1.02865	1.47458	5.78444	1.11449	0.98	0.0678	51
	Dry	0.63137	1.46903	3.73598	1.09831	0.98	0.0664	51
North. red oak	Green	3.95586	1.21777	5.61591	1.14470	0.99	0.0462	71
	Dry	2.40772	1.19591	3.27347	1.13186	0.99	0.0481	71
Scarlet oak	Green	1.06906	1.46877	5.10270	1.14286	0.99	0.0484	27
	Dry	0.63385	1.45552	3.45720	1.10180	0.99	0.0526	27
White oak	Green	2.22827	1.31979	3.83790	1.20642	0.98	0.0660	28
	Dry	1.38070	1.31206	2.87565	1.15907	0.98	0.0707	28
All Species	Green	2.32825	1.29142	3.38635	1.21330	0.97	0.0819	475
	Dry	1.30842	1.29844	2.20176	1.18992	0.95	0.0959	475

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

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

[2]Trees $\geq$ 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 the above-stump total-tree wood and bark combined and wood alone for hardwood species in the Southern Appalachian Mountains, 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	0.05802	1.28608	0.06153	1.27383	0.98	0.0663	128
	Wood	0.04501	1.29710	0.05131	1.26978	0.97	0.0734	128
Basswood	Wd&Bk	0.07357	1.23831	0.06447	1.26584	0.98	0.0569	18
	Wood	0.04976	1.27105	0.03994	1.31689	0.98	0.0554	18
Blackgum (upland)	Wd&Bk	0.04090	1.31863	0.06364	1.22644	0.99	0.0455	18
	Wood	0.02912	1.33350	0.04119	1.26120	0.99	0.0510	18
Red maple	Wd&Bk	0.06378	1.27295	0.15680	1.08537	0.98	0.0557	30
	Wood	0.04930	1.29431	0.14248	1.07299	0.98	0.0579	30
Yellow-poplar	Wd&Bk	0.04585	1.35223	0.07795	1.24157	0.99	0.0541	62
	Wood	0.03886	1.34410	0.06532	1.23584	0.99	0.0555	62
Hard Hardwoods	Wd&Bk	0.05537	1.29983	0.07301	1.24217	0.98	0.0655	347
	Wood	0.03915	1.32732	0.05585	1.25324	0.97	0.0753	347
White ash	Wd&Bk	0.08067	1.22543	0.09913	1.18248	0.98	0.0580	52
	Wood	0.05529	1.26044	0.07580	1.19466	0.98	0.0600	52
Sweet birch	Wd&Bk	0.11822	1.14568	0.15666	1.08698	0.99	0.0380	21
	Wood	0.09520	1.15088	0.13160	1.08336	0.99	0.0446	21
Black locust	Wd&Bk	0.10831	1.11241	0.03519	1.34682	0.96	0.0762	18
	Wood	0.07412	1.12961	0.02836	1.32995	0.96	0.0783	18
Hickory	Wd&Bk	0.02021	1.52367	0.06722	1.27307	0.98	0.0613	54
	Wood	0.01280	1.57260	0.05106	1.28412	0.98	0.0674	54
Black oak	Wd&Bk	0.04099	1.33969	0.05912	1.26330	0.99	0.0536	27
	Wood	0.02595	1.39254	0.05279	1.24450	0.99	0.0552	27
Chestnut oak	Wd&Bk	0.02622	1.45566	0.09785	1.18104	0.98	0.0611	51
	Wood	0.01764	1.47986	0.06883	1.19592	0.98	0.0619	51
North. red oak	Wd&Bk	0.08970	1.20851	0.08773	1.21314	0.99	0.0442	71
	Wood	0.07073	1.22312	0.07400	1.21369	0.99	0.0449	71
Scarlet oak	Wd&Bk	0.04951	1.31646	0.06803	1.25020	0.99	0.0453	27
	Wood	0.03011	1.37901	0.04966	1.27467	0.99	0.0432	27
White oak	Wd&Bk	0.04304	1.35273	0.04598	1.33897	0.99	0.0513	28
	Wood	0.03430	1.35552	0.03445	1.35460	0.99	0.0522	28
All Species	Wd&Bk	0.05612	1.29589	0.06974	1.25058	0.98	0.0656	475
	Wood	0.04091	1.31780	0.05462	1.25751	0.97	0.0746	475

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

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

[2]Trees $\geq$ 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 10.--Regression equations for estimating cubic-foot volume of the total-stem wood and bark combined and wood alone for hardwood species in the Southern Appalachian Mountains, 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				
Soft Hardwoods	Wd&Bk	0.05195	1.26995	0.04238	1.31240	0.96	0.0903	128
	Wood	0.03947	1.29199	0.03836	1.29797	0.96	0.0933	128
Basswood	Wd&Bk	0.06238	1.23003	0.06487	1.22188	0.99	0.0446	18
	Wood	0.04157	1.27449	0.04134	1.27562	0.99	0.0460	18
Blackgum (upland)	Wd&Bk	0.02124	1.40349	0.04354	1.25385	0.98	0.0628	18
	Wood	0.01380	1.44717	0.03267	1.26743	0.98	0.0660	18
Red maple	Wd&Bk	0.07559	1.17514	0.09946	1.11791	0.97	0.0663	30
	Wood	0.05485	1.21982	0.10109	1.09235	0.97	0.0666	30
Yellow-poplar	Wd&Bk	0.03888	1.36861	0.08087	1.21590	0.98	0.0597	62
	Wood	0.03438	1.35427	0.06773	1.21287	0.98	0.0597	62
Hard Hardwoods	Wd&Bk	0.05337	1.26301	0.09024	1.15347	0.98	0.0672	347
	Wood	0.03738	1.29966	0.06889	1.17215	0.97	0.0741	347
White ash	Wd&Bk	0.09402	1.14061	0.06737	1.21012	0.97	0.0750	52
	Wood	0.06326	1.18725	0.05445	1.21852	0.97	0.0758	52
Sweet birch	Wd&Bk	0.08453	1.14744	0.12361	1.06818	0.98	0.0474	21
	Wood	0.07232	1.15397	0.12089	1.04683	0.98	0.0520	21
Black locust	Wd&Bk	0.10288	1.08093	0.02191	1.40339	0.94	0.0948	18
	Wood	0.06691	1.11710	0.02106	1.35819	0.94	0.0913	18
Hickory	Wd&Bk	0.02510	1.42907	0.08166	1.18313	0.98	0.0598	54
	Wood	0.01480	1.50277	0.06279	1.20138	0.98	0.0667	54
Black oak	Wd&Bk	0.04054	1.31045	0.11881	1.08626	0.99	0.0509	27
	Wood	0.02568	1.36870	0.09878	1.08776	0.99	0.0529	27
Chestnut oak	Wd&Bk	0.02746	1.47145	0.19753	1.06004	0.98	0.0602	51
	Wood	0.01793	1.45245	0.09736	1.09965	0.98	0.0617	51
North. red oak	Wd&Bk	0.09105	1.15950	0.09673	1.14688	0.99	0.0451	71
	Wood	0.07170	1.17986	0.08156	1.15300	0.99	0.0456	71
Scarlet oak	Wd&Bk	0.02603	1.40341	0.08946	1.14595	0.99	0.0465	27
	Wood	0.01730	1.45519	0.06724	1.17208	0.99	0.0465	27
White oak	Wd&Bk	0.03821	1.33563	0.08641	1.16549	0.98	0.0602	28
	Wood	0.03097	1.34368	0.06420	1.19163	0.98	0.0607	28
All Species	Wd&Bk	0.05279	1.26592	0.07606	1.18976	0.97	0.0760	475
	Wood	0.03798	1.29756	0.06054	1.20033	0.97	0.0810	475

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

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

[2]Trees $\geq$ 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 the above-stump total-tree wood and bark combined and wood alone for hardwood species in the Southern Appalachian Mountains, 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-TREE WOOD AND BARK					
Soft Hardwoods	Green	0.31602	0.91874	0.20742	1.00653	0.91874	0.97	0.0707	128
	Dry	0.16021	0.91717	0.08941	1.03878	0.91717	0.96	0.0936	128
Basswood	Green	0.09136	1.05036	0.14541	0.95344	1.05036	0.98	0.0505	18
	Dry	0.05335	1.02167	0.04667	1.04954	1.02167	0.98	0.0603	18
Blackgum (upland)	Green	0.47487	0.88913	0.36480	0.94411	0.88913	0.98	0.0601	18
	Dry	0.20398	0.91126	0.14438	0.98332	0.91126	0.98	0.0621	18
Red maple	Green	0.16008	1.01323	0.34839	0.85107	1.01323	0.98	0.0544	30
	Dry	0.07954	1.02615	0.16035	0.87996	1.02615	0.98	0.0547	30
Yellow-poplar	Green	0.19596	0.96111	0.13363	1.04093	0.96111	0.99	0.0550	62
	Dry	0.05841	1.01185	0.04445	1.06881	1.01185	0.99	0.0506	62
Hard Hardwoods	Green	0.19669	0.98801	0.11131	1.10671	0.98801	0.98	0.0702	347
	Dry	0.12092	0.98756	0.08018	1.07324	0.98756	0.98	0.0625	347
White ash	Green	0.21956	0.96160	0.24471	0.93899	0.96160	0.97	0.0654	52
	Dry	0.15213	0.96987	0.19074	0.92271	0.96987	0.97	0.0673	52
Sweet birch	Green	0.44356	0.90980	0.20032	1.07555	0.90980	0.99	0.0358	21
	Dry	0.26925	0.90717	0.12181	1.07256	0.90717	0.99	0.0389	21
Black locust	Green	0.63183	0.82875	0.14351	1.13781	0.82875	0.97	0.0658	18
	Dry	0.41824	0.83091	0.11081	1.10786	0.83091	0.97	0.0703	18
Hickory	Green	0.06729	1.11301	0.09083	1.05044	1.11301	0.99	0.0493	54
	Dry	0.04484	1.10947	0.06609	1.02860	1.10947	0.99	0.0497	54
Black oak	Green	0.15621	1.00554	0.06290	1.19522	1.00554	0.99	0.0436	27
	Dry	0.09126	1.00484	0.04390	1.15741	1.00484	0.99	0.0500	27
Chestnut oak	Green	0.12392	1.03751	0.09386	1.09544	1.03751	0.98	0.0598	51
	Dry	0.08257	1.02692	0.06110	1.08969	1.02692	0.99	0.0591	51
North. red oak	Green	0.23662	0.97831	0.17965	1.03575	0.97831	0.99	0.0395	71
	Dry	0.14824	0.96680	0.10553	1.03766	0.96680	0.99	0.0439	71
Scarlet oak	Green	0.26569	0.97104	0.21019	1.01990	0.97104	0.99	0.0396	27
	Dry	0.15176	0.97144	0.13286	0.99918	0.97144	0.99	0.0419	27
White oak	Green	0.24482	0.96607	0.08487	1.18696	0.96607	0.99	0.0420	28
	Dry	0.14990	0.96325	0.05823	1.16040	0.96325	0.99	0.0437	28
All Species	Green	0.25451	0.95414	0.12346	1.10498	0.95414	0.97	0.0797	475
	Dry	0.15774	0.94683	0.07345	1.10620	0.94683	0.95	0.1017	475

Continued

Table 11.--Regression equations for estimating green and dry weight of the above-stump total-tree wood and bark combined and wood alone for hardwood species in the Southern Appalachian Mountains, 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
				TOTAL-TREE WOOD					
Soft Hardwoods	Green	0.23311	0.93122	0.15977	1.00999	0.93122	0.97	0.0763	128
	Dry	0.11091	0.93642	0.06709	1.04123	0.93642	0.96	0.0974	128
Basswood	Green	0.06023	1.06970	0.08407	1.00015	1.06970	0.98	0.0527	18
	Dry	0.03219	1.04781	0.02456	1.10418	1.04781	0.97	0.0669	18
Blackgum (upland)	Green	0.33390	0.90895	0.30966	0.92466	0.90895	0.98	0.0647	18
	Dry	0.13582	0.93072	0.10799	0.97855	0.93072	0.98	0.0773	18
Red maple	Green	0.11327	1.03393	0.30305	0.82873	1.03393	0.98	0.0529	30
	Dry	0.05210	1.05514	0.13766	0.85253	1.05514	0.98	0.0546	30
Yellow-poplar	Green	0.13651	0.97924	0.10017	1.04379	0.97924	0.99	0.0553	62
	Dry	0.04912	1.01161	0.03699	1.07073	1.01161	0.99	0.0508	62
Hard Hardwoods	Green	0.13063	1.01304	0.08669	1.09853	1.01304	0.98	0.0710	347
	Dry	0.08244	1.01028	0.06680	1.05416	1.01028	0.98	0.0636	347
White ash	Green	0.12941	1.00033	0.18612	0.92456	1.00033	0.98	0.0636	52
	Dry	0.09735	0.99043	0.13839	0.91706	0.99043	0.97	0.0671	52
Sweet birch	Green	0.32861	0.92113	0.15693	1.07523	0.92113	0.99	0.0358	21
	Dry	0.21468	0.90970	0.10348	1.06186	0.90970	0.99	0.0400	21
Black locust	Green	0.51442	0.83256	0.10250	1.16894	0.83256	0.96	0.0722	18
	Dry	0.36413	0.82824	0.08353	1.13523	0.82824	0.96	0.0727	18
Hickory	Green	0.04243	1.14287	0.07024	1.03779	1.14287	0.99	0.0506	54
	Dry	0.02982	1.13570	0.05406	1.01167	1.13570	0.99	0.0530	54
Black oak	Green	0.09092	1.04481	0.05014	1.16891	1.04481	0.99	0.0447	27
	Dry	0.99231	1.04328	0.99230	1.16891	1.04328	0.99	0.0530	27
Chestnut oak	Green	0.09113	1.04647	0.06928	1.10364	1.04647	0.99	0.0585	51
	Dry	0.05684	1.04198	0.04387	1.09602	1.04198	0.99	0.0594	51
North. red oak	Green	0.17312	0.99498	0.14480	1.03223	0.99498	0.99	0.0397	71
	Dry	0.10808	0.98245	0.08739	1.02675	0.98245	0.99	0.0443	71
Scarlet oak	Green	0.15089	1.01381	0.14609	1.02054	1.01381	0.99	0.0361	27
	Dry	0.09311	1.00441	0.09709	0.99569	1.00441	0.99	0.0404	27
White oak	Green	0.20358	0.96705	0.07117	1.18619	0.96705	0.99	0.0377	28
	Dry	0.12347	0.96604	0.05037	1.15300	0.96604	0.99	0.0411	28
All Species	Green	0.17494	0.97508	0.09590	1.10044	0.97508	0.97	0.0821	475
	Dry	0.10805	0.96858	0.05945	1.09315	0.96858	0.95	0.1042	475

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

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

[2]Trees $\geq$ 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 12.--Regression equations for estimating green and dry weight of the total-stem wood and bark combined and wood alone for hardwood species in the Southern Appalachian Mountains, 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	0.19934	0.94973	0.16133	0.99384	0.94973	0.99	0.0518	128
	Dry	0.09888	0.95125	0.06854	1.02768	0.95125	0.98	0.0705	128
Basswood	Green	0.08821	1.03198	0.16014	0.90765	1.03198	0.99	0.0442	18
	Dry	0.05129	1.00461	0.04977	1.01089	1.00461	0.98	0.0554	18
Blackgum (upland)	Green	0.15859	0.98515	0.22795	0.90950	0.98515	0.99	0.0402	18
	Dry	0.06880	1.00676	0.08988	0.95103	1.00676	0.99	0.0439	18
Red maple	Green	0.22441	0.94430	0.31468	0.87381	0.94430	0.98	0.0496	30
	Dry	0.10581	0.96411	0.14771	0.89455	0.96411	0.98	0.0479	30
Yellow-poplar	Green	0.15121	0.97890	0.13749	0.99873	0.97890	0.99	0.0478	62
	Dry	0.04546	1.03017	0.04582	1.02854	1.03017	0.99	0.0451	62
Hard Hardwoods	Green	0.17993	0.97590	0.15338	1.00919	0.97590	0.98	0.0595	347
	Dry	0.11152	0.97453	0.11745	0.96373	0.97453	0.98	0.0517	347
White ash	Green	0.23622	0.92708	0.22621	0.93611	0.92708	0.98	0.0522	52
	Dry	0.15030	0.93298	0.15789	0.92271	0.93298	0.98	0.0557	52
Sweet birch	Green	0.31103	0.91450	0.16546	1.04610	0.91450	0.99	0.0285	21
	Dry	0.18284	0.91559	0.10396	1.03331	0.91559	0.99	0.0301	21
Black locust	Green	0.57284	0.81908	0.10412	1.17462	0.81908	0.96	0.0735	18
	Dry	0.39304	0.81739	0.08647	1.13311	0.81739	0.96	0.0767	18
Hickory	Green	0.09583	1.05114	0.14380	0.96651	1.05114	0.99	0.0405	54
	Dry	0.06362	1.04848	0.10916	0.93591	1.04848	0.99	0.0408	54
Black oak	Green	0.14548	0.99793	0.13822	1.00861	0.99793	0.99	0.0314	27
	Dry	0.08687	0.99464	0.10937	0.94660	0.99464	0.99	0.0399	27
Chestnut oak	Green	0.12840	1.01954	0.15468	0.98071	1.01954	0.99	0.0513	51
	Dry	0.08603	1.00853	0.10592	0.96515	1.00853	0.99	0.0495	51
North. red oak	Green	0.24070	0.95415	0.23072	0.96299	0.95415	0.99	0.0310	71
	Dry	0.15595	0.93760	0.14071	0.95903	0.93760	0.99	0.0340	71
Scarlet oak	Green	0.11172	1.04344	0.24082	0.88329	1.04344	0.99	0.0217	27
	Dry	0.06479	1.04088	0.16509	0.84587	1.04088	0.99	0.0238	27
White oak	Green	0.20662	0.96388	0.16762	1.00750	0.96388	0.99	0.0406	28
	Dry	0.12930	0.95884	0.12498	0.96593	0.95884	0.99	0.0439	28
All Species	Green	0.19770	0.96086	0.14855	1.02045	0.96086	0.98	0.0630	475
	Dry	0.12095	0.95501	0.09243	1.01108	0.95501	0.96	0.0826	475

Continued

Table 12.--Regression equations for estimating green and dry weight of the total-stem wood and bark combined and wood alone for hardwood species in the Southern Appalachian Mountains, 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
				TOTAL-STEM WOOD					
Soft Hardwoods	Green	0.15261	0.96172	0.13246	0.99124	0.96172	0.98	0.0573	128
	Dry	0.06892	0.97261	0.05358	1.02508	0.97261	0.97	0.0786	128
Basswood	Green	0.05550	1.06156	0.09094	0.95858	1.06156	0.99	0.0490	18
	Dry	0.02942	1.04125	0.02627	1.06487	1.04125	0.98	0.0635	18
Blackgum (upland)	Green	0.10942	1.01097	0.20976	0.87527	1.01097	0.99	0.0474	18
	Dry	0.04376	1.03588	0.07323	0.92852	1.03588	0.98	0.0639	18
Red maple	Green	0.14686	0.97847	0.27906	0.84461	0.97847	0.98	0.0491	30
	Dry	0.06349	1.00702	0.12853	0.85996	1.00702	0.98	0.0494	30
Yellow-poplar	Green	0.12422	0.98142	0.10984	1.00707	0.98142	0.99	0.0489	62
	Dry	0.03932	1.02757	0.03764	1.03668	1.02757	0.99	0.0453	62
Hard Hardwoods	Green	0.12083	1.00298	0.11700	1.00970	1.00298	0.98	0.0613	347
	Dry	0.07607	0.99989	0.09454	0.95455	0.99989	0.98	0.0535	347
White ash	Green	0.14063	0.96902	0.17946	0.91817	0.96902	0.98	0.0532	52
	Dry	0.10748	0.95689	0.13168	0.91455	0.95689	0.98	0.0559	52
Sweet birch	Green	0.25981	0.91883	0.14974	1.03374	0.91883	0.99	0.0340	21
	Dry	0.15736	0.91519	0.09736	1.01531	0.91519	0.99	0.0363	21
Black locust	Green	0.44948	0.83007	0.08217	1.18440	0.83007	0.96	0.0768	18
	Dry	0.32742	0.82255	0.07165	1.13938	0.82255	0.96	0.0772	18
Hickory	Green	0.05624	1.09284	0.10452	0.96359	1.09284	0.99	0.0442	54
	Dry	0.03952	1.08526	0.08380	0.92852	1.08525	0.99	0.0450	54
Black oak	Green	0.08573	1.03812	0.10050	1.00496	1.03812	0.99	0.0344	27
	Dry	0.05028	1.03559	0.08744	0.92022	1.03559	0.99	0.0439	27
Chestnut oak	Green	0.09235	1.03304	0.10413	1.00801	1.03304	0.99	0.0538	51
	Dry	0.05798	1.02760	0.06828	0.99350	1.02760	0.99	0.0536	51
North. red oak	Green	0.17657	0.97299	0.18231	0.96632	0.97299	0.99	0.0321	71
	Dry	0.11374	0.95543	0.11302	0.95675	0.95543	0.99	0.0354	71
Scarlet oak	Green	0.07051	1.07773	0.17181	0.89202	1.07773	0.99	0.0205	27
	Dry	0.04141	1.07196	0.12017	0.84980	1.07196	0.99	0.0228	27
White oak	Green	0.17712	0.96533	0.13718	1.01862	0.96533	0.99	0.0393	28
	Dry	0.10869	0.96249	0.10490	0.96989	0.96249	0.99	0.0441	28
All Species	Green	0.13914	0.98254	0.11546	1.02144	0.98254	0.98	0.0660	475
	Dry	0.08352	0.97859	0.07357	1.00504	0.97859	0.96	0.0873	475

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

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

[2]Trees $\geq$ 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 the above-stump total-tree wood and bark combined and wood alone for hardwood species in the Southern Appalachian Mountains, 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	0.00377	0.96802	0.00304	1.01320	0.96802	0.99	0.0494	128
	Wood	0.00269	0.98343	0.00248	0.99998	0.98343	0.99	0.0518	128
Basswood	Wd&Bk	0.00182	1.04757	0.00189	1.04029	1.04757	0.98	0.0520	18
	Wood	0.00113	1.07381	0.00106	1.08723	1.07381	0.98	0.0513	18
Blackgum (upland)	Wd&Bk	0.00558	0.93016	0.00404	0.99741	0.93016	0.99	0.0507	18
	Wood	0.00364	0.94820	0.00259	1.01950	0.94820	0.99	0.0476	18
Red maple	Wd&Bk	0.00240	1.02973	0.00488	0.88130	1.02973	0.98	0.0482	30
	Wood	0.00171	1.05004	0.00423	0.86117	1.05004	0.99	0.0471	30
Yellow-poplar	Wd&Bk	0.00311	0.98332	0.00239	1.03846	0.98332	0.99	0.0391	62
	Wood	0.00267	0.97804	0.00204	1.03346	0.97804	0.99	0.0405	62
Hard Hardwoods	Wd&Bk	0.00351	0.98106	0.00221	1.07756	0.98106	0.98	0.0556	347
	Wood	0.00216	1.01097	0.00157	1.07753	1.01097	0.98	0.0606	347
White ash	Wd&Bk	0.00389	0.97227	0.00437	0.94831	0.97227	0.98	0.0578	52
	Wood	0.00240	1.00222	0.00306	0.95133	1.00222	0.98	0.0581	52
Sweet birch	Wd&Bk	0.00754	0.90703	0.00495	0.99501	0.90703	0.99	0.0378	21
	Wood	0.00547	0.92188	0.00412	0.98078	0.92188	0.99	0.0344	21
Black locust	Wd&Bk	0.01034	0.84979	0.00356	1.07222	0.84979	0.97	0.0606	18
	Wood	0.00665	0.86588	0.00280	1.04662	0.86588	0.97	0.0604	18
Hickory	Wd&Bk	0.00102	1.11877	0.00124	1.07735	1.11877	0.99	0.0579	54
	Wood	0.00056	1.16061	0.00083	1.07704	1.16061	0.99	0.0593	54
Black oak	Wd&Bk	0.00318	0.97999	0.00111	1.19925	0.97999	0.99	0.0455	27
	Wood	0.00179	1.02067	0.00085	1.17661	1.02067	0.99	0.0451	27
Chestnut oak	Wd&Bk	0.00266	1.00944	0.00185	1.08446	1.00944	0.99	0.0562	51
	Wood	0.00168	1.02897	0.00122	1.09546	1.02897	0.99	0.0542	51
North. red oak	Wd&Bk	0.00448	0.95561	0.00294	1.04314	0.95561	0.99	0.0384	71
	Wood	0.00336	0.96872	0.00238	1.04053	0.96872	0.99	0.0379	71
Scarlet oak	Wd&Bk	0.00494	0.95073	0.00324	1.03857	0.95073	0.99	0.0418	27
	Wood	0.00264	0.99805	0.00205	1.05112	0.99805	0.99	0.0368	27
White oak	Wd&Bk	0.00371	0.97305	0.00150	1.16096	0.97305	0.99	0.0366	28
	Wood	0.00284	0.97894	0.00112	1.17278	0.97894	0.99	0.0321	28
All Species	Wd&Bk	0.00375	0.97203	0.00234	1.07007	0.97203	0.98	0.0557	475
	Wood	0.00242	0.99723	0.00174	1.06639	0.99723	0.98	0.0599	475

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

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

[2]Trees $\geq$ 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 the total-stem wood and bark combined and wood alone for hardwood species in the Southern Appalachian Mountains, 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 STEM					
Soft Hardwoods	Wd&Bk	0.00232	1.00250	0.00224	1.00966	1.00250	0.99	0.0403	128
	Wood	0.00166	1.02072	0.00193	0.98916	1.02072	0.99	0.0432	128
Basswood	Wd&Bk	0.00160	1.03943	0.00194	0.99928	1.03943	0.99	0.0395	18
	Wood	0.00094	1.07630	0.00109	1.04587	1.07630	0.99	0.0415	18
Blackgum (upland)	Wd&Bk	0.00201	1.01801	0.00250	0.97272	1.01801	0.99	0.0342	18
	Wood	0.00116	1.05448	0.00174	0.97115	1.05448	0.99	0.0283	18
Red maple	Wd&Bk	0.00313	0.96860	0.00427	0.90395	0.96860	0.99	0.0437	30
	Wood	0.00205	1.00321	0.00382	0.87340	1.00321	0.99	0.0446	30
Yellow-poplar	Wd&Bk	0.00235	1.00446	0.00237	1.00309	1.00446	0.99	0.0359	62
	Wood	0.00215	0.99360	0.00206	1.00256	0.99360	0.99	0.0369	62
Hard Hardwoods	Wd&Bk	0.00320	0.96878	0.00302	0.98064	0.96878	0.99	0.0465	347
	Wood	0.00196	1.00246	0.00209	0.98968	1.00246	0.99	0.0505	347
White ash	Wd&Bk	0.00432	0.93473	0.00386	0.95852	0.93473	0.98	0.0563	52
	Wood	0.00262	0.97061	0.00276	0.95927	0.97061	0.98	0.0574	52
Sweet birch	Wd&Bk	0.00446	0.93001	0.00394	0.95556	0.93001	0.99	0.0250	21
	Wood	0.00362	0.93932	0.00379	0.92974	0.93932	0.99	0.0276	21
Black locust	Wd&Bk	0.00935	0.83921	0.00248	1.11605	0.83921	0.96	0.0760	18
	Wood	0.00559	0.86772	0.00222	1.06058	0.86772	0.97	0.0697	18
Hickory	Wd&Bk	0.00144	1.05555	0.00193	0.99419	1.05555	0.99	0.0515	54
	Wood	0.00071	1.11439	0.00123	0.99890	1.11439	0.99	0.0548	54
Black oak	Wd&Bk	0.00311	0.96620	0.00242	1.01863	0.96620	0.99	0.0360	27
	Wood	0.00174	1.01004	0.00169	1.01653	1.01004	0.99	0.0362	27
Chestnut oak	Wd&Bk	0.00282	0.98847	0.00321	0.96142	0.98847	0.99	0.0501	51
	Wood	0.00173	1.01362	0.00186	0.99799	1.01362	0.99	0.0507	51
North. red oak	Wd&Bk	0.00463	0.92849	0.00370	0.97558	0.92849	0.99	0.0302	71
	Wood	0.00348	0.94423	0.00294	0.97909	0.94423	0.99	0.0308	71
Scarlet oak	Wd&Bk	0.00197	1.02777	0.00350	0.90801	1.02777	0.99	0.0241	27
	Wood	0.00119	1.06556	0.00233	0.92547	1.06556	0.99	0.0218	27
White oak	Wd&Bk	0.00307	0.97217	0.00296	0.97964	0.97217	0.99	0.0349	28
	Wood	0.00242	0.97936	0.00216	1.00348	0.97936	0.99	0.0335	28
All Species	Wd&Bk	0.00286	0.98063	0.00278	0.98659	0.98063	0.99	0.0453	475
	Wood	0.00186	1.00839	0.00204	0.98927	1.00839	0.99	0.0486	475

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

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

[2]Trees $\geq$ 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 15.--Regression equations for estimating green and dry weight of the above-stump total-tree wood and bark combined and wood alone for hardwood species in the Southern Appalachian Mountains, with d.b.h. and height to a 4-inch top 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-TREE WOOD AND BARK					
Soft Hardwoods	Green	3.87800	0.66860	0.72890	1.01714	0.66860	0.98	0.0666	128
	Dry	1.95868	0.66739	0.31347	1.04946	0.66739	0.96	0.0907	128
Basswood	Green	2.04305	0.73478	0.58172	0.99672	0.73478	0.98	0.0540	18
	Dry	1.06650	0.71797	0.18270	1.08586	0.71797	0.98	0.0597	18
Blackgum (upland)	Green	4.23896	0.67201	1.37469	0.90682	0.67201	0.98	0.0638	18
	Dry	1.94174	0.68751	0.55848	0.94735	0.68751	0.98	0.0673	18
Red maple	Green	2.79645	0.72718	1.33332	0.88163	0.72718	0.98	0.0540	30
	Dry	1.48526	0.73274	0.61053	0.91811	0.73274	0.98	0.0593	30
Yellow-poplar	Green	3.11197	0.68358	0.49999	1.06483	0.68358	0.99	0.0506	62
	Dry	1.08338	0.71857	0.17801	1.09515	0.71857	0.99	0.0468	62
Hard Hardwoods	Green	2.39226	0.73786	0.37669	1.12332	0.73786	0.97	0.0779	347
	Dry	1.43617	0.74025	0.27244	1.08687	0.74025	0.98	0.0690	347
White ash	Green	2.50718	0.71370	0.57204	1.02182	0.71370	0.96	0.0809	52
	Dry	1.58972	0.71973	0.40270	1.00605	0.71973	0.96	0.0825	52
Sweet birch	Green	4.04501	0.69652	0.78224	1.03912	0.69652	0.99	0.0337	21
	Dry	2.40566	0.69623	0.47615	1.03399	0.69623	0.99	0.0347	21
Black locust	Green	1.94396	0.73625	0.52809	1.00799	0.73625	0.98	0.0557	18
	Dry	1.31417	0.73594	0.40396	0.98192	0.73594	0.97	0.0627	18
Hickory	Green	1.63821	0.78657	0.37653	1.09317	0.78657	0.98	0.0646	54
	Dry	1.06957	0.78530	0.27338	1.06975	0.78530	0.98	0.0635	54
Black oak	Green	1.53755	0.78627	0.29164	1.13291	0.78627	0.99	0.0415	27
	Dry	0.86880	0.78956	0.20407	1.09162	0.78956	0.99	0.0443	27
Chestnut oak	Green	1.36133	0.79879	0.33655	1.09018	0.79879	0.98	0.0608	51
	Dry	0.88762	0.79030	0.21614	1.08485	0.79030	0.98	0.0604	51
North. red oak	Green	2.01988	0.77154	0.61891	1.01818	0.77154	0.99	0.0438	71
	Dry	1.23446	0.76241	0.35828	1.02036	0.76241	0.99	0.0478	71
Scarlet oak	Green	4.10752	0.69123	0.70194	1.05962	0.69123	0.99	0.0431	27
	Dry	2.35170	0.69136	0.44376	1.03909	0.69136	0.99	0.0454	27
White oak	Green	3.58815	0.69390	0.27149	1.23218	0.69390	0.99	0.0502	28
	Dry	2.18335	0.69168	0.18557	1.20572	0.69168	0.99	0.0519	28
All Species	Green	2.95488	0.70930	0.42263	1.11480	0.70930	0.97	0.0818	475
	Dry	1.69369	0.71102	0.25268	1.10773	0.71102	0.95	0.0995	475

Continued

Table 15.--Regression equations for estimating green and dry weight of the above-stump total-tree wood and bark combined and wood alone for hardwood species in the Southern Appalachian Mountains, 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
				TOTAL-TREE WOOD					
Soft Hardwoods	Green	2.96375	0.67752	0.57084	1.02096	0.67752	0.97	0.0726	128
	Dry	1.45160	0.67951	0.24020	1.05463	0.67951	0.96	0.0957	128
Basswood	Green	1.39838	0.75067	0.34907	1.04005	0.75067	0.98	0.0533	18
	Dry	0.67563	0.73970	0.10124	1.13550	0.73970	0.98	0.0629	18
Blackgum (upland)	Green	3.23948	0.68264	1.17299	0.89447	0.68264	0.97	0.0727	18
	Dry	1.41496	0.69690	0.41741	0.95146	0.69690	0.96	0.0862	18
Red maple	Green	2.09711	0.74209	1.19238	0.85982	0.74209	0.98	0.0524	30
	Dry	1.04762	0.75450	0.54780	0.88970	0.75450	0.98	0.0580	30
Yellow-poplar	Green	2.27879	0.69674	0.38437	1.06786	0.69674	0.99	0.0504	62
	Dry	0.91051	0.71839	0.14811	1.09707	0.71839	0.99	0.0470	62
Hard Hardwoods	Green	1.70092	0.75597	0.30230	1.11618	0.75597	0.97	0.0794	347
	Dry	1.04156	0.75671	0.23324	1.06873	0.75671	0.97	0.0707	347
White ash	Green	1.61925	0.74327	0.45156	1.00955	0.74327	0.96	0.0800	52
	Dry	1.19503	0.73519	0.33202	1.00224	0.73519	0.96	0.0831	52
Sweet birch	Green	3.14751	0.70253	0.61852	1.04179	0.70253	0.99	0.0374	21
	Dry	1.96765	0.69578	0.40326	1.02628	0.69578	0.99	0.0390	21
Black locust	Green	1.60581	0.73849	0.37694	1.04069	0.73849	0.97	0.0639	18
	Dry	1.13645	0.73395	0.30391	1.00897	0.73395	0.97	0.0651	18
Hickory	Green	1.12061	0.80821	0.30283	1.08104	0.80821	0.98	0.0657	54
	Dry	0.77109	0.80320	0.23097	1.05457	0.80320	0.98	0.0674	54
Black oak	Green	0.99751	0.81466	0.24632	1.10630	0.81466	0.99	0.0451	27
	Dry	0.56446	0.81742	0.19472	1.03934	0.81742	0.99	0.0496	27
Chestnut oak	Green	1.01223	0.80684	0.25162	1.09709	0.80684	0.99	0.0582	51
	Dry	0.62573	0.80321	0.15840	1.08967	0.80321	0.99	0.0593	51
North. red oak	Green	1.53212	0.78474	0.50950	1.01431	0.78474	0.99	0.0441	71
	Dry	0.93166	0.77473	0.30265	1.00918	0.77473	0.99	0.0483	71
Scarlet oak	Green	2.65815	0.72045	0.51314	1.06342	0.72045	0.99	0.0420	27
	Dry	1.60282	0.71334	0.33673	1.03867	0.71334	0.99	0.0462	27
White oak	Green	3.02013	0.69348	0.22740	1.23277	0.69348	0.99	0.0483	28
	Dry	1.83047	0.69249	0.16065	1.19983	0.69249	0.99	0.0514	28
All Species	Green	2.15321	0.72432	0.33690	1.11110	0.72432	0.97	0.0845	475
	Dry	1.23450	0.72643	0.21000	1.09577	0.72643	0.95	0.1024	475

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

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

[2]Trees $\geq$ 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 weight of the total-stem wood and bark combined and wood alone for hardwood species in the Southern Appalachian Mountains, with d.b.h. and height to a 4-inch top 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	2.70598	0.68917	0.58816	1.00742	0.68917	0.99	0.0485	128
	Dry	1.34721	0.69034	0.25043	1.04120	0.69034	0.98	0.0681	128
Basswood	Green	1.80352	0.72616	0.63852	0.94268	0.72616	0.99	0.0420	18
	Dry	0.94076	0.71033	0.19456	1.03894	0.71033	0.98	0.0496	18
Blackgum (upland)	Green	1.78861	0.74493	0.99337	0.86756	0.74493	0.99	0.0463	18
	Dry	0.83050	0.75941	0.40037	0.91156	0.75941	0.99	0.0526	18
Red maple	Green	3.08548	0.68327	1.13653	0.89152	0.68327	0.99	0.0406	30
	Dry	1.56821	0.69512	0.53992	0.91745	0.69512	0.99	0.0425	30
Yellow-poplar	Green	2.54447	0.69544	0.52654	1.02392	0.69544	0.99	0.0435	62
	Dry	0.89497	0.73079	0.18796	1.05619	0.73079	0.99	0.0418	62
Hard Hardwoods	Green	2.04725	0.73315	0.51514	1.02087	0.73315	0.98	0.0649	347
	Dry	1.23429	0.73505	0.39578	0.97221	0.73505	0.98	0.0552	347
White ash	Green	2.28808	0.69737	0.52864	1.00288	0.69737	0.98	0.0620	52
	Dry	1.47697	0.70182	0.37101	0.98989	0.70182	0.97	0.0651	52
Sweet birch	Green	3.03771	0.69307	0.63758	1.01860	0.69307	0.99	0.0367	21
	Dry	1.76762	0.69548	0.40309	1.00372	0.69548	0.99	0.0360	21
Black locust	Green	1.67174	0.73255	0.38808	1.03707	0.73255	0.97	0.0608	18
	Dry	1.16427	0.72894	0.31758	0.99982	0.72894	0.97	0.0663	18
Hickory	Green	1.88020	0.74741	0.55575	1.00155	0.74741	0.99	0.0513	54
	Dry	1.22829	0.74655	0.42129	0.96967	0.74655	0.99	0.0502	54
Black oak	Green	1.37979	0.78271	0.63488	0.94457	0.78271	0.99	0.0024	27
	Dry	0.78855	0.78452	0.50189	0.87873	0.78452	0.99	0.0281	27
Chestnut oak	Green	1.35011	0.78522	0.54270	0.97525	0.78522	0.99	0.0521	51
	Dry	0.88479	0.77634	0.36639	0.96018	0.77634	0.99	0.0508	51
North. red oak	Green	1.90954	0.75492	0.77247	0.94363	0.75492	0.99	0.0334	71
	Dry	1.19086	0.74208	0.46145	0.93977	0.74208	0.99	0.0359	71
Scarlet oak	Green	2.12715	0.74227	0.87900	0.92654	0.74227	1.00	0.0294	27
	Dry	1.22755	0.74017	0.60029	0.88933	0.74017	1.00	0.0315	27
White oak	Green	2.97960	0.69355	0.53612	1.05120	0.69355	0.99	0.0473	28
	Dry	1.84123	0.68976	0.39718	1.00958	0.68976	0.99	0.0504	28
All Species	Green	2.29643	0.71631	0.51504	1.02802	0.71631	0.98	0.0639	475
	Dry	1.30544	0.71901	0.32256	1.01051	0.71901	0.97	0.0784	475

Continued

Table 16.--Regression equations for estimating green and dry weight of the total-stem wood and bark combined and wood alone for hardwood species in the Southern Appalachian Mountains, 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
				TOTAL-STEM WOOD					
Soft Hardwoods	Green	2.14792	0.69749	0.49031	1.00551	0.69749	0.99	0.0548	128
	Dry	1.00818	0.70434	0.20072	1.04089	0.70434	0.97	0.0776	128
Basswood	Green	1.22165	0.74849	0.38011	0.99193	0.74849	0.99	0.0447	18
	Dry	0.58750	0.73878	0.10930	1.08944	0.73878	0.98	0.0552	18
Blackgum (upland)	Green	1.36219	0.76003	0.92697	0.84029	0.76003	0.98	0.0591	18
	Dry	0.59238	0.77606	0.33071	0.89760	0.77606	0.98	0.0763	18
Red maple	Green	2.22053	0.70795	1.05548	0.86304	0.70795	0.99	0.0393	30
	Dry	1.05063	0.72725	0.50125	0.88156	0.72725	0.99	0.0415	30
Yellow-poplar	Green	2.10187	0.69743	0.42224	1.03211	0.69743	0.99	0.0444	62
	Dry	0.76818	0.72896	0.15386	1.06425	0.72896	0.99	0.0420	62
Hard Hardwoods	Green	1.48446	0.75239	0.40565	1.02290	0.75239	0.98	0.0677	347
	Dry	0.90326	0.75324	0.32831	0.96427	0.75324	0.98	0.0579	347
White ash	Green	1.52026	0.72808	0.43468	0.98915	0.72808	0.97	0.0644	52
	Dry	1.12946	0.71879	0.31524	0.98489	0.71879	0.97	0.0666	52
Sweet birch	Green	2.56733	0.69624	0.58049	1.00625	0.69624	0.99	0.0414	21
	Dry	1.51926	0.69522	0.37731	0.98567	0.69522	0.99	0.0412	21
Black locust	Green	1.34884	0.74071	0.30875	1.04816	0.74071	0.97	0.0658	18
	Dry	0.97729	0.73344	0.26517	1.00544	0.73344	0.97	0.0668	18
Hickory	Green	1.24698	0.77656	0.42581	1.00061	0.77656	0.99	0.0556	54
	Dry	0.85661	0.77131	0.33818	0.96511	0.77131	0.99	0.0559	54
Black oak	Green	0.90801	0.81183	0.48979	0.94055	0.81183	0.99	0.0314	27
	Dry	0.51024	0.81433	0.42621	0.85185	0.81433	0.99	0.0360	27
Chestnut oak	Green	0.99043	0.79698	0.37229	1.00101	0.79698	0.99	0.5276	51
	Dry	0.61484	0.79264	0.24243	0.98669	0.79264	0.99	0.0528	51
North. red oak	Green	1.45796	0.76993	0.62520	0.94648	0.76993	0.99	0.0345	71
	Dry	0.90260	0.75622	0.37912	0.93710	0.75622	0.99	0.0372	71
Scarlet oak	Green	1.49501	0.76534	0.65249	0.93822	0.76534	1.00	0.0317	27
	Dry	0.86961	0.76041	0.45232	0.89671	0.76041	0.99	0.0348	27
White oak	Green	2.58959	0.69342	0.43846	1.06374	0.69342	0.99	0.0479	28
	Dry	1.58227	0.69095	0.33384	1.01539	0.69095	0.99	0.0524	28
All Species	Green	1.72268	0.73146	0.41085	1.03035	0.73146	0.98	0.0678	475
	Dry	0.96364	0.73579	0.26426	1.00556	0.73579	0.96	0.0838	475

[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 17.--Regression equations for estimating cubic-foot volume of the above-stump total-tree wood and bark combined and wood alone for hardwood species in the Southern Appalachian Mountains, 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 TREE					
Soft Hardwoods	Wd&Bk	0.05474	0.70054	0.01130	1.02957	0.70054	0.99	0.0485	128
	Wood	0.04134	0.70969	0.00937	1.01925	0.70969	0.99	0.0535	128
Basswood	Wd&Bk	0.04080	0.73184	0.00749	1.08520	0.73184	0.98	0.0565	18
	Wood	0.02709	0.75153	0.00439	1.13087	0.75153	0.98	0.0545	18
Blackgum (upland)	Wd&Bk	0.05331	0.70720	0.01657	0.95079	0.70720	0.99	0.0497	18
	Wood	0.03752	0.71700	0.01067	0.97912	0.71700	0.99	0.0524	18
Red maple	Wd&Bk	0.04535	0.73493	0.01864	0.92030	0.73493	0.98	0.0538	30
	Wood	0.03424	0.74945	0.01656	0.90088	0.74945	0.98	0.0530	30
Yellow-poplar	Wd&Bk	0.05378	0.69692	0.00918	1.06554	0.69692	0.99	0.0367	62
	Wood	0.04522	0.69357	0.00780	1.05996	0.69357	0.99	0.0376	62
Hard Hardwoods	Wd&Bk	0.03974	0.73923	0.00750	1.08690	0.73923	0.98	0.0595	347
	Wood	0.02666	0.76032	0.00552	1.08874	0.76032	0.98	0.0656	347
White ash	Wd&Bk	0.04333	0.72793	0.01052	1.02317	0.72793	0.97	0.0704	52
	Wood	0.02863	0.75098	0.00760	1.02761	0.75098	0.97	0.0709	52
Sweet birch	Wd&Bk	0.06728	0.69628	0.01934	0.95624	0.69628	0.99	0.0333	21
	Wood	0.05171	0.70489	0.01635	0.94500	0.70489	0.99	0.0335	21
Black locust	Wd&Bk	0.03373	0.75125	0.01325	0.94608	0.75125	0.98	0.0525	18
	Wood	0.02223	0.76526	0.01066	0.91850	0.76526	0.99	0.0522	18
Hickory	Wd&Bk	0.02357	0.79863	0.00527	1.11100	0.79863	0.98	0.0637	54
	Wood	0.01416	0.83119	0.00374	1.10881	0.83119	0.99	0.0625	54
Black oak	Wd&Bk	0.02878	0.76935	0.00172	1.35720	0.76935	0.99	0.0403	27
	Wood	0.01803	0.79928	0.00402	1.11227	0.79928	0.99	0.0416	27
Chestnut oak	Wd&Bk	0.02749	0.77663	0.00642	1.07994	0.77663	0.98	0.0578	51
	Wood	0.01788	0.79366	0.00434	1.08868	0.79366	0.99	0.0834	51
North. red oak	Wd&Bk	0.03597	0.75490	0.00986	1.02482	0.75490	0.99	0.0415	71
	Wood	0.02777	0.76524	0.00811	1.02199	0.76524	0.99	0.0411	71
Scarlet oak	Wd&Bk	0.07180	0.67727	0.01056	1.07687	0.67727	0.99	0.0444	27
	Wood	0.04451	0.70926	0.00706	1.09332	0.70926	0.99	0.0424	27
White oak	Wd&Bk	0.05516	0.69940	0.00486	1.20595	0.69940	0.99	0.0453	28
	Wood	0.04323	0.70290	0.00364	1.21889	0.70290	0.99	0.0430	28
All Species	Wd&Bk	0.04521	0.72360	0.00823	1.07891	0.72360	0.98	0.0578	475
	Wood	0.03169	0.74013	0.00627	1.07802	0.74013	0.98	0.0639	475

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

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

[2]Trees $\geq$ 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 18.--Regression equations for estimating cubic-foot volume of the total-stem wood and bark combined and wood alone for hardwood species in the Southern Appalachian Mountains, 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	0.03746	0.72416	0.00871	1.02837	0.72416	0.99	0.0414	128
	Wood	0.02856	0.73561	0.00764	1.01048	0.73561	0.99	0.0470	128
Basswood	Wd&Bk	0.03371	0.73050	0.00778	1.03617	0.73050	0.99	0.0039	18
	Wood	0.02195	0.75703	0.00460	1.08296	0.75703	0.99	0.0395	18
Blackgum (upland)	Wd&Bk	0.02359	0.77495	0.01177	0.91997	0.77495	0.99	0.0300	18
	Wood	0.01543	0.79862	0.00846	0.92396	0.79862	0.99	0.0345	18
Red maple	Wd&Bk	0.04727	0.69759	0.01562	0.92844	0.69759	0.99	0.0390	30
	Wood	0.03392	0.72326	0.01472	0.89732	0.72326	0.99	0.0383	30
Yellow-poplar	Wd&Bk	0.04350	0.71115	0.00936	1.03155	0.71115	0.99	0.0346	62
	Wood	0.03834	0.70393	0.00802	1.03020	0.70393	0.99	0.0348	62
Hard Hardwoods	Wd&Bk	0.03369	0.73486	0.01017	0.98455	0.73486	0.99	0.0458	347
	Wood	0.02288	0.75831	0.00732	0.99601	0.75831	0.99	0.0520	347
White ash	Wd&Bk	0.04012	0.71050	0.00929	1.01546	0.71050	0.98	0.0593	52
	Wood	0.02669	0.73667	0.00686	1.01996	0.73667	0.98	0.0616	52
Sweet birch	Wd&Bk	0.04491	0.70572	0.01558	0.92643	0.70572	0.99	0.0331	21
	Wood	0.03732	0.71290	0.01520	0.90017	0.71290	0.99	0.0351	21
Black locust	Wd&Bk	0.02878	0.74727	0.00937	0.98133	0.74727	0.97	0.0658	18
	Wood	0.01809	0.77187	0.00872	0.92407	0.77187	0.98	0.0589	18
Hickory	Wd&Bk	0.02651	0.75977	0.00766	1.01864	0.75977	0.99	0.0499	54
	Wood	0.01507	0.80356	0.00526	1.02305	0.80356	0.99	0.0513	54
Black oak	Wd&Bk	0.02665	0.76146	0.01062	0.95328	0.76146	0.99	0.0243	27
	Wood	0.01672	0.79414	0.00794	0.94946	0.79414	0.99	0.0268	27
Chestnut oak	Wd&Bk	0.02773	0.76059	0.01082	0.95689	0.76059	0.99	0.0518	51
	Wood	0.01767	0.78232	0.00650	0.99076	0.78232	0.99	0.0492	51
North. red oak	Wd&Bk	0.03440	0.73586	0.01199	0.95561	0.73586	0.99	0.0311	71
	Wood	0.02670	0.74844	0.00974	0.95868	0.74844	0.99	0.0316	71
Scarlet oak	Wd&Bk	0.03592	0.73107	0.01253	0.95066	0.73107	0.99	0.0311	27
	Wood	0.02446	0.75654	0.00873	0.97133	0.75654	0.99	0.0327	27
White oak	Wd&Bk	0.04510	0.70008	0.00958	1.02305	0.70008	0.99	0.0418	28
	Wood	0.03659	0.70428	0.00703	1.04835	0.70428	0.99	0.0423	28
All Species	Wd&Bk	0.03463	0.73223	0.00992	0.99296	0.73223	0.99	0.0451	475
	Wood	0.02463	0.75060	0.00750	0.99852	0.75060	0.99	0.0512	475

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

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

[2]Trees $\geq$ 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 the above-stump total-tree wood and bark combined and wood alone for hardwood species in the Southern Appalachian Mountains, 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 AND BARK				
Soft Hardwoods	Green	4.05976	1.15137	0.11698	0.95	0.0556	64
	Dry	1.86603	1.19791	0.07544	0.94	0.0648	64
Yellow-poplar	Green	3.63549	1.15471	0.14090	0.96	0.0514	38
	Dry	1.31796	1.18011	0.18123	0.97	0.0518	38
Hard Hardwoods	Green	2.98611	1.20675	0.16314	0.90	0.0728	194
	Dry	2.50064	1.17013	0.12749	0.90	0.0708	194
White ash	Green	4.12121	1.24290	-0.04067	0.87	0.0738	22
	Dry	3.48126	1.21437	-0.06425	0.86	0.0762	22
Hickory	Green	4.34712	1.18669	0.11729	0.94	0.0540	33
	Dry	3.05128	1.15651	0.13495	0.93	0.0582	33
Black oak	Green	3.41609	1.23276	0.06840	0.97	0.0381	18
	Dry	2.73215	1.17562	0.06050	0.97	0.0386	18
Chestnut oak	Green	3.58371	1.05408	0.32267	0.93	0.0571	32
	Dry	2.48376	1.05737	0.28062	0.93	0.0575	32
North. red oak	Green	5.99037	1.10049	0.15495	0.96	0.0470	35
	Dry	3.46886	1.09854	0.15107	0.95	0.0525	35
Scarlet oak	Green	4.53057	1.21071	0.04946	0.96	0.0489	18
	Dry	2.91232	1.19164	0.04318	0.95	0.0538	18
White oak	Green	2.35939	1.28245	0.14044	0.97	0.0430	19
	Dry	1.32111	1.26763	0.17245	0.97	0.0458	19
All Species	Green	3.35825	1.22626	0.09181	0.90	0.0754	258
	Dry	2.35086	1.24448	0.01370	0.86	0.0924	258

Continued

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

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				
Soft Hardwoods	Green	3.24470	1.16033	0.11400	0.94	0.0593	64
	Dry	1.37310	1.20500	0.09655	0.92	0.0731	64
Yellow-poplar	Green	2.79150	1.16660	0.14325	0.96	0.0553	38
	Dry	0.99658	1.19403	0.18713	0.96	0.0558	38
Hard Hardwoods	Green	2.32731	1.20508	0.18321	0.90	0.0750	194
	Dry	2.12789	1.15769	0.13923	0.89	0.0751	194
White ash	Green	3.45613	1.24018	-0.03654	0.87	0.0732	22
	Dry	2.91578	1.22271	-0.06896	0.85	0.7690	22
Hickory	Green	3.26847	1.15941	0.18233	0.94	0.0572	33
	Dry	2.44480	1.13369	0.18065	0.92	0.0637	33
Black oak	Green	3.11513	1.20511	0.08186	0.97	0.0419	18
	Dry	3.37766	1.10757	0.04619	0.96	0.0435	18
Chestnut oak	Green	2.49920	1.05608	0.35718	0.93	0.0564	32
	Dry	1.72630	1.05331	0.32219	0.93	0.0590	32
North. red oak	Green	4.98757	1.09466	0.16954	0.96	0.0473	35
	Dry	2.97391	1.08462	0.16492	0.95	0.0519	35
Scarlet oak	Green	3.73344	1.21738	0.04638	0.96	0.0514	18
	Dry	2.60260	1.19230	0.02328	0.94	0.0580	18
White oak	Green	1.66906	1.29182	0.17117	0.97	0.0468	19
	Dry	0.93583	1.27017	0.21304	0.96	0.0507	19
All Species	Green	2.65966	1.22734	0.10322	0.90	0.0780	258
	Dry	1.90465	1.23786	0.02986	0.84	0.0969	258

[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 the saw-log merchantable stem wood and bark combined and wood alone for hardwood species in the Southern Appalachian Mountains, 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	0.55968	0.97608	0.76439	0.98	0.0394	64
	Dry	0.24291	1.03375	0.72406	0.97	0.0531	64
Yellow-poplar	Green	0.68901	1.06155	0.59776	0.98	0.0388	38
	Dry	0.23686	1.10009	0.63576	0.98	0.0399	38
Hard Hardwoods	Green	0.42639	1.04226	0.78699	0.96	0.0529	194
	Dry	0.38048	0.99659	0.74397	0.96	0.0468	194
White ash	Green	0.37684	1.09124	0.68547	0.97	0.0449	22
	Dry	0.31732	1.06878	0.65457	0.96	0.0494	22
Hickory	Green	0.58322	1.00433	0.76511	0.99	0.0303	33
	Dry	0.42405	0.96934	0.77888	0.98	0.0328	33
Black oak	Green	0.49216	1.04357	0.74573	0.99	0.0145	18
	Dry	0.46869	0.95839	0.72629	0.98	0.0228	18
Chestnut oak	Green	0.63082	0.95792	0.80829	0.98	0.0342	32
	Dry	0.45925	0.95093	0.94403	0.98	0.0344	32
North. red oak	Green	0.76656	0.99153	0.72285	0.98	0.0324	35
	Dry	0.43066	0.99038	0.71939	0.98	0.0374	35
Scarlet oak	Green	0.69724	0.96281	0.78401	0.99	0.0250	18
	Dry	0.45295	0.92838	0.78994	0.98	0.0286	18
White oak	Green	0.49208	1.08126	0.70438	0.93	0.0601	19
	Dry	0.27107	1.05723	0.74927	0.94	0.0562	19
All Species	Green	0.47048	1.06146	0.72104	0.95	0.0593	258
	Dry	0.33634	1.07137	0.64708	0.92	0.0762	258

Continued

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

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				
Soft Hardwoods	Green	0.50293	0.99146	0.73096	0.98	0.0450	64
	Dry	0.20254	1.04938	0.70802	0.96	0.0621	64
Yellow-poplar	Green	0.55389	1.08099	0.58465	0.98	0.0430	38
	Dry	0.18726	1.12510	0.61962	0.98	0.0453	38
Hard Hardwoods	Green	0.35194	1.04701	0.79339	0.96	0.0538	194
	Dry	0.33381	0.99188	0.74595	0.96	0.0493	194
White ash	Green	0.34623	1.08809	0.67732	0.96	0.0470	22
	Dry	0.28903	1.07233	0.64416	0.95	0.0511	22
Hickory	Green	0.46205	0.99169	0.80794	0.99	0.0312	33
	Dry	0.34990	0.95888	0.80950	0.98	0.0366	33
Black oak	Green	0.47034	1.02642	0.74214	0.99	0.0207	18
	Dry	0.57210	0.90650	0.70112	0.97	0.0273	18
Chestnut oak	Green	0.43231	0.97235	0.84074	0.98	0.0367	32
	Dry	0.30374	0.96258	0.80876	0.97	0.0391	32
North. red oak	Green	0.66689	0.99419	0.72204	0.98	0.0332	35
	Dry	0.37474	0.98637	0.72305	0.98	0.0377	35
Scarlet oak	Green	0.60720	0.97327	0.77023	0.99	0.0261	18
	Dry	0.41128	0.93365	0.76718	0.98	0.0304	18
White oak	Green	0.37821	1.08957	0.72864	0.93	0.0618	19
	Dry	0.20442	1.05844	0.78758	0.93	0.0587	19
All Species	Green	0.40454	1.06935	0.71126	0.95	0.0619	258
	Dry	0.29232	1.07303	0.64172	0.91	0.0803	258

[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 volume of the above-stump total-tree wood and bark combined and wood alone for hardwood species in the Southern Appalachian Mountains, with d.b.h. and saw-log merchantable height as the independent variables

Species or species group	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
			TOTAL TREE				
Soft Hardwoods	Wd&Bk	0.06348	1.15377	0.16627	0.96	0.0542	64
	Wood	0.05071	1.17519	0.14022	0.95	0.0593	64
Yellow-poplar	Wd&Bk	0.05911	1.09737	0.26467	0.98	0.0424	38
	Wood	0.04603	1.11422	0.25069	0.97	0.0466	38
Hard Hardwoods	Wd&Bk	0.06694	1.17704	0.12273	0.93	0.0574	194
	Wood	0.04642	1.19770	0.13386	0.92	0.0637	194
White ash	Wd&Bk	0.06137	1.22971	0.05813	0.91	0.0628	22
	Wood	0.04236	1.26906	0.04386	0.91	0.0630	22
Hickory	Wd&Bk	0.07906	1.21638	0.04475	0.95	0.0526	33
	Wood	0.05522	1.19934	0.10844	0.94	0.0539	33
Black oak	Wd&Bk	0.04500	1.24048	0.11235	0.98	0.0345	18
	Wood	0.04156	1.21387	0.11566	0.97	0.0379	18
Chestnut oak	Wd&Bk	0.07369	1.05046	0.26836	0.95	0.0496	32
	Wood	0.04431	1.05971	0.31747	0.95	0.0493	32
North. red oak	Wd&Bk	0.09386	1.09528	0.15845	0.96	0.0465	35
	Wood	0.07549	1.09058	0.17826	0.96	0.0469	35
Scarlet oak	Wd&Bk	0.06083	1.23182	0.05781	0.96	0.0475	18
	Wood	0.04770	1.24873	0.05083	0.96	0.0491	18
White oak	Wd&Bk	0.04580	1.26747	0.10850	0.97	0.0390	19
	Wood	0.03026	1.29052	0.13024	0.97	0.0414	19
All Species	Wd&Bk	0.06486	1.17578	0.13215	0.94	0.0565	258
	Wood	0.04764	1.19441	0.13107	0.93	0.0623	258

[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 22.--Regression equations for estimating cubic-foot volume of the saw-log merchantable-stem wood and bark combined and wood alone for hardwood species in the Southern Appalachian Mountains, with d.b.h. and saw-log merchantable height as the independent variables

Species or species group	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	0.00780	0.99177	0.82682	0.99	0.0330	64
	Wood	0.00701	1.02126	0.76649	0.99	0.0348	64
Yellow-poplar	Wd&Bk	0.01052	1.01910	0.72073	0.99	0.0283	38
	Wood	0.00841	1.04599	0.69141	0.99	0.0320	38
Hard Hardwoods	Wd&Bk	0.00967	1.01633	0.73612	0.98	0.0378	194
	Wood	0.00722	1.04258	0.73139	0.97	0.0408	194
White ash	Wd&Bk	0.00507	1.10571	0.77375	0.97	0.0407	22
	Wood	0.00393	1.13881	0.74777	0.97	0.0425	22
Hickory	Wd&Bk	0.01177	1.03084	0.66606	0.98	0.0348	33
	Wood	0.00910	1.02807	0.69683	0.98	0.0337	33
Black oak	Wd&Bk	0.00640	1.05525	0.78692	0.99	0.0189	18
	Wood	0.00616	1.03754	0.77832	0.99	0.0214	18
Chestnut oak	Wd&Bk	0.01297	0.95130	0.75417	0.97	0.0389	32
	Wood	0.00758	0.97846	0.79829	0.97	0.0375	32
North. red oak	Wd&Bk	0.01156	0.99620	0.71988	0.98	0.0331	35
	Wood	0.00983	1.00126	0.72005	0.98	0.0337	35
Scarlet oak	Wd&Bk	0.00922	0.98666	0.79196	0.99	0.0247	18
	Wood	0.00770	1.00493	0.77708	0.99	0.0265	18
White oak	Wd&Bk	0.00959	1.07178	0.66050	0.93	0.0578	19
	Wood	0.00723	1.09265	0.66626	0.93	0.0578	19
All Species	Wd&Bk	0.00876	1.01407	0.76589	0.98	0.0370	258
	Wood	0.00707	1.04112	0.73845	0.98	0.0394	258

[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 Southern Appalachian Mountains

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	-2.21340	3.69663	-4.00734	-2.32156	3.64529	-3.97653
Basswood	-1.29361	3.91860	-4.02401	-1.28273	3.87891	-3.97929
Blackgum (upland)	-1.67063	4.31740	-4.55837	-1.62090	4.27337	-4.51105
Red maple	-1.48733	4.07172	-4.15788	-1.43083	4.05497	-4.12303
Yellow-poplar	-3.13237	3.24562	-3.77925	-3.54839	3.17747	-3.76535
Hard Hardwoods	-2.16093	3.80095	-4.16788	-2.16635	3.76999	-4.13510
White ash	-0.85286	3.25306	-3.30904	-0.84279	3.28603	-3.33279
Sweet birch	-0.86248	4.24300	-4.12996	-0.81251	4.21844	-4.08482
Black locust	-1.43964	3.34777	-3.55779	-1.27900	3.33578	-3.49181
Hickory	-4.46031	3.84056	-4.44415	-4.48018	3.83474	-4.43554
Black oak	-4.21018	3.91449	-4.53686	-4.35164	3.85984	-4.49173
Chestnut oak	-2.33213	4.00430	-4.37862	-2.25664	4.00092	-4.35574
North. red oak	-1.78853	4.05625	-4.35269	-1.90345	3.95236	-4.27185
Scarlet oak	-2.56711	3.67652	-4.17429	-2.65117	3.58558	-4.09877
White oak	-12.89794	2.66329	-4.01784	-12.00001	2.64614	-3.96330
All Species	-2.18145	3.83824	-4.18924	-2.19443	3.79947	-4.15151
			WOOD ONLY			
Soft Hardwoods	-2.14922	3.76998	-4.07255	-2.24102	3.72688	-4.04629
Basswood	-1.09439	4.07301	-4.11466	-1.05926	4.01311	-4.04160
Blackgum (upland)	-1.45781	4.43140	-4.61952	-1.34282	4.39292	-4.56007
Red maple	-1.37214	4.19926	-4.25422	-1.33864	4.16262	-4.20601
Yellow-poplar	-3.16748	3.28202	-3.82586	-3.51229	3.24724	-3.83278
Hard Hardwoods	-2.00963	3.93252	-4.27051	-2.05785	3.87551	-4.22144
White ash	-0.79212	3.40027	-3.42870	-0.80589	3.38150	-3.41391
Sweet birch	-0.76917	4.34999	-4.19013	-0.72051	4.31785	-4.13646
Black locust	-1.42866	3.44696	-3.65524	-1.27952	3.42285	-3.58019
Hickory	-4.23466	3.96634	-4.54756	-4.36489	3.93623	-4.52542
Black oak	-3.74181	4.01847	-4.59825	-3.94567	3.93141	-4.53034
Chestnut oak	-2.23141	4.17046	-4.53052	-2.22131	4.14820	-4.50149
North. red oak	-1.64068	4.17440	-4.43072	-1.76424	4.05667	-4.34109
Scarlet oak	-2.34160	3.76911	-4.22934	-2.49944	3.64618	-4.13742
White oak	-13.82341	2.74531	-4.14893	-12.83857	2.72014	-4.08425
All Species	-2.03288	3.95927	-4.28299	-2.06850	3.90215	-4.23251

[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 Southern Appalachian Mountains

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	-2.65041	3.63613	-4.02198	-2.49527	3.75217	-4.11106
Basswood	-1.57495	3.83251	-4.01512	-1.44150	3.94456	-4.09578
Blackgum (upland)	-3.11888	4.50575	-4.98933	-3.00702	4.60007	-5.08323
Red maple	-1.64317	3.97988	-4.10493	-1.56405	4.07950	-4.18514
Yellow-poplar	-4.18242	3.20385	-3.86194	-3.93057	3.33593	-3.96294
Hard Hardwoods	-2.11609	3.69565	-4.06590	-2.01927	3.85912	-4.20784
White ash	-0.83488	3.28203	-3.33403	-0.81118	3.41128	-3.45707
Sweet birch	-0.54868	4.13144	-3.86409	-0.47153	4.25228	-3.92355
Black locust	-1.33357	3.33736	-3.51539	-1.72742	3.92136	-4.14425
Hickory	-4.10624	3.76795	-4.35556	-3.74791	3.90765	-4.45962
Black oak	-4.24857	3.92307	-4.55072	-3.86927	4.03853	-4.63239
Chestnut oak	-1.89796	3.77009	-4.07300	-1.81088	3.92867	-4.21943
North. red oak	-2.08619	3.93878	-4.30635	-1.97257	4.04188	-4.38210
Scarlet oak	-2.72820	3.63031	-4.15933	-2.77208	3.93948	-4.44871
White oak	-13.81307	2.63083	-4.00315	-14.82177	2.71406	-4.13623
All Species	-2.29927	3.76224	-4.14072	-2.18185	3.90966	-4.26572

[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 Southern Appalachian Mountains

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	20.03667	-1.15011	0.30738	22.65502	-1.17892	0.30687
Yellow-poplar	10.22822	-0.98536	0.36914	13.88862	-1.05701	0.35508
Hard Hardwoods	21.83094	-1.20030	0.34703	22.05487	-1.19924	0.35256
White ash	7.59795	-0.84256	0.34097	9.74167	-0.91132	0.33776
Hickory	5.62084	-0.78282	0.33669	6.31538	-0.81008	0.34761
Black oak	8.59159	-0.96498	0.34859	10.22071	-1.00848	0.36275
Chestnut oak	10.16324	-1.02615	0.34438	11.77550	-1.06016	0.35889
North. red oak	11.43588	-1.07021	0.33698	12.89204	-1.09324	0.35282
Scarlet oak	13.89580	-1.14183	0.33685	16.33739	-1.18006	0.35211
White oak	9.77724	-1.03753	0.24075	11.57127	-1.07768	0.24979
All Species	22.10956	-1.19842	0.33093	23.34055	-1.20928	0.33401
			WOOD ONLY			
Soft Hardwoods	19.97709	-1.15553	0.30428	22.66578	-1.18538	0.30423
Yellow-poplar	9.93078	-0.98459	0.36906	13.76196	-1.06203	0.35548
Hard Hardwoods	22.56773	-1.21533	0.34214	21.93139	-1.20369	0.34429
White ash	7.64692	-0.85097	0.33715	9.74286	-0.91666	0.33500
Black oak	8.45354	-0.96445	0.34659	8.46965	-0.96165	0.34694
Hickory	5.58002	-0.78519	0.33356	5.64166	-0.78507	0.33487
Chestnut oak	10.71803	-1.05121	0.33926	10.71403	-1.04734	0.34011
North. red oak	11.20075	-1.06846	0.33485	10.98689	-1.05719	0.33593
Scarlet oak	13.44225	-1.13557	0.33509	13.58787	-1.13547	0.33509
White oak	9.93996	-1.04879	0.24099	9.78499	-1.03963	0.24026
All Species	22.54655	-1.20977	0.32670	23.23192	-1.21400	0.32802

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

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 = base of natural log

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 Southern Appalachian Mountains

Species	Ratio equation and coefficients[1] $Y_R = e^{a(Mh)^b ((1-(\frac{d}{.78D})^2)^2)^c}$					
	Wood and bark			Wood only		
	a	b	c	a	b	c
Soft Hardwoods	17.02169	-1.10696	0.30429	16.72438	-1.10825	0.30068
Yellow-poplar	9.53972	-0.97107	0.36942	9.08017	-0.96511	0.36804
Hard Hardwoods	18.34030	-1.15240	0.34627	18.69832	-1.16454	0.34023
White ash	6.19949	-0.78674	0.33896	6.14057	-0.79208	0.33351
Hickory	4.46825	-0.72269	0.33443	4.25711	-0.71497	0.33028
Black oak	7.13860	-0.91520	0.34770	6.68841	-0.90165	0.34567
Chestnut oak	7.98372	-0.95562	0.34672	8.18125	-0.97506	0.34032
North. red oak	9.70538	-1.02782	0.33574	9.06390	-1.01358	0.33344
Scarlet oak	12.08963	-1.10806	0.33484	11.17720	-1.09039	0.33229
White oak	8.12968	-0.98631	0.23765	7.84004	-0.98376	0.23730
All Species	18.67262	-1.15229	0.32937	18.84524	-1.16148	0.32498

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

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 = base of natural log

*GPO-86-637/608

Clark, Alexander, III; Schroeder, James G.
Weight, volume, and physical properties of major hardwood species in the Southern Appalachian Mountains. Res. Pap. SE-253. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southeastern Forest Experiment Station; 1985. 63 pp.

The weight, volume, and physical properties of trees 1 to 20 inches d.b.h. were determined for basswood, blackgum (upland), red maple, yellow-poplar, white oak, sweet birch, black locust, hickory, black oak, chestnut oak, northern red oak, scarlet oak, and white oak in the Southern Appalachian Mountains. 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 by using d.b.h. and total height, d.b.h. and height to a 4-inch top, d.b.h. and saw-log merchantable height, and d.b.h. alone. 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.

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

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