

United States  
Department of  
Agriculture

Forest Service



Southeastern Forest  
Experiment Station

Research Paper  
SE-257

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

Alexander Clark III  
Douglas R. Phillips  
Douglas J. Frederick



November 1986

Southeastern Forest Experiment Station  
P. O. Box 2680  
Asheville, NC 28802

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

**Alexander Clark III, Wood Scientist  
Southeastern Forest Experiment Station  
Athens, Georgia**

**Douglas R. Phillips, Mensurationist  
Southeastern Forest Experiment Station  
Clemson, South Carolina**

and

**Douglas J. Frederick, Professor  
School of Forest Resources  
North Carolina State University  
Raleigh, North Carolina**

## Procedure

|                      |   |
|----------------------|---|
| Field . . . . .      | 2 |
| Laboratory . . . . . | 3 |
| Analysis . . . . .   | 4 |

## Results

|   |    |
|---|----|
| Physical Properties of Sample Trees . . . . . | 6  |
| Prediction Equations . . . . .                | 7  |
| How to Use Prediction Equations . . . . .     | 8  |
| Literature Cited . . . . .                    | 11 |

## Tables (for hardwood species in the Upland-South)

|  |    |
|--|----|
| 1. Mean and range of tree age and measurements, by species and tree size class . . . . .   | 12 |
| 2. Average specific gravity of wood, bark, and wood and bark combined, by tree component and size class . . . . .  | 14 |
| 3. Average moisture content of wood, bark, and wood and bark combined, by tree component and size class . . . . .  | 18 |
| 4. Average proportion of wood and bark green weight in bark, by tree component and size class . . . . .  | 22 |
| 5. Average green weight per cubic foot of wood, bark, and wood and bark combined, by tree component and size class . . . . .   | 23 |
| 6. Average green weight of wood and bark per cubic foot of wood, by tree component and size class . . . . .  | 27 |
| 7. Regression equations for estimating green and dry weight of above-stump total-tree wood, bark, and foliage, wood and bark combined, and wood alone, with d.b.h. as the independent variable . . . . . | 28 |
| 8. Regression equations for estimating green and dry weight of total-stem wood and bark combined and wood alone, with d.b.h. as the independent variable . . . . .                                       | 31 |
| 9. Regression equations for estimating cubic-foot volume of above-stump total-tree wood and bark combined and wood alone, with d.b.h. as the independent variable . . . . .                              | 33 |
| 10. Regression equations for estimating cubic-foot volume of total-stem wood and bark combined and wood alone, with d.b.h. as the independent variable . . . . .   | 34 |

|  |    |
|--|----|
| 11. Regression equations for estimating green and dry weight of above-stump total-tree wood, bark, and foliage, wood and bark combined, and wood alone, with d.b.h. and total height as independent variables . . . . .                | 35 |
| 12. Regression equations for estimating green and dry weight of total-stem wood and bark combined and wood alone, with d.b.h. and total height as independent variables . . . . .  | 38 |
| 13. Regression equations for estimating cubic-foot volume of above-stump total-tree wood and bark combined and wood alone, with d.b.h. and total height as independent variables . . . . .   | 40 |
| 14. Regression equations for estimating cubic-foot volume of total-stem wood and bark combined and wood alone, with d.b.h. and total height as independent variables . . . . .   | 41 |
| 15. Regression equations for estimating green and dry weight of above-stump total-tree wood, bark, and foliage, wood and bark combined, and wood alone, with d.b.h. and height to a 4-inch top as independent variables . . . . .      | 42 |
| 16. Regression equations for estimating green and dry weight of total-stem wood and bark combined and wood alone, with d.b.h. and height to 4-inch top as independent variables . . . . .  | 45 |
| 17. Regression equations for estimating cubic-foot volume of above-stump total-tree wood and bark combined and wood alone, with d.b.h. and height to 4-inch top as independent variables . . . . .                                     | 47 |
| 18. Regression equations for estimating cubic-foot volume of total-stem wood and bark combined and wood alone, with d.b.h. and height to 4-inch top as independent variables . . . . .   | 48 |
| 19. Regression equations for estimating green and dry weight of above-stump total-tree wood, bark, and foliage, wood and bark combined, and wood alone, with d.b.h. and saw-log merchantable height as independent variables . . . . . | 49 |
| 20. Regression equations for estimating green and dry weight of saw-log merchantable-stem wood and bark combined and wood alone, with d.b.h. and saw-log merchantable height as independent variables . . . . .                        | 50 |
| 21. Regression equations for estimating cubic-foot volume of above-stump total-tree wood and bark combined and wood alone, with d.b.h. and saw-log merchantable height as independent variables . . . . .                              | 51 |
| 22. Regression equations for estimating cubic-foot volume of saw-log merchantable-stem wood and bark combined and wood alone, with d.b.h. and saw-log merchantable height as independent variables . . . . .                           | 51 |

|  |    |
|--|----|
| 23. Regression coefficients for estimating above-stump stem weight to a specified d.o.b. top diameter as a proportion of total-stem weight . . . . . | 52 |
| 24. Regression coefficients for estimating above-stump stem volume to a specified d.o.b. top diameter as a proportion of total-stem volume . . . . . | 53 |
| 25. Regression coefficients for estimating stem weight to a specified d.o.b. top diameter as a proportion of saw-log stem weight . . . .             | 54 |
| 26. Regression coefficients for estimating stem volume to a specified d.o.b. top diameter as a proportion of saw-log stem volume . . . .             | 55 |

## ABSTRACT

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

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

---

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

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

For this study, the South was divided into three geographic regions--the Gulf and Atlantic Coastal Plains, the Piedmont Plateau, and the Upland-South. The data collected in the Gulf and Atlantic Coastal Plains and Piedmont have been reported in earlier publications (Clark and others 1983, 1985b, 1986; Frederick and others 1983; Gower and others 1983; Messina and others 1983, Megalos and others 1986).

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

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

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

## Procedure

### Field

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

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

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

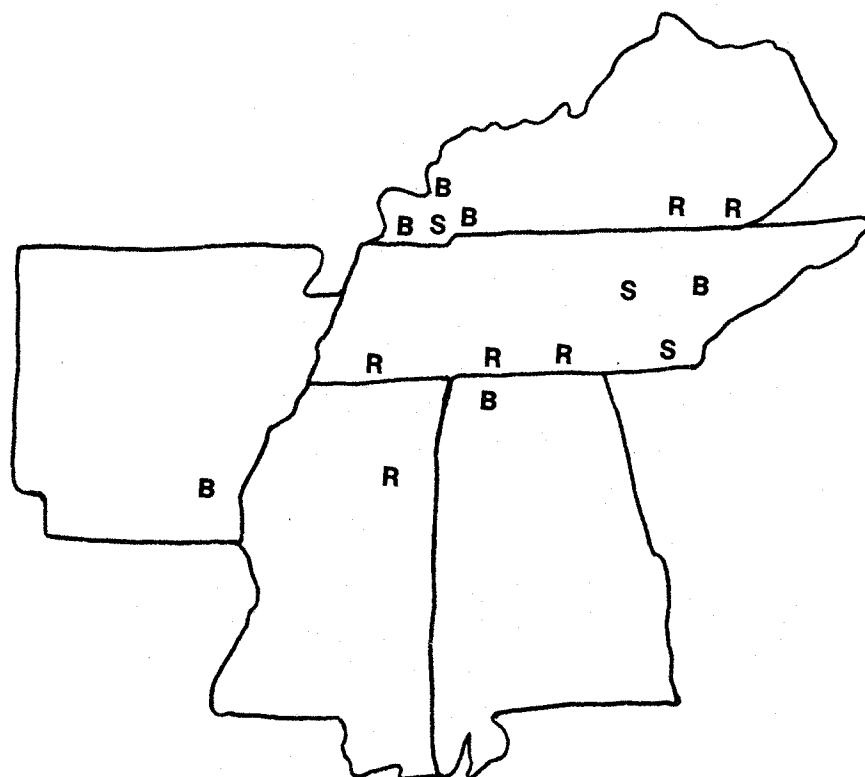


Figure 1.--Locations of plots where trees were sampled on bottom-land sites (B), ridge and upland sites (R), and supplemental (S) locations.

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

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

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

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

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

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

### Laboratory

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

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

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

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

A logarithmic transformation (base 10) was used to obtain relatively homogeneous variance, which is assumed in regression analysis. Two equations were developed for the d.b.h., d.b.h. and total height, and d.b.h. and height to 4-inch top--one for trees < 11.0 inches d.b.h. and one for trees > 11.0 inches d.b.h. The 11 inches was not the statistically optimum point to shift from one equation to the other for 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 > 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:

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

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

where:  $Y_p$  = predicted component weight or volume for trees

< 11.0 inches d.b.h.

$Y_s$  = predicted component weight or volume for trees

> 11.0 inches d.b.h.

X = D<sup>2</sup>, D<sup>2</sup>Th, or D<sup>2</sup>H4

H = Th or H4

D = d.b.h.

E = experimental error

a,b,c = regression coefficients

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

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

where: Y = predicted component weight or volume

$$X_1 = D^2$$

$$X_2 = Mh$$

E = experimental error

a,b,c = regression coefficients

When logarithmic estimates are converted back to original units, they are biased downward because the antilogarithm of an estimated mean is the geometric rather than 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:

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

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

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

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:  $a' = 10^a + (s_{y,x}^2 \log_e 10)/2$

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

$s_{y,x}^2$  = error mean square from regression analysis

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

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

$$Y_R = ea (db Dc) \quad (11)$$

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.

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

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

estimated saw-log stem weight or volume

Mh = saw-log merchantable height in feet

d = specified top diameter in inches

D = tree diameter at breast height in inches

.78 = constant based on average form class

a,b,c = regression coefficients

e = 2.71828 (base of natural log)

## Results

### 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 0.523 for saplings (1.0 to 4.9 inches d.b.h.), 0.466 for poletimber (5.0 to 10.9 inches d.b.h.), and 0.465 for sawtimber (> 11.0 inches d.b.h.). Averages for hard-hardwood species were 0.612 for saplings, 0.632 for poletimber, and 0.613 for sawtimber. Specific gravity of bark was generally lower than that of wood for both soft-hardwood and hard-hardwood species (table 2).

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

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

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

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

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

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

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

#### Prediction Equations

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

Since tree height is measured to different top limits by various 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 1.0 to 10.9 inches d.b.h., and equation (10) was used for trees > 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 > 11.0 inches d.b.h. when D and Mh were the independent variables. Equations based on D and Mh were developed only for

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

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

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

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

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

In addition to the regression coefficients, tables 7 through 22 contain the coefficients of determination ( $R^2$ ) and standard error ( $S_{y,x}$ ,  $\log_{10}$ ) 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 weights and volumes of saw-log merchantable stems are shown in tables 25 and 26.

#### How to Use Prediction Equations

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

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

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

$$\begin{aligned} Y_{STEMWB} &= a' (D^2 Th)^b \\ &= 0.25113 ((10^2) (70))^{0.91865} \\ &= 0.25113 (7000)^{0.91865} \\ &= 0.25113 (3,406.43) \\ Y_{STEMWB} &= 855 \text{ pounds} \end{aligned}$$

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

$$\begin{aligned} Y_{STEMWB} &= a'' (D^2)^b (Th)^c \\ &= 0.22629 (14^2)^{0.94037} (90)^{0.91865} \\ &= 0.22629 (196)^{0.94037} (90)^{0.91865} \\ &= 0.22629 (143.08) (62.41) \\ Y_{STEMWB} &= 2,021 \text{ pounds} \end{aligned}$$

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

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

$$\begin{aligned} Y_R &= ea (d)^b (D)^c \\ &= 2.71828 -1.66655 (4)^{4.50927} (10) -4.50649 \\ &= 2.71828 -1.66655 (518.62) (0.0000312) \\ &= 2.71828 -0.02693 \end{aligned}$$

$$Y_R = 0.973$$

$$\begin{aligned} \text{Stem weight to 4-inch top} &= (Y_{\text{STEMWB}}) (Y_R) \\ &= 855 (0.973) \end{aligned}$$

$$\text{Stem weight to 4-inch top} = 832 \text{ pounds}$$

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 the above equation.

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

$$Mh = 33.1 \text{ feet} = (2.0 \text{ logs}) (16.3 \text{ ft/log}) + (0.5 \text{ ft for stump})$$

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

$$\begin{aligned} Y_{\text{SAWWB}} &= a' (D^2)b (Mh)c \\ &= 0.67303 (14^2)^{0.84073} (33.1)^{0.90211} \\ &= 0.67303 (84.56) (23.50) \end{aligned}$$

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

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

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

$$\begin{aligned} Y_R &= ea \left[ (Mh)^b ((1 - (\frac{d}{.78D})^2)^2)^c \right] \\ &= 2.718288 \cdot 47209 \left[ (33.1)^{-0.87551} ((1 - (\frac{4}{.78(14)})^2)^2)^{0.38432} \right] \\ &= 2.718288 \cdot 47209 (0.04671) (0.89517) \\ &= 2.718280 \cdot 35425 \\ Y_R &= 1.425 \end{aligned}$$

$$\begin{aligned} \text{Stem weight to 4-inch top} &= (Y_{\text{SAWWB}}) (Y_R) \\ &= 1,337 (1.425) \end{aligned}$$

$$\text{Stem weight to 4-inch top} = 1,905 \text{ pounds}$$

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.

## Literature Cited

- Baskerville, G.L. Use of logarithmic regression in the estimation of plant biomass. Canadian Journal of Forest Research 2:49-53; 1972.
- Clark, Alexander, III; Muse, H. David; Phillips, Douglas R.; Frederick, Douglas J. Use of segmented log-log equations to estimate tree biomass. In: Saucier, Joseph R., ed. Proceedings of the 1984 southern forest biomass workshop. Sixth annual meeting of the Southern Forest Biomass Working Group; 1984 June 5-7; Athens, GA. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southeastern Forest Experiment Station; 1985a: 51-57.
- Clark, Alexander, III; Phillips, Douglas R.; Frederick, Douglas J. Biomass distribution and production of Coastal Plain hardwood stands. In: Energy from biomass and wastes 7: proceedings of Institute of Gas Technology symposium; 1983 January 24-28; Lake Buena Vista, FL; 1983: 101-115. [Available from Institute of Gas Technology, Chicago, IL]
- Clark, Alexander, III; Phillips, Douglas R.; Frederick, Douglas J. Weight, volume, and physical properties of major hardwood species in the Gulf and Atlantic Coastal Plains. Res. Pap. SE-250. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southeastern Forest Experiment Station; 1985b. 66 pp.
- Clark, Alexander, III; Phillips, Douglas R.; Frederick, Douglas J. Weight, volume, and physical properties of major hardwood species in the Piedmont. Res. Pap. SE-255. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southeastern Forest Experiment Station; 1986. 78 pp.
- Cunia, T. Weighted least squares method and construction of volume tables. Forest Science 10:180-191; 1964.
- Draper, N.R.; Smith, H. Applied regression analyses. 2d ed. New York: John Wiley & Sons, Inc.; 1981. 709 pp.
- Frederick, Douglas J.; Clark, Alexander, III; Phillips, Douglas R. Biomass, nutrient and energy relationships of Coastal Plain hardwoods. In: The hardwood resource and its utilization: where are we going?: 11th annual hardwood symposium of the Hardwood Research Council; 1983 May 10-13; High Hampton, NC; 1983:139-147. [Available from U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station, New Orleans, LA]
- Gower, S.T.; Frederick, D.J.; Clark, A., III. Caloric content estimation and distribution in seven bottomland hardwood tree species growing in natural stands in the South. In: Proceedings: fourth central hardwood forest conference; 1982 November 8-10; Lexington, KY: University of Kentucky; 1983: 384-390.
- Megalos, M.A.; Frederick, D.J.; Clark, A.; Phillips, D.R. Biomass, nutrient, and energy content of southern Piedmont hardwood forests. Hardwood Research Cooperative Series No. 5. Raleigh, NC: North Carolina State University; 1986. 34 pp.
- Messina, M.G.; Gower, S.T.; Frederick, D.J.; Clark, A., III; Phillips, D.R. Biomass, nutrient, and energy content of southeastern wetland hardwood forests. Hardwood Research Cooperative Series No. 2. Raleigh, NC: North Carolina State University; 1983. 28 pp.

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

| Tree<br>size<br>class<br>(inches) | Sample<br>trees | Age | D.b.h. | Total height |           |         |        | Height to 4-<br>inch d.o.b.<br>top | Height to saw-<br>log merchantable<br>top | D.o.b. at saw-<br>log merchantable<br>top |
|-----------------------------------|-----------------|-----|--------|--------------|-----------|---------|--------|------------------------------------|---|---|
|                                   |                 |     |        | Average      | Range     | Average | Range  |                                    |   |   |
| Number                            |                 |     |        |              |           |         |        |                                    |   |   |
| 1.0- 4.9                          | 40              | 21  | 8-55   | 2.7          | 1.3- 4.9  | 31      | 15- 52 | --                                 | --  | --  |
| 5.0-10.9                          | 54              | 31  | 13-64  | 6.7          | 5.0-10.4  | 59      | 35-104 | 32                                 | --  | --  |
| >11.0                             | 28              | 45  | 36-65  | 14.6         | 11.0-19.3 | 96      | 78-112 | 41                                 | 21-68                                     | 10.0                                      |
| All trees                         | 122             | 32  | 8-65   | 7.2          | 1.3-19.3  | 59      | 15-112 | 44                                 | 21-68                                     | 10.0                                      |
| Inches                            |                 |     |        |              |           |         |        |                                    |   |   |
| SOFT HARDWOODS                    |                 |     |        |              |           |         |        |                                    |   |   |
| 1.0- 4.9                          | 10              | 20  | 9-55   | 3.4          | 1.9- 4.9  | 39      | 25- 52 | --                                 | --  | --  |
| 5.0-10.9                          | 20              | 28  | 15-57  | 6.6          | 5.2- 8.5  | 61      | 44- 89 | 32                                 | --  | --  |
| >11.0                             | 9               | 51  | 40-65  | 14.5         | 11.0-17.2 | 93      | 78-108 | 73                                 | 49-87                                     | 38  |
| All trees                         | 39              | 32  | 9-65   | 7.6          | 1.9-17.2  | 63      | 25-108 | 41                                 | 4-87                                      | 38  |
| Feet                              |                 |     |        |              |           |         |        |                                    |   |   |
| SWEETGUM                          |                 |     |        |              |           |         |        |                                    |   |   |
| 1.0- 4.9                          | 102             | 21  | 9- 53  | 2.3          | 1.0- 4.9  | 28      | 10- 50 | --                                 | --  | --  |
| 5.0-10.9                          | 191             | 46  | 15-100 | 7.4          | 5.0-10.9  | 54      | 31- 88 | 30                                 | 7-68                                      | --  |
| >11.0                             | 71              | 77  | 22-130 | 14.9         | 11.0-22.0 | 71      | 50-103 | 52                                 | 34-86                                     | 27  |
| All trees                         | 364             | 48  | 9-130  | 7.4          | 1.0-22.0  | 50      | 10-103 | 35                                 | 2-86                                      | 27  |
| HARD HARDWOODS                    |                 |     |        |              |           |         |        |                                    |   |   |
| 1.0- 4.9                          | 102             | 21  | 9- 53  | 2.3          | 1.0- 4.9  | 28      | 10- 50 | --                                 | --  | --  |
| 5.0-10.9                          | 191             | 46  | 15-100 | 7.4          | 5.0-10.9  | 54      | 31- 88 | 30                                 | 7-68                                      | --  |
| >11.0                             | 71              | 77  | 22-130 | 14.9         | 11.0-22.0 | 71      | 50-103 | 52                                 | 34-86                                     | 27  |
| All trees                         | 364             | 48  | 9-130  | 7.4          | 1.0-22.0  | 50      | 10-103 | 35                                 | 2-86                                      | 27  |
| HICKORY                           |                 |     |        |              |           |         |        |                                    |   |   |
| 1.0- 4.9                          | 15              | 24  | 14- 40 | 2.1          | 1.0- 4.7  | 25      | 10- 42 | --                                 | --  | --  |
| 5.0-10.9                          | 20              | 55  | 19- 93 | 6.9          | 5.0-10.8  | 50      | 32- 88 | 24                                 | 7-64                                      | --  |
| >11.0                             | 2               | 83  | 66-100 | 16.1         | 14.1-18.1 | 88      | 72-103 | 71                                 | 55-86                                     | 31  |
| All trees                         | 37              | 47  | 14-100 | 5.4          | 1.0-18.1  | 42      | 10-103 | 27                                 | 7-86                                      | 31  |
| Inches                            |                 |     |        |              |           |         |        |                                    |   |   |

Continued

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

| Tree<br>size<br>class<br>(inches) | Sample<br>trees | Age | D.b.h. | Total height |           |         | Height to 4-<br>inch d.o.b.<br>top |         |       | Height to saw-<br>log merchantable<br>top |       |         | D.o.b. at saw-<br>log merchantable<br>top |         |       |
|-----------------------------------|-----------------|-----|--------|--------------|-----------|---------|------------------------------------|---------|-------|---|-------|---------|---|---------|-------|
|                                   |                 |     |        | Average      | Range     | Average | Range                              | Average | Range | Average                                   | Range | Average | Range                                     | Average | Range |
| Number                            |                 |     |        |              |           |         |                                    |         |       |   |       |         |   |         |       |
| 5.0-10.9                          | 14              | 54  | 41-100 | 6.7          | 5.1-10.2  | 45      | 33-66                              | 23      | 10-49 | --  | 12-35 | 10.2    | 8.7-13.2                                  | --      | --    |
| > 11.0                            | 12              | 110 | 88-130 | 14.4         | 11.2-20.9 | 57      | 50-63                              | 43      | 36-54 | 24  | 12-35 | 10.2    | 8.7-13.2                                  | --      | --    |
| All trees                         | 26              | 80  | 41-130 | 10.3         | 5.1-20.9  | 51      | 33-66                              | 32      | 10-54 | 24  | 12-35 | 10.2    | 8.7-13.2                                  | --      | --    |
| POST OAK                          |                 |     |        |              |           |         |                                    |         |       |   |       |         |   |         |       |
| 5.0-10.9                          | 24              | 44  | 36-65  | 8.1          | 5.1-10.9  | 60      | 45-73                              | 35      | 17-51 | --  | 13-45 | 11.7    | 8.8-15.1                                  | --      | --    |
| > 11.0                            | 17              | 63  | 39-98  | 15.0         | 11.5-20.0 | 79      | 58-94                              | 57      | 42-69 | 30  | 13-45 | 11.7    | 8.8-15.1                                  | --      | --    |
| All trees                         | 42              | 52  | 36-98  | 10.8         | 4.8-20.0  | 68      | 45-94                              | 44      | 16-69 | 30  | 13-45 | 11.7    | 8.8-15.1                                  | --      | --    |
| SCARLET OAK                       |                 |     |        |              |           |         |                                    |         |       |   |       |         |   |         |       |
| 5.0-10.9                          | 17              | 51  | 37-74  | 8.2          | 5.4-10.2  | 63      | 53-80                              | 36      | 13-54 | --  | 18-35 | 12.5    | 8.6-16.9                                  | --      | --    |
| > 11.0                            | 17              | 69  | 44-100 | 15.6         | 11.3-22.0 | 75      | 68-84                              | 54      | 45-65 | 24  | 18-35 | 12.5    | 8.6-16.9                                  | --      | --    |
| All trees                         | 34              | 60  | 37-100 | 11.9         | 5.4-22.0  | 69      | 53-84                              | 45      | 13-65 | 24  | 18-35 | 12.5    | 8.6-16.9                                  | --      | --    |
| SOUTHERN RED OAK                  |                 |     |        |              |           |         |                                    |         |       |   |       |         |   |         |       |
| 5.0-10.9                          | 17              | 51  | 44-100 | 15.6         | 11.3-22.0 | 75      | 68-84                              | 54      | 45-65 | 24  | 18-35 | 12.5    | 8.6-16.9                                  | --      | --    |
| > 11.0                            | 17              | 69  | 53-112 | 17.1         | 13.3-20.5 | 64      | 53-74                              | 48      | 37-57 | 29  | 21-38 | 12.4    | 9.5-14.4                                  | --      | --    |
| All trees                         | 87              | 51  | 14-112 | 7.7          | 1.3-20.5  | 49      | 16-74                              | 28      | 5-57  | 29  | 21-38 | 11.8    | 9.0-14.4                                  | --      | --    |
| WHITE OAK                         |                 |     |        |              |           |         |                                    |         |       |   |       |         |   |         |       |
| 1.0-4.9                           | 12              | 27  | 14-53  | 3.2          | 1.3-4.7   | 34      | 16-47                              | --      | 7-52  | --  | 12-38 | 12.4    | 9.5-14.4                                  | --      | --    |
| 5.0-10.9                          | 65              | 48  | 27-76  | 7.0          | 5.0-10.6  | 50      | 31-69                              | 26      | 7-52  | 29  | 21-38 | 12.4    | 9.5-14.4                                  | --      | --    |
| > 11.0                            | 10              | 98  | 53-112 | 17.1         | 13.3-20.5 | 64      | 53-74                              | 48      | 37-57 | 29  | 21-38 | 12.4    | 9.5-14.4                                  | --      | --    |
| All trees                         | 87              | 51  | 14-112 | 7.7          | 1.3-20.5  | 49      | 16-74                              | 28      | 5-57  | 29  | 21-38 | 11.8    | 9.0-14.4                                  | --      | --    |
| ALL SPECIES                       |                 |     |        |              |           |         |                                    |         |       |   |       |         |   |         |       |
| 1.0-4.9                           | 142             | 21  | 8-55   | 2.4          | 1.0-4.9   | 29      | 10-52                              | --      | 7-80  | --  | 12-68 | 11.1    | 8.6-16.9                                  | --      | --    |
| 5.0-10.9                          | 245             | 43  | 13-100 | 7.2          | 5.0-10.9  | 55      | 31-104                             | 30      | 7-80  | --  | 12-68 | 10.9    | 8.6-16.9                                  | --      | --    |
| > 11.0                            | 99              | 68  | 22-130 | 14.9         | 11.0-22.0 | 78      | 50-112                             | 59      | 34-87 | 31  | 12-68 | 10.9    | 8.6-16.9                                  | --      | --    |
| All trees                         | 486             | 43  | 8-130  | 7.4          | 1.0-22.0  | 52      | 10-112                             | 37      | 1-87  | 30  | 12-68 | 10.9    | 8.6-16.9                                  | --      | --    |

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

| Tree<br>size<br>class<br>(inches) | Total<br>tree | Average and standard deviation |                         |                       |                  |                |               |  |
|-----------------------------------|---------------|--------------------------------|-------------------------|-----------------------|------------------|----------------|---------------|--|
|                                   |               | Butt to<br>9-inch top          | 9-inch to<br>4-inch top | Butt to<br>4-inch top | 4-inch to<br>tip | Butt to<br>tip | Branches      |  |
| SOFT HARDWOODS                    |               |                                |                         |                       |                  |                |               |  |
| Wood                              |               |                                |                         |                       |                  |                |               |  |
| 1.0- 4.9                          | 0.523 ± 0.042 | —                              | —                       | 0.471 ± 0.057         | 0.461 ± 0.054    | 0.529 ± 0.047  | 0.489 ± 0.038 |  |
| 5.0-10.9                          | 0.466 ± 0.054 | 0.455 ± 0.029                  | 0.464 ± 0.044           | 0.464 ± 0.040         | 0.464 ± 0.042    | 0.468 ± 0.058  | 0.464 ± 0.051 |  |
| ≥11.0                             | 0.465 ± 0.041 | —                              | —                       | —                     | 0.477 ± 0.034    | 0.464 ± 0.042  | 0.473 ± 0.040 |  |
| 1.0- 4.9                          | 0.445 ± 0.065 | —                              | —                       | 0.405 ± 0.095         | 0.405 ± 0.095    | 0.456 ± 0.082  | 0.423 ± 0.046 |  |
| 5.0-10.9                          | 0.407 ± 0.072 | 0.419 ± 0.090                  | 0.430 ± 0.078           | 0.423 ± 0.077         | 0.418 ± 0.078    | 0.406 ± 0.083  | 0.421 ± 0.053 |  |
| ≥11.0                             | 0.422 ± 0.068 | 0.418 ± 0.079                  | 0.430 ± 0.077           | 0.429 ± 0.062         | 0.424 ± 0.076    | 0.424 ± 0.076  | 0.419 ± 0.055 |  |
| 1.0- 4.9                          | 0.507 ± 0.039 | —                              | —                       | 0.459 ± 0.054         | 0.451 ± 0.050    | 0.514 ± 0.046  | 0.468 ± 0.031 |  |
| 5.0-10.9                          | 0.457 ± 0.051 | 0.442 ± 0.032                  | 0.458 ± 0.043           | 0.458 ± 0.043         | 0.467 ± 0.035    | 0.459 ± 0.055  | 0.450 ± 0.046 |  |
| ≥11.0                             | 0.459 ± 0.042 | —                              | —                       | —                     | —                | 0.459 ± 0.044  | 0.459 ± 0.038 |  |
| SWEETGUM                          |               |                                |                         |                       |                  |                |               |  |
| Wood                              |               |                                |                         |                       |                  |                |               |  |
| 1.0- 4.9                          | 0.485 ± 0.022 | —                              | —                       | 0.486 ± 0.028         | 0.472 ± 0.032    | 0.485 ± 0.022  | 0.488 ± 0.058 |  |
| 5.0-10.9                          | 0.481 ± 0.027 | 0.484 ± 0.000                  | 0.493 ± 0.016           | 0.493 ± 0.019         | 0.496 ± 0.017    | 0.480 ± 0.023  | 0.476 ± 0.028 |  |
| ≥11.0                             | 0.498 ± 0.015 | 0.497 ± 0.016                  | —                       | —                     | 0.500 ± 0.026    | 0.496 ± 0.017  | 0.510 ± 0.018 |  |
| 1.0- 4.9                          | 0.370 ± 0.031 | —                              | —                       | 0.370 ± 0.047         | 0.421 ± 0.040    | 0.369 ± 0.030  | 0.376 ± 0.047 |  |
| 5.0-10.9                          | 0.388 ± 0.040 | 0.419 ± 0.000                  | 0.406 ± 0.035           | 0.428 ± 0.045         | 0.417 ± 0.032    | 0.384 ± 0.045  | 0.421 ± 0.036 |  |
| ≥11.0                             | 0.418 ± 0.027 | —                              | —                       | —                     | 0.446 ± 0.026    | 0.418 ± 0.030  | 0.419 ± 0.021 |  |
| 1.0- 4.9                          | 0.465 ± 0.021 | —                              | —                       | 0.467 ± 0.023         | 0.462 ± 0.030    | 0.465 ± 0.022  | 0.449 ± 0.044 |  |
| 5.0-10.9                          | 0.467 ± 0.024 | —                              | —                       | 0.482 ± 0.019         | 0.484 ± 0.017    | 0.489 ± 0.020  | 0.458 ± 0.021 |  |
| ≥11.0                             | 0.488 ± 0.015 | 0.485 ± 0.015                  | —                       | —                     | —                | 0.487 ± 0.017  | 0.487 ± 0.013 |  |
| YELLOW-POPLAR                     |               |                                |                         |                       |                  |                |               |  |
| Wood                              |               |                                |                         |                       |                  |                |               |  |
| 5.0-10.9                          | 0.389 ± 0.052 | 0.441 ± 0.031                  | 0.389 ± 0.053           | 0.390 ± 0.053         | 0.392 ± 0.053    | 0.388 ± 0.050  | 0.402 ± 0.071 |  |
| ≥11.0                             | 0.412 ± 0.020 | 0.409 ± 0.027                  | 0.414 ± 0.023           | 0.410 ± 0.020         | 0.445 ± 0.023    | 0.410 ± 0.020  | 0.428 ± 0.020 |  |
| 5.0-10.9                          | 0.350 ± 0.018 | 0.346 ± 0.016                  | 0.330 ± 0.017           | 0.345 ± 0.019         | 0.345 ± 0.019    | 0.350 ± 0.023  | 0.345 ± 0.019 |  |
| ≥11.0                             | 0.344 ± 0.017 | —                              | —                       | 0.342 ± 0.019         | 0.336 ± 0.018    | 0.352 ± 0.018  | 0.337 ± 0.018 |  |

Continued

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

| Tree<br>size<br>class<br>(inches) | Total<br>tree | Average and standard deviation |                         |                       |                  |                |               |
|-----------------------------------|---------------|--------------------------------|-------------------------|-----------------------|------------------|----------------|---------------|
|                                   |               | Butt to<br>9-inch top          | 9-inch to<br>4-inch top | Butt to<br>4-inch top | 4-inch to<br>tip | Butt to<br>tip | Branches      |
| HARD HARDWOODS                    |               |                                |                         |                       |                  |                |               |
| 5.0-10.9                          | 0.383 ± 0.045 | 0.425 ± 0.023                  | 0.345 ± 0.019           | 0.345 ± 0.019         | 0.350 ± 0.023    | 0.345 ± 0.019  | 0.365 ± 0.053 |
| > 11.0                            | 0.404 ± 0.018 | 0.400 ± 0.024                  | 0.402 ± 0.018           | 0.400 ± 0.018         | 0.427 ± 0.019    | 0.401 ± 0.018  | 0.410 ± 0.015 |
| Wood                              |               |                                |                         |                       |                  |                |               |
| 1.0- 4.9                          | 0.612 ± 0.040 | —                              | 0.613 ± 0.062           | 0.631 ± 0.051         | 0.631 ± 0.051    | 0.617 ± 0.041  | 0.578 ± 0.045 |
| 5.0-10.9                          | 0.632 ± 0.049 | —                              | 0.596 ± 0.040           | 0.622 ± 0.031         | 0.600 ± 0.034    | 0.631 ± 0.049  | 0.639 ± 0.055 |
| > 11.0                            | 0.613 ± 0.031 | —                              | —                       | —                     | 0.649 ± 0.027    | 0.601 ± 0.034  | 0.646 ± 0.037 |
| Bark                              |               |                                |                         |                       |                  |                |               |
| 1.0- 4.9                          | 0.483 ± 0.083 | —                              | 0.552 ± 0.067           | 0.561 ± 0.075         | 0.559 ± 0.072    | 0.548 ± 0.067  | 0.498 ± 0.094 |
| 5.0-10.9                          | 0.541 ± 0.061 | —                              | 0.596 ± 0.087           | 0.599 ± 0.098         | 0.596 ± 0.088    | 0.582 ± 0.080  | 0.558 ± 0.071 |
| > 11.0                            | 0.582 ± 0.077 | —                              | —                       | —                     | —                | —              | 0.596 ± 0.087 |
| Wood and Bark                     |               |                                |                         |                       |                  |                |               |
| 1.0- 4.9                          | 0.587 ± 0.035 | —                              | 0.597 ± 0.058           | 0.619 ± 0.044         | 0.619 ± 0.044    | 0.616 ± 0.042  | 0.594 ± 0.036 |
| 5.0-10.9                          | 0.616 ± 0.042 | —                              | 0.596 ± 0.036           | 0.619 ± 0.031         | 0.600 ± 0.030    | 0.633 ± 0.030  | 0.620 ± 0.043 |
| > 11.0                            | 0.609 ± 0.027 | —                              | —                       | —                     | —                | —              | 0.601 ± 0.029 |
| HICKORY                           |               |                                |                         |                       |                  |                |               |
| Wood                              |               |                                |                         |                       |                  |                |               |
| 1.0- 4.9                          | 0.642 ± 0.050 | —                              | 0.622 ± 0.029           | 0.663 ± 0.043         | 0.662 ± 0.044    | 0.656 ± 0.050  | 0.655 ± 0.055 |
| 5.0-10.9                          | 0.651 ± 0.043 | —                              | 0.627 ± 0.061           | 0.649 ± 0.017         | 0.632 ± 0.053    | 0.628 ± 0.077  | 0.659 ± 0.044 |
| > 11.0                            | 0.624 ± 0.056 | —                              | —                       | —                     | —                | —              | 0.631 ± 0.053 |
| Bark                              |               |                                |                         |                       |                  |                |               |
| 1.0- 4.9                          | 0.526 ± 0.035 | —                              | 0.529 ± 0.045           | 0.554 ± 0.050         | 0.554 ± 0.049    | 0.524 ± 0.058  | 0.536 ± 0.036 |
| 5.0-10.9                          | 0.528 ± 0.044 | —                              | 0.528 ± 0.054           | 0.542 ± 0.040         | 0.530 ± 0.050    | 0.498 ± 0.071  | 0.548 ± 0.053 |
| > 11.0                            | 0.511 ± 0.048 | —                              | —                       | —                     | —                | —              | 0.529 ± 0.050 |
| Wood and Bark                     |               |                                |                         |                       |                  |                |               |
| 1.0- 4.9                          | 0.607 ± 0.038 | —                              | 0.617 ± 0.019           | 0.640 ± 0.040         | 0.640 ± 0.040    | 0.625 ± 0.045  | 0.615 ± 0.041 |
| 5.0-10.9                          | 0.625 ± 0.039 | —                              | 0.613 ± 0.057           | 0.631 ± 0.021         | 0.617 ± 0.050    | 0.593 ± 0.086  | 0.637 ± 0.042 |
| > 11.0                            | 0.605 ± 0.052 | —                              | —                       | —                     | —                | —              | 0.617 ± 0.051 |
| POST OAK                          |               |                                |                         |                       |                  |                |               |
| Wood                              |               |                                |                         |                       |                  |                |               |
| 5.0-10.9                          | 0.678 ± 0.028 | —                              | 0.650 ± 0.047           | 0.672 ± 0.039         | 0.673 ± 0.036    | 0.664 ± 0.042  | 0.671 ± 0.035 |
| > 11.0                            | 0.646 ± 0.020 | —                              | 0.634 ± 0.028           | 0.645 ± 0.029         | 0.635 ± 0.027    | 0.668 ± 0.027  | 0.635 ± 0.027 |

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

| Tree<br>size<br>class<br>(inches) | Total<br>tree | Average and standard deviation |                         |                       |                  |                |                |
|-----------------------------------|---------------|--------------------------------|-------------------------|-----------------------|------------------|----------------|----------------|
|                                   |               | Butt to<br>9-inch top          | 9-inch to<br>4-inch top | Butt to<br>4-inch top | 4-inch to<br>tip | Butt to<br>tip | Branches       |
| Bark                              |               |                                |                         |                       |                  |                |                |
| 5.0-10.9                          | 0.492 ± 0.063 | 0.556 ± 0.119                  | 0.504 ± 0.073           | 0.501 ± 0.064         | 0.483 ± 0.077    | 0.497 ± 0.066  | 0.484 ± 0.065  |
| ≥ 11.0                            | 0.520 ± 0.052 | 0.544 ± 0.049                  | 0.504 ± 0.057           | 0.536 ± 0.052         | 0.485 ± 0.054    | 0.534 ± 0.052  | 0.497 ± 0.052  |
| 5.0-10.9                          | 0.644 ± 0.021 | 0.633 ± 0.038                  | 0.640 ± 0.027           | 0.641 ± 0.026         | 0.622 ± 0.025    | 0.645 ± 0.026  | 0.621 ± 0.039  |
| ≥ 11.0                            | 0.626 ± 0.016 | 0.621 ± 0.018                  | 0.622 ± 0.024           | 0.620 ± 0.018         | 0.622 ± 0.024    | 0.623 ± 0.019  | 0.620 ± 0.028  |
| Wood and Bark                     |               |                                |                         |                       |                  |                |                |
| 5.0-10.9                          | 0.621 ± 0.021 | 0.620 ± 0.024                  | 0.613 ± 0.029           | 0.612 ± 0.029         | 0.630 ± 0.036    | 0.639 ± 0.000  | 0.5556 ± 0.000 |
| ≥ 11.0                            | 0.606 ± 0.022 | 0.584 ± 0.025                  | 0.626 ± 0.027           | 0.588 ± 0.025         | 0.648 ± 0.022    | 0.614 ± 0.029  | 0.652 ± 0.048  |
| SCARLET OAK                       |               |                                |                         |                       |                  |                |                |
| 1.0-4.9                           | 0.534 ± 0.000 | —                              | —                       | —                     | —                | —              | —              |
| 5.0-10.9                          | 0.622 ± 0.032 | 0.609 ± 0.024                  | 0.613 ± 0.029           | 0.612 ± 0.029         | 0.630 ± 0.036    | 0.639 ± 0.000  | 0.5556 ± 0.000 |
| ≥ 11.0                            | 0.606 ± 0.022 | 0.584 ± 0.025                  | 0.626 ± 0.027           | 0.588 ± 0.025         | 0.648 ± 0.022    | 0.614 ± 0.029  | 0.653 ± 0.026  |
| Bark                              |               |                                |                         |                       |                  |                |                |
| 1.0-4.9                           | 0.621 ± 0.000 | —                              | —                       | —                     | —                | —              | —              |
| 5.0-10.9                          | 0.606 ± 0.022 | 0.607 ± 0.038                  | 0.643 ± 0.036           | 0.635 ± 0.035         | 0.608 ± 0.030    | 0.636 ± 0.000  | 0.477 ± 0.000  |
| ≥ 11.0                            | 0.623 ± 0.028 | 0.640 ± 0.032                  | 0.654 ± 0.030           | 0.641 ± 0.031         | 0.625 ± 0.035    | 0.631 ± 0.035  | 0.548 ± 0.028  |
| Wood and Bark                     |               |                                |                         |                       |                  |                |                |
| 1.0-4.9                           | 0.630 ± 0.000 | —                              | —                       | —                     | —                | —              | —              |
| 5.0-10.9                          | 0.620 ± 0.028 | 0.608 ± 0.017                  | 0.617 ± 0.025           | 0.616 ± 0.026         | 0.626 ± 0.031    | 0.638 ± 0.000  | 0.522 ± 0.000  |
| ≥ 11.0                            | 0.609 ± 0.018 | 0.592 ± 0.022                  | 0.632 ± 0.021           | 0.595 ± 0.022         | 0.644 ± 0.019    | 0.617 ± 0.026  | 0.622 ± 0.037  |
| SOUTHERN RED OAK                  |               |                                |                         |                       |                  |                |                |
| 5.0-10.9                          | 0.605 ± 0.019 | 0.607 ± 0.023                  | 0.593 ± 0.018           | 0.596 ± 0.018         | 0.618 ± 0.023    | 0.597 ± 0.018  | 0.653 ± 0.036  |
| ≥ 11.0                            | 0.601 ± 0.020 | 0.579 ± 0.022                  | 0.609 ± 0.022           | 0.581 ± 0.021         | 0.652 ± 0.028    | 0.582 ± 0.021  | 0.652 ± 0.021  |
| Bark                              |               |                                |                         |                       |                  |                |                |
| 5.0-10.9                          | 0.602 ± 0.030 | 0.592 ± 0.034                  | 0.623 ± 0.031           | 0.613 ± 0.029         | 0.623 ± 0.024    | 0.616 ± 0.027  | 0.556 ± 0.035  |
| ≥ 11.0                            | 0.662 ± 0.026 | 0.675 ± 0.026                  | 0.695 ± 0.024           | 0.678 ± 0.025         | 0.663 ± 0.035    | 0.677 ± 0.025  | 0.630 ± 0.042  |
| Wood and Bark                     |               |                                |                         |                       |                  |                |                |
| 5.0-10.9                          | 0.605 ± 0.015 | 0.600 ± 0.014                  | 0.600 ± 0.013           | 0.600 ± 0.013         | 0.619 ± 0.020    | 0.601 ± 0.014  | 0.623 ± 0.036  |
| ≥ 11.0                            | 0.615 ± 0.014 | 0.596 ± 0.017                  | 0.628 ± 0.018           | 0.598 ± 0.016         | 0.656 ± 0.022    | 0.598 ± 0.016  | 0.645 ± 0.017  |

Continued

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

| Tree<br>size<br>class<br>(inches) | Total<br>tree | Average and standard deviation |               |                         |               |                       |               |  |
|-----------------------------------|---------------|--------------------------------|---------------|-------------------------|---------------|-----------------------|---------------|--|
|                                   |               | Butt to<br>9-inch top          |               | 9-inch to<br>4-inch top |               | Butt to<br>4-inch top |               |  |
|                                   |               | Stem                           | Wood          | Bark                    | Wood          | Bark                  | Branches      |  |
| WHITE OAK                         |               |                                |               |                         |               |                       |               |  |
| Wood                              |               |                                |               |                         |               |                       |               |  |
| 1.0- 4.9                          | 0.641 ± 0.022 | ---                            | 0.654 ± 0.041 | 0.654 ± 0.046           | 0.650 ± 0.046 | 0.646 ± 0.023         | 0.594 ± 0.031 |  |
| 5.0-10.9                          | 0.654 ± 0.039 | 0.659 ± 0.053                  | 0.639 ± 0.012 | 0.627 ± 0.011           | 0.654 ± 0.013 | 0.652 ± 0.041         | 0.656 ± 0.044 |  |
| > 11.0                            | 0.635 ± 0.007 | 0.626 ± 0.011                  | 0.608 ± 0.039 | 0.605 ± 0.040           | 0.575 ± 0.033 | 0.628 ± 0.011         | 0.657 ± 0.021 |  |
| Bark                              |               |                                |               |                         |               |                       |               |  |
| 1.0- 4.9                          | 0.483 ± 0.048 | ---                            | 0.530 ± 0.052 | 0.530 ± 0.054           | 0.521 ± 0.056 | 0.484 ± 0.054         | 0.473 ± 0.026 |  |
| 5.0-10.9                          | 0.518 ± 0.050 | 0.530 ± 0.047                  | 0.608 ± 0.039 | 0.605 ± 0.040           | 0.575 ± 0.033 | 0.528 ± 0.053         | 0.508 ± 0.113 |  |
| > 11.0                            | 0.573 ± 0.036 | 0.604 ± 0.041                  | 0.624 ± 0.010 | 0.633 ± 0.010           | 0.635 ± 0.014 | 0.604 ± 0.040         | 0.533 ± 0.035 |  |
| Wood and Bark                     |               |                                |               |                         |               |                       |               |  |
| 1.0- 4.9                          | 0.607 ± 0.026 | ---                            | 0.636 ± 0.039 | 0.635 ± 0.039           | 0.622 ± 0.045 | 0.614 ± 0.026         | 0.544 ± 0.031 |  |
| 5.0-10.9                          | 0.632 ± 0.036 | 0.633 ± 0.060                  | 0.633 ± 0.010 | 0.625 ± 0.009           | 0.635 ± 0.014 | 0.636 ± 0.039         | 0.605 ± 0.048 |  |
| > 11.0                            | 0.626 ± 0.005 | 0.624 ± 0.010                  | 0.622 ± 0.010 | 0.625 ± 0.010           | 0.625 ± 0.009 | 0.625 ± 0.009         | 0.622 ± 0.022 |  |
| ALL SPECIES                       |               |                                |               |                         |               |                       |               |  |
| Wood                              |               |                                |               |                         |               |                       |               |  |
| 1.0- 4.9                          | 0.582 ± 0.058 | ---                            | 0.595 ± 0.085 | 0.595 ± 0.085           | 0.598 ± 0.086 | 0.588 ± 0.060         | 0.549 ± 0.060 |  |
| 5.0-10.9                          | 0.595 ± 0.085 | 0.601 ± 0.074                  | 0.558 ± 0.072 | 0.561 ± 0.072           | 0.606 ± 0.083 | 0.597 ± 0.084         | 0.601 ± 0.091 |  |
| > 11.0                            | 0.571 ± 0.075 | 0.558 ± 0.075                  | 0.577 ± 0.079 | 0.547 ± 0.115           | 0.538 ± 0.102 | 0.562 ± 0.072         | 0.597 ± 0.087 |  |
| Bark                              |               |                                |               |                         |               |                       |               |  |
| 1.0- 4.9                          | 0.471 ± 0.079 | ---                            | 0.526 ± 0.103 | 0.525 ± 0.101           | 0.521 ± 0.087 | 0.484 ± 0.092         | 0.436 ± 0.058 |  |
| 5.0-10.9                          | 0.511 ± 0.085 | 0.541 ± 0.077                  | 0.546 ± 0.117 | 0.551 ± 0.120           | 0.547 ± 0.115 | 0.526 ± 0.097         | 0.491 ± 0.082 |  |
| > 11.0                            | 0.537 ± 0.104 | 0.546 ± 0.117                  | 0.551 ± 0.120 | 0.551 ± 0.120           | 0.538 ± 0.102 | 0.547 ± 0.114         | 0.521 ± 0.090 |  |
| Wood and Bark                     |               |                                |               |                         |               |                       |               |  |
| 1.0- 4.9                          | 0.561 ± 0.052 | ---                            | 0.584 ± 0.081 | 0.583 ± 0.081           | 0.582 ± 0.080 | 0.568 ± 0.054         | 0.511 ± 0.048 |  |
| 5.0-10.9                          | 0.581 ± 0.079 | 0.583 ± 0.072                  | 0.557 ± 0.074 | 0.574 ± 0.081           | 0.560 ± 0.073 | 0.587 ± 0.080         | 0.564 ± 0.077 |  |
| > 11.0                            | 0.567 ± 0.075 | 0.557 ± 0.075                  | 0.557 ± 0.075 | 0.557 ± 0.075           | 0.586 ± 0.081 | 0.561 ± 0.073         | 0.575 ± 0.082 |  |

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

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

Continued

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

| Tree<br>size<br>class<br>(inches) | Total<br>tree | Average and standard deviation |                         |                       |                  |                |            | Branches |  |  |
|-----------------------------------|---------------|--------------------------------|-------------------------|-----------------------|------------------|----------------|------------|----------|--|--|
|                                   |               | Butt to<br>9-inch top          | 9-inch to<br>4-inch top | Butt to<br>4-inch top | 4-inch to<br>tip | Butt to<br>tip |            |          |  |  |
| - - - - - Percent - - - - -       |               |                                |                         |                       |                  |                |            |          |  |  |
| Wood and Bark                     |               |                                |                         |                       |                  |                |            |          |  |  |
| 5.0-10.9                          | 106 ± 16.4    | 92 ± 3.8                       | 106 ± 17.4              | 106 ± 17.4            | 116 ± 18.2       | 107 ± 17.0     | 114 ± 19.8 |          |  |  |
| ≥ 11.0                            | 96 ± 4.9      | 96 ± 5.6                       | 97 ± 6.5                | 96 ± 5.2              | 104 ± 11.2       | 96 ± 4.8       | 106 ± 10.7 |          |  |  |
| HARD HARDWOODS                    |               |                                |                         |                       |                  |                |            |          |  |  |
| Wood                              |               |                                |                         |                       |                  |                |            |          |  |  |
| 1.0- 4.9                          | 66 ± 10.1     | --                             | --                      | --                    | --               | 65 ± 10.6      | 67 ± 9.6   |          |  |  |
| 5.0-10.9                          | 63 ± 8.8      | 69 ± 10.1                      | 64 ± 9.3                | 64 ± 9.6              | 61 ± 9.1         | 64 ± 9.4       | 59 ± 7.3   |          |  |  |
| ≥ 11.0                            | 68 ± 11.0     | 72 ± 13.3                      | 65 ± 9.8                | 71 ± 13.4             | 61 ± 6.6         | 71 ± 13.3      | 60 ± 5.7   |          |  |  |
| Bark                              |               |                                |                         |                       |                  |                |            |          |  |  |
| 1.0- 4.9                          | 74 ± 22.5     | --                             | --                      | --                    | --               | 73 ± 22.4      | 80 ± 28.2  |          |  |  |
| 5.0-10.9                          | 66 ± 12.4     | 61 ± 14.0                      | 61 ± 13.0               | 61 ± 12.8             | 69 ± 15.4        | 63 ± 13.1      | 74 ± 13.0  |          |  |  |
| ≥ 11.0                            | 58 ± 10.6     | 55 ± 12.3                      | 56 ± 11.9               | 55 ± 11.9             | 61 ± 10.7        | 55 ± 11.8      | 62 ± 10.4  |          |  |  |
| Wood and Bark                     |               |                                |                         |                       |                  |                |            |          |  |  |
| 1.0- 4.9                          | 68 ± 9.7      | --                             | --                      | --                    | --               | 67 ± 10.3      | 71 ± 11.7  |          |  |  |
| 5.0-10.9                          | 63 ± 7.2      | 68 ± 8.5                       | 63 ± 7.9                | 64 ± 8.0              | 63 ± 8.0         | 64 ± 7.9       | 64 ± 7.2   |          |  |  |
| ≥ 11.0                            | 66 ± 8.0      | 69 ± 10.4                      | 63 ± 6.8                | 68 ± 10.4             | 60 ± 4.3         | 68 ± 10.5      | 60 ± 3.3   |          |  |  |
| HICKORY                           |               |                                |                         |                       |                  |                |            |          |  |  |
| Wood                              |               |                                |                         |                       |                  |                |            |          |  |  |
| 1.0- 4.9                          | 52 ± 3.9      | --                             | --                      | --                    | --               | 51 ± 3.3       | 56 ± 7.7   |          |  |  |
| 5.0-10.9                          | 52 ± 3.9      | 61 ± 9.0                       | 53 ± 4.0                | 53 ± 4.1              | 50 ± 4.0         | 52 ± 4.0       | 52 ± 8.0   |          |  |  |
| ≥ 11.0                            | 54 ± 6.9      | 57 ± 9.4                       | 51 ± 3.7                | 56 ± 8.3              | 51 ± 5.9         | 56 ± 8.2       | 51 ± 4.3   |          |  |  |
| Bark                              |               |                                |                         |                       |                  |                |            |          |  |  |
| 1.0- 4.9                          | 76 ± 21.7     | --                             | --                      | --                    | --               | 74 ± 22.5      | 91 ± 16.2  |          |  |  |
| 5.0-10.9                          | 75 ± 15.8     | 76 ± 12.3                      | 69 ± 16.6               | 69 ± 16.8             | 81 ± 20.0        | 72 ± 18.3      | 84 ± 12.6  |          |  |  |
| ≥ 11.0                            | 81 ± 13.6     | 81 ± 24.4                      | 78 ± 13.6               | 81 ± 22.1             | 83 ± 5.8         | 81 ± 22.0      | 83 ± 3.5   |          |  |  |
| Wood and Bark                     |               |                                |                         |                       |                  |                |            |          |  |  |
| 1.0- 4.9                          | 60 ± 9.1      | --                             | --                      | --                    | --               | 59 ± 10.1      | 70 ± 9.3   |          |  |  |
| 5.0-10.9                          | 56 ± 5.1      | 62 ± 10.4                      | 56 ± 5.4                | 56 ± 5.6              | 57 ± 6.4         | 56 ± 5.8       | 64 ± 8.1   |          |  |  |
| ≥ 11.0                            | 59 ± 7.6      | 61 ± 11.0                      | 55 ± 5.4                | 60 ± 9.8              | 59 ± 8.4         | 60 ± 9.8       | 60 ± 3.3   |          |  |  |
| POST OAK                          |               |                                |                         |                       |                  |                |            |          |  |  |
| Wood                              |               |                                |                         |                       |                  |                |            |          |  |  |
| 5.0-10.9                          | 63 ± 3.4      | 68 ± 5.0                       | 62 ± 4.7                | 64 ± 3.9              | 62 ± 3.3         | 64 ± 3.9       | 59 ± 3.7   |          |  |  |
| ≥ 11.0                            | 65 ± 7.0      | 67 ± 8.9                       | 64 ± 7.3                | 67 ± 8.6              | 61 ± 4.0         | 67 ± 8.5       | 61 ± 5.0   |          |  |  |

Continued

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

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

Continued

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

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

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

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

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

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

Continued

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

| Tree<br>size<br>class<br>(inches)         | Total<br>tree | Average and standard deviation |                         |                       |                  |                |          | Branches |  |  |
|---|---------------|--------------------------------|-------------------------|-----------------------|------------------|----------------|----------|----------|--|--|
|   |               | Butt to<br>9-inch top          | 9-inch to<br>4-inch top | Butt to<br>4-inch top | 4-inch to<br>tip | Butt to<br>tip |          |          |  |  |
| - - - - - Pounds per cubic foot - - - - - |               |                                |                         |                       |                  |                |          |          |  |  |
| Wood and Bark                             |               |                                |                         |                       |                  |                |          |          |  |  |
| 5.0-10.9                                  | 50 ± 5.4      | 56 ± 8.6                       | 47 ± 2.6                | 50 ± 6.0              | 54 ± 4.4         | 50 ± 5.8       | 51 ± 3.0 |          |  |  |
| > 11.0                                    | 49 ± 2.8      | 49 ± 4.9                       | 48 ± 3.1                | 49 ± 4.1              | 54 ± 3.9         | 49 ± 4.0       | 52 ± 3.4 |          |  |  |
| HARD HARDWOODS                            |               |                                |                         |                       |                  |                |          |          |  |  |
| Wood                                      |               |                                |                         |                       |                  |                |          |          |  |  |
| 1.0- 4.9                                  | 61 ± 5.3      | --                             | --                      | --                    | 48 ± 0.0         | 61 ± 5.7       | 60 ± 5.6 |          |  |  |
| 5.0-10.9                                  | 62 ± 4.9      | 62 ± 9.1                       | 61 ± 6.2                | 62 ± 5.6              | 61 ± 5.1         | 62 ± 5.2       | 63 ± 5.0 |          |  |  |
| > 11.0                                    | 62 ± 5.6      | 62 ± 6.5                       | 63 ± 6.0                | 62 ± 6.2              | 62 ± 4.3         | 62 ± 6.2       | 64 ± 4.8 |          |  |  |
| Bark                                      |               |                                |                         |                       |                  |                |          |          |  |  |
| 1.0- 4.9                                  | 51 ± 5.9      | --                             | --                      | --                    | --               | 53 ± 7.2       | 49 ± 7.0 |          |  |  |
| 5.0-10.9                                  | 55 ± 4.5      | 55 ± 4.9                       | 57 ± 6.0                | 56 ± 5.8              | 57 ± 6.1         | 56 ± 5.6       | 55 ± 5.2 |          |  |  |
| > 11.0                                    | 57 ± 5.3      | 57 ± 6.2                       | 58 ± 6.9                | 57 ± 6.2              | 58 ± 5.8         | 57 ± 6.1       | 56 ± 4.9 |          |  |  |
| Wood and Bark                             |               |                                |                         |                       |                  |                |          |          |  |  |
| 1.0- 4.9                                  | 59 ± 3.9      | --                             | --                      | --                    | --               | 60 ± 4.4       | 57 ± 4.8 |          |  |  |
| 5.0-10.9                                  | 61 ± 4.3      | 61 ± 8.0                       | 61 ± 5.8                | 61 ± 5.0              | 60 ± 4.4         | 61 ± 4.7       | 60 ± 3.8 |          |  |  |
| > 11.0                                    | 61 ± 5.1      | 61 ± 6.1                       | 62 ± 5.6                | 61 ± 5.8              | 61 ± 4.1         | 61 ± 5.8       | 62 ± 3.9 |          |  |  |
| HICKORY                                   |               |                                |                         |                       |                  |                |          |          |  |  |
| Wood                                      |               |                                |                         |                       |                  |                |          |          |  |  |
| 1.0- 4.9                                  | 52 ± 3.7      | --                             | --                      | --                    | 48 ± 0.0         | 52 ± 4.0       | 55 ± 4.4 |          |  |  |
| 5.0-10.9                                  | 59 ± 4.6      | 52 ± 14.1                      | 55 ± 5.6                | 59 ± 6.1              | 58 ± 4.6         | 59 ± 5.5       | 58 ± 4.8 |          |  |  |
| > 11.0                                    | 61 ± 2.1      | 63 ± 1.1                       | 59 ± 0.2                | 62 ± 0.9              | 57 ± 8.1         | 62 ± 1.0       | 57 ± 3.8 |          |  |  |
| Bark                                      |               |                                |                         |                       |                  |                |          |          |  |  |
| 1.0- 4.9                                  | 58 ± 4.7      | --                             | --                      | --                    | --               | 58 ± 5.3       | 54 ± 5.5 |          |  |  |
| 5.0-10.9                                  | 57 ± 2.1      | 58 ± 2.5                       | 58 ± 3.0                | 58 ± 2.5              | 58 ± 2.5         | 58 ± 2.3       | 55 ± 2.7 |          |  |  |
| > 11.0                                    | 57 ± 1.0      | 59 ± 1.9                       | 60 ± 0.3                | 59 ± 1.8              | 56 ± 6.9         | 59 ± 1.7       | 56 ± 3.3 |          |  |  |
| Wood and Bark                             |               |                                |                         |                       |                  |                |          |          |  |  |
| 1.0- 4.9                                  | 54 ± 2.8      | --                             | --                      | --                    | --               | 54 ± 2.8       | 55 ± 3.3 |          |  |  |
| 5.0-10.9                                  | 58 ± 3.6      | 53 ± 11.9                      | 56 ± 4.8                | 59 ± 5.1              | 58 ± 3.6         | 59 ± 4.5       | 57 ± 3.6 |          |  |  |
| > 11.0                                    | 60 ± 1.8      | 62 ± 0.6                       | 59 ± 0.1                | 62 ± 0.5              | 57 ± 7.8         | 62 ± 0.5       | 56 ± 3.6 |          |  |  |
| POST OAK                                  |               |                                |                         |                       |                  |                |          |          |  |  |
| Wood                                      |               |                                |                         |                       |                  |                |          |          |  |  |
| 5.0-10.9                                  | 66 ± 2.0      | 64 ± 5.3                       | 64 ± 1.6                | 65 ± 2.6              | 64 ± 2.8         | 65 ± 2.2       | 70 ± 1.7 |          |  |  |
| > 11.0                                    | 63 ± 4.4      | 61 ± 6.3                       | 63 ± 6.0                | 62 ± 5.9              | 63 ± 1.4         | 62 ± 5.8       | 68 ± 2.6 |          |  |  |

Continued

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

| Tree<br>size<br>class<br>(inches)         | Total<br>tree | Average and standard deviation |                         |                       |                  |                |          | Branches |  |  |
|---|---------------|--------------------------------|-------------------------|-----------------------|------------------|----------------|----------|----------|--|--|
|   |               | Butt to<br>9-inch top          | 9-inch to<br>4-inch top | Butt to<br>4-inch top | 4-inch to<br>tip | Butt to<br>tip |          |          |  |  |
| - - - - - Pounds per cubic foot - - - - - |               |                                |                         |                       |                  |                |          |          |  |  |
| Bark                                      |               |                                |                         |                       |                  |                |          |          |  |  |
| 5.0-10.9                                  | 50 ± 4.1      | 53 ± 5.7                       | 54 ± 7.4                | 50 ± 4.1              | 50 ± 6.1         | 50 ± 4.0       | 50 ± 6.0 |          |  |  |
| ≥ 11.0                                    | 51 ± 2.6      | 53 ± 2.8                       | 51 ± 2.8                | 52 ± 2.6              | 49 ± 3.2         | 52 ± 2.6       | 50 ± 4.1 |          |  |  |
| Wood and Bark                             |               |                                |                         |                       |                  |                |          |          |  |  |
| 5.0-10.9                                  | 62 ± 1.8      | 62 ± 4.9                       | 63 ± 0.3                | 62 ± 2.2              | 60 ± 2.2         | 62 ± 1.9       | 62 ± 3.3 |          |  |  |
| ≥ 11.0                                    | 60 ± 3.4      | 60 ± 5.3                       | 61 ± 4.6                | 60 ± 4.8              | 59 ± 1.7         | 60 ± 4.7       | 62 ± 2.3 |          |  |  |
| SCARLET OAK                               |               |                                |                         |                       |                  |                |          |          |  |  |
| Wood                                      |               |                                |                         |                       |                  |                |          |          |  |  |
| 1.0- 4.9                                  | 59 ± 0.0      | --                             | --                      | --                    | 48 ± 0.0         | 59 ± 0.0       | 56 ± 0.0 |          |  |  |
| 5.0-10.9                                  | 65 ± 2.4      | 67 ± 3.7                       | 65 ± 2.6                | 65 ± 2.7              | 63 ± 3.0         | 65 ± 2.5       | 64 ± 3.8 |          |  |  |
| ≥ 11.0                                    | 66 ± 3.6      | 66 ± 4.2                       | 67 ± 5.5                | 66 ± 4.3              | 64 ± 2.9         | 66 ± 4.3       | 66 ± 2.0 |          |  |  |
| Bark                                      |               |                                |                         |                       |                  |                |          |          |  |  |
| 1.0- 4.9                                  | 60 ± 0.0      | --                             | --                      | --                    | --               | 61 ± 0.0       | 54 ± 0.0 |          |  |  |
| 5.0-10.9                                  | 59 ± 2.1      | 59 ± 2.9                       | 63 ± 2.7                | 61 ± 3.2              | 60 ± 2.2         | 61 ± 3.0       | 56 ± 3.9 |          |  |  |
| ≥ 11.0                                    | 62 ± 2.6      | 63 ± 2.6                       | 64 ± 2.8                | 63 ± 2.6              | 62 ± 3.5         | 63 ± 2.6       | 59 ± 3.8 |          |  |  |
| Wood and Bark                             |               |                                |                         |                       |                  |                |          |          |  |  |
| 1.0- 4.9                                  | 59 ± 0.0      | --                             | --                      | --                    | --               | 59 ± 0.0       | 55 ± 0.0 |          |  |  |
| 5.0-10.9                                  | 64 ± 2.1      | 66 ± 3.2                       | 64 ± 2.2                | 64 ± 2.2              | 62 ± 2.4         | 64 ± 2.0       | 62 ± 3.4 |          |  |  |
| ≥ 11.0                                    | 65 ± 2.8      | 66 ± 3.4                       | 66 ± 4.3                | 66 ± 3.4              | 64 ± 2.0         | 66 ± 3.4       | 64 ± 1.9 |          |  |  |
| SOUTHERN RED OAK                          |               |                                |                         |                       |                  |                |          |          |  |  |
| Wood                                      |               |                                |                         |                       |                  |                |          |          |  |  |
| 5.0-10.9                                  | 63 ± 2.8      | 67 ± 1.9                       | 63 ± 1.4                | 64 ± 3.2              | 62 ± 2.7         | 63 ± 3.1       | 65 ± 2.7 |          |  |  |
| ≥ 11.0                                    | 66 ± 1.5      | 66 ± 1.6                       | 66 ± 2.0                | 66 ± 1.6              | 65 ± 2.6         | 66 ± 1.6       | 66 ± 1.7 |          |  |  |
| Bark                                      |               |                                |                         |                       |                  |                |          |          |  |  |
| 5.0-10.9                                  | 56 ± 1.8      | 54 ± 2.7                       | 56 ± 2.4                | 56 ± 2.5              | 61 ± 11.2        | 57 ± 2.3       | 56 ± 3.2 |          |  |  |
| ≥ 11.0                                    | 60 ± 1.9      | 60 ± 1.5                       | 62 ± 1.6                | 60 ± 1.4              | 62 ± 3.0         | 61 ± 1.4       | 59 ± 3.6 |          |  |  |
| Wood and Bark                             |               |                                |                         |                       |                  |                |          |          |  |  |
| 5.0-10.9                                  | 62 ± 2.2      | 64 ± 1.6                       | 62 ± 1.1                | 62 ± 2.5              | 61 ± 3.2         | 62 ± 2.5       | 62 ± 2.8 |          |  |  |
| ≥ 11.0                                    | 65 ± 1.3      | 65 ± 1.4                       | 65 ± 1.7                | 65 ± 1.4              | 64 ± 2.1         | 65 ± 1.4       | 64 ± 1.7 |          |  |  |

Continued

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

| Tree<br>size<br>class<br>(inches)         | Total<br>tree | Average and standard deviation |                         |                       |                  |                |          | Branches |  |  |
|---|---------------|--------------------------------|-------------------------|-----------------------|------------------|----------------|----------|----------|--|--|
|   |               | Butt to<br>9-inch top          | 9-inch to<br>4-inch top | Butt to<br>4-inch top | 4-inch to<br>tip | Butt to<br>tip |          |          |  |  |
| - - - - - Pounds per cubic foot - - - - - |               |                                |                         |                       |                  |                |          |          |  |  |
| WHITE OAK                                 |               |                                |                         |                       |                  |                |          |          |  |  |
| Wood                                      |               |                                |                         |                       |                  |                |          |          |  |  |
| 1.0- 4.9                                  | 62 ± 1.8      | --                             | --                      | --                    | 48 ± 0.0         | 62 ± 1.9       | 60 ± 3.5 |          |  |  |
| 5.0-10.9                                  | 64 ± 3.8      | 62 ± 9.3                       | 61 ± 6.3                | 64 ± 4.7              | 62 ± 4.4         | 63 ± 4.3       | 65 ± 3.2 |          |  |  |
| ≥ 11.0                                    | 61 ± 3.0      | 60 ± 4.4                       | 63 ± 2.8                | 60 ± 3.9              | 61 ± 3.0         | 60 ± 3.9       | 66 ± 2.2 |          |  |  |
| Bark                                      |               |                                |                         |                       |                  |                |          |          |  |  |
| 1.0- 4.9                                  | 50 ± 3.6      | --                             | --                      | --                    | --               | 49 ± 3.8       | 51 ± 4.4 |          |  |  |
| 5.0-10.9                                  | 54 ± 3.1      | 56 ± 5.4                       | 58 ± 2.9                | 54 ± 3.7              | 56 ± 4.3         | 55 ± 3.6       | 55 ± 5.5 |          |  |  |
| ≥ 11.0                                    | 57 ± 2.5      | 58 ± 2.4                       | 59 ± 2.2                | 58 ± 2.3              | 59 ± 2.1         | 58 ± 2.2       | 55 ± 3.2 |          |  |  |
| Wood and Bark                             |               |                                |                         |                       |                  |                |          |          |  |  |
| 1.0- 4.9                                  | 59 ± 2.2      | --                             | --                      | --                    | --               | 59 ± 2.0       | 56 ± 3.6 |          |  |  |
| 5.0-10.9                                  | 62 ± 3.2      | 61 ± 8.2                       | 61 ± 5.4                | 62 ± 4.1              | 61 ± 3.7         | 62 ± 3.7       | 61 ± 3.2 |          |  |  |
| ≥ 11.0                                    | 61 ± 2.5      | 60 ± 3.8                       | 62 ± 2.4                | 60 ± 3.4              | 60 ± 2.5         | 60 ± 3.4       | 63 ± 2.3 |          |  |  |
| ALL SPECIES                               |               |                                |                         |                       |                  |                |          |          |  |  |
| Wood                                      |               |                                |                         |                       |                  |                |          |          |  |  |
| 1.0- 4.9                                  | 60 ± 5.4      | --                             | --                      | --                    | 48 ± 0.0         | 61 ± 5.9       | 58 ± 6.6 |          |  |  |
| 5.0-10.9                                  | 61 ± 6.0      | 62 ± 9.3                       | 61 ± 7.3                | 61 ± 6.7              | 60 ± 5.5         | 61 ± 6.2       | 61 ± 6.4 |          |  |  |
| ≥ 11.0                                    | 60 ± 6.9      | 60 ± 7.4                       | 60 ± 7.6                | 60 ± 7.2              | 60 ± 5.8         | 60 ± 7.2       | 62 ± 6.6 |          |  |  |
| Bark                                      |               |                                |                         |                       |                  |                |          |          |  |  |
| 1.0- 4.9                                  | 51 ± 5.5      | --                             | --                      | --                    | --               | 52 ± 6.9       | 50 ± 7.0 |          |  |  |
| 5.0-10.9                                  | 54 ± 5.5      | 55 ± 4.9                       | 57 ± 6.1                | 54 ± 7.2              | 57 ± 6.8         | 55 ± 6.8       | 55 ± 5.1 |          |  |  |
| ≥ 11.0                                    | 56 ± 5.4      | 55 ± 6.8                       | 57 ± 7.1                | 56 ± 6.8              | 58 ± 5.4         | 56 ± 6.7       | 57 ± 4.7 |          |  |  |
| Wood and Bark                             |               |                                |                         |                       |                  |                |          |          |  |  |
| 1.0- 4.9                                  | 58 ± 4.3      | --                             | --                      | --                    | --               | 59 ± 5.1       | 56 ± 5.2 |          |  |  |
| 5.0-10.9                                  | 60 ± 5.3      | 61 ± 8.2                       | 60 ± 6.8                | 60 ± 6.2              | 60 ± 4.9         | 60 ± 5.8       | 59 ± 4.7 |          |  |  |
| ≥ 11.0                                    | 59 ± 6.1      | 59 ± 6.9                       | 60 ± 6.9                | 59 ± 6.7              | 59 ± 5.0         | 59 ± 6.7       | 60 ± 5.0 |          |  |  |

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 Upland-South

| Tree<br>size<br>class<br>(inches)         | Total<br>tree | Average and standard deviation |                         |                       |                  |                |           |  |
|---|---------------|--------------------------------|-------------------------|-----------------------|------------------|----------------|-----------|--|
|   |               | Butt to<br>9-inch top          | 9-inch to<br>4-inch top | Butt to<br>4-inch top | 4-inch to<br>tip | Butt to<br>tip | Branches  |  |
| - - - - - Pounds per cubic foot - - - - - |               |                                |                         |                       |                  |                |           |  |
| SOFT HARDWOODS                            |               |                                |                         |                       |                  |                |           |  |
| 1.0- 4.9                                  | 73 ± 5.9      | --                             | --                      | --                    | 50 ± 0.0         | 73 ± 6.4       | 77 ± 11.8 |  |
| 5.0-10.9                                  | 66 ± 6.5      | 66 ± 13.5                      | 61 ± 11.6               | 63 ± 7.2              | 70 ± 6.4         | 64 ± 6.8       | 78 ± 9.2  |  |
| ≥ 11.0                                    | 62 ± 5.4      | 60 ± 5.8                       | 62 ± 7.6                | 60 ± 5.5              | 68 ± 7.0         | 60 ± 5.4       | 74 ± 9.1  |  |
| SWEETGUM                                  |               |                                |                         |                       |                  |                |           |  |
| 1.0- 4.9                                  | 74 ± 3.1      | --                             | --                      | --                    | 50 ± 0.0         | 72 ± 3.1       | 89 ± 7.1  |  |
| 5.0-10.9                                  | 69 ± 3.0      | --                             | --                      | 66 ± 3.1              | 75 ± 4.7         | 67 ± 2.9       | 87 ± 4.6  |  |
| ≥ 11.0                                    | 68 ± 4.1      | 64 ± 5.0                       | 69 ± 2.2                | 65 ± 4.5              | 74 ± 3.5         | 65 ± 4.4       | 82 ± 8.8  |  |
| YELLOW-POPLAR                             |               |                                |                         |                       |                  |                |           |  |
| 5.0-10.9                                  | 61 ± 7.1      | 69 ± 14.1                      | 55 ± 3.4                | 59 ± 7.6              | 68 ± 5.2         | 60 ± 7.2       | 75 ± 7.6  |  |
| ≥ 11.0                                    | 58 ± 3.6      | 56 ± 5.9                       | 59 ± 8.5                | 56 ± 4.7              | 68 ± 6.4         | 57 ± 4.6       | 69 ± 6.8  |  |
| HARD HARDWOODS                            |               |                                |                         |                       |                  |                |           |  |
| 1.0- 4.9                                  | 77 ± 5.7      | --                             | --                      | --                    | 50 ± 0.0         | 76 ± 5.7       | 86 ± 9.4  |  |
| 5.0-10.9                                  | 76 ± 6.1      | 72 ± 11.2                      | 72 ± 7.6                | 73 ± 6.7              | 77 ± 5.4         | 74 ± 6.2       | 90 ± 6.8  |  |
| ≥ 11.0                                    | 76 ± 7.1      | 72 ± 7.9                       | 76 ± 7.6                | 72 ± 7.5              | 81 ± 6.3         | 73 ± 7.5       | 87 ± 7.2  |  |
| HICKORY                                   |               |                                |                         |                       |                  |                |           |  |
| 1.0- 4.9                                  | 82 ± 4.3      | --                             | --                      | --                    | 50 ± 0.0         | 81 ± 3.5       | 93 ± 7.6  |  |
| 5.0-10.9                                  | 77 ± 5.8      | 63 ± 15.0                      | 68 ± 6.5                | 74 ± 7.3              | 77 ± 4.8         | 75 ± 6.7       | 89 ± 7.5  |  |
| ≥ 11.0                                    | 74 ± 3.6      | 73 ± 2.6                       | 71 ± 0.01               | 73 ± 2.4              | 77 ± 4.0         | 73 ± 2.4       | 78 ± 7.5  |  |
| POST OAK                                  |               |                                |                         |                       |                  |                |           |  |
| 5.0-10.9                                  | 81 ± 2.5      | 75 ± 4.7                       | 76 ± 0.9                | 76 ± 3.0              | 78 ± 2.6         | 76 ± 2.4       | 99 ± 3.4  |  |
| ≥ 11.0                                    | 76 ± 3.3      | 71 ± 4.7                       | 74 ± 3.1                | 72 ± 4.0              | 79 ± 2.6         | 72 ± 3.9       | 92 ± 9.6  |  |
| SCARLET OAK                               |               |                                |                         |                       |                  |                |           |  |
| 1.0- 4.9                                  | 80 ± 0.0      | --                             | --                      | --                    | 50 ± 0.0         | 79 ± 0.0       | 96 ± 0.0  |  |
| 5.0-10.9                                  | 78 ± 2.1      | 78 ± 4.0                       | 76 ± 2.7                | 76 ± 2.7              | 77 ± 2.9         | 76 ± 2.6       | 87 ± 4.8  |  |
| ≥ 11.0                                    | 79 ± 2.9      | 76 ± 3.8                       | 80 ± 4.3                | 76 ± 3.7              | 83 ± 3.4         | 76 ± 3.7       | 85 ± 3.1  |  |
| SOUTHERN RED OAK                          |               |                                |                         |                       |                  |                |           |  |
| 5.0-10.9                                  | 79 ± 3.3      | 80 ± 3.5                       | 78 ± 2.6                | 78 ± 3.8              | 79 ± 4.3         | 78 ± 3.8       | 91 ± 5.4  |  |
| ≥ 11.0                                    | 82 ± 1.9      | 79 ± 1.8                       | 83 ± 3.6                | 79 ± 1.8              | 88 ± 3.9         | 79 ± 1.8       | 90 ± 3.1  |  |
| WHITE OAK                                 |               |                                |                         |                       |                  |                |           |  |
| 1.0- 4.9                                  | 80 ± 2.4      | --                             | --                      | --                    | 50 ± 0.0         | 78 ± 2.7       | 96 ± 2.8  |  |
| 5.0-10.9                                  | 77 ± 4.7      | 69 ± 10.8                      | 70 ± 7.2                | 73 ± 5.4              | 77 ± 4.7         | 73 ± 4.9       | 93 ± 4.2  |  |
| ≥ 11.0                                    | 72 ± 3.6      | 67 ± 4.1                       | 73 ± 3.1                | 68 ± 3.6              | 79 ± 3.2         | 68 ± 3.6       | 87 ± 4.9  |  |
| ALL SPECIES                               |               |                                |                         |                       |                  |                |           |  |
| 1.0- 4.9                                  | 76 ± 6.1      | --                             | --                      | --                    | 50 ± 0.0         | 75 ± 6.0       | 83 ± 11.0 |  |
| 5.0-10.9                                  | 74 ± 7.7      | 71 ± 11.4                      | 71 ± 8.6                | 71 ± 8.0              | 75 ± 6.4         | 72 ± 7.5       | 88 ± 8.9  |  |
| ≥ 11.0                                    | 72 ± 9.1      | 69 ± 9.2                       | 72 ± 9.8                | 69 ± 8.9              | 77 ± 8.7         | 69 ± 8.9       | 83 ± 9.7  |  |

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

| Species or species group                  | Weight green or dry | Regression equation coefficients    |         |  |         | Coefficient of determination ( $R^2$ ) | Standard error <sup>3</sup> ( $S_{y,x}$ ) | No. of trees sampled |
|---|---------------------|-------------------------------------|---------|--|---------|--|---|----------------------|
|   |                     | Trees < 11.0 in d.b.h. <sup>1</sup> |         | Trees $\geq$ 11.0 in d.b.h. <sup>2</sup> |         |  |   |                      |
|   |                     | a <sup>4</sup>                      | b       | a <sup>4</sup>                           | b       |  |   |                      |
| <b>TOTAL-TREE WOOD, BARK, AND FOLIAGE</b> |                     |                                     |         |  |         |  |   |                      |
| Soft Hardwoods                            | Green               | 4.03305                             | 1.22682 | 3.76200                                  | 1.24133 | 0.98                                   | 0.0957                                    | 122                  |
|   | Dry                 | 2.24316                             | 1.20782 | 1.58122                                  | 1.28073 | 0.98                                   | 0.1023                                    | 122                  |
| Sweetgum                                  | Green               | 3.45384                             | 1.26820 | 3.10274                                  | 1.29055 | 0.99                                   | 0.0721                                    | 39                   |
|   | Dry                 | 1.57902                             | 1.28241 | 1.23675                                  | 1.33335 | 0.99                                   | 0.0725                                    | 39                   |
| Yellow-poplar                             | Green               | 1.49817                             | 1.47090 | 8.55437                                  | 1.10762 | 0.98                                   | 0.0678                                    | 19                   |
|   | Dry                 | 0.46515                             | 1.58089 | 5.84275                                  | 1.05322 | 0.98                                   | 0.0764                                    | 19                   |
| Hard Hardwoods                            | Green               | 4.41595                             | 1.21429 | 3.90893                                  | 1.23972 | 0.99                                   | 0.0873                                    | 364                  |
|   | Dry                 | 2.47910                             | 1.23265 | 3.00118                                  | 1.19280 | 0.99                                   | 0.0849                                    | 364                  |
| Hickory                                   | Green               | 4.21010                             | 1.19922 | 0.16719                                  | 1.87191 | 0.99                                   | 0.0826                                    | 37                   |
|   | Dry                 | 2.42737                             | 1.22122 | 0.14027                                  | 1.81569 | 0.99                                   | 0.0741                                    | 37                   |
| Post oak                                  | Green               | 3.52810                             | 1.24978 | 11.43392                                 | 1.00460 | 0.98                                   | 0.0612                                    | 26                   |
|   | Dry                 | 2.23650                             | 1.24077 | 6.79066                                  | 1.00918 | 0.98                                   | 0.0619                                    | 26                   |
| Scarlet oak                               | Green               | 5.85797                             | 1.18664 | 3.44343                                  | 1.29743 | 0.98                                   | 0.0626                                    | 42                   |
|   | Dry                 | 3.71351                             | 1.16900 | 2.45847                                  | 1.25500 | 0.98                                   | 0.0603                                    | 42                   |
| South. red oak                            | Green               | 3.40229                             | 1.28096 | 3.77536                                  | 1.25927 | 0.98                                   | 0.0552                                    | 34                   |
|   | Dry                 | 1.95177                             | 1.28848 | 2.60305                                  | 1.22844 | 0.98                                   | 0.0580                                    | 34                   |
| White oak                                 | Green               | 3.77132                             | 1.24770 | 11.91623                                 | 1.00781 | 0.99                                   | 0.0634                                    | 87                   |
|   | Dry                 | 2.40974                             | 1.23665 | 7.10021                                  | 1.01133 | 0.99                                   | 0.0653                                    | 87                   |
| All Species                               | Green               | 4.31938                             | 1.21728 | 3.88272                                  | 1.23950 | 0.99                                   | 0.0898                                    | 486                  |
|   | Dry                 | 2.40445                             | 1.22954 | 2.76893                                  | 1.20011 | 0.99                                   | 0.0957                                    | 486                  |
| <b>TOTAL-TREE WOOD AND BARK</b>           |                     |                                     |         |  |         |  |   |                      |
| Soft Hardwoods                            | Green               | 3.72086                             | 1.23838 | 3.57667                                  | 1.24662 | 0.98                                   | 0.0988                                    | 122                  |
|   | Dry                 | 2.13830                             | 1.21440 | 1.53461                                  | 1.28357 | 0.98                                   | 0.1042                                    | 122                  |

Continued

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

| Species or species group | Weight green or dry | Regression equation coefficients    |         |  |         | Coefficient of determination ( $R^2$ ) | Standard error <sup>3</sup> ( $S_{y,x}$ ) | No. of trees sampled |
|--------------------------|---------------------|-------------------------------------|---------|--|---------|--|---|----------------------|
|                          |                     | Trees < 11.0 in d.b.h. <sup>1</sup> |         | Trees $\geq$ 11.0 in d.b.h. <sup>2</sup> |         |  |   |                      |
|                          |                     | a <sup>4</sup>                      | b       | a <sup>4</sup>                           | b       |  |   |                      |
| Sweetgum                 | Green               | 3.21390                             | 1.27554 | 2.83100                                  | 1.30200 | 0.99                                   | 0.0717                                    | 39                   |
|                          | Dry                 | 1.49799                             | 1.28900 | 1.18827                                  | 1.33730 | 0.99                                   | 0.0725                                    | 39                   |
| Yellow-poplar            | Green               | 1.38087                             | 1.48551 | 8.44488                                  | 1.10792 | 0.98                                   | 0.0671                                    | 19                   |
|                          | Dry                 | 0.44159                             | 1.59040 | 5.80899                                  | 1.05310 | 0.98                                   | 0.0764                                    | 19                   |
| Hard Hardwoods           | Green               | 4.03700                             | 1.22483 | 3.70662                                  | 1.24263 | 0.99                                   | 0.0868                                    | 364                  |
|                          | Dry                 | 2.34325                             | 1.23822 | 2.81946                                  | 1.19965 | 0.99                                   | 0.0849                                    | 364                  |
| Hickory                  | Green               | 3.64420                             | 1.22404 | 0.18250                                  | 1.84836 | 0.99                                   | 0.0755                                    | 37                   |
|                          | Dry                 | 2.20539                             | 1.23749 | 0.14913                                  | 1.79919 | 0.99                                   | 0.0705                                    | 37                   |
| Post oak                 | Green               | 3.41839                             | 1.24923 | 11.08083                                 | 1.00401 | 0.98                                   | 0.0619                                    | 26                   |
|                          | Dry                 | 2.17824                             | 1.24051 | 6.65153                                  | 1.00744 | 0.98                                   | 0.0624                                    | 26                   |
| Scarlet oak              | Green               | 5.44452                             | 1.19363 | 3.10396                                  | 1.31080 | 0.98                                   | 0.0637                                    | 42                   |
|                          | Dry                 | 3.52314                             | 1.17476 | 2.25162                                  | 1.26812 | 0.98                                   | 0.0613                                    | 42                   |
| South. red oak           | Green               | 3.20531                             | 1.28487 | 3.39595                                  | 1.27282 | 0.98                                   | 0.0561                                    | 34                   |
|                          | Dry                 | 1.88717                             | 1.29016 | 2.38797                                  | 1.24109 | 0.98                                   | 0.0585                                    | 34                   |
| White oak                | Green               | 3.54192                             | 1.25138 | 11.44305                                 | 1.00685 | 0.99                                   | 0.0649                                    | 87                   |
|                          | Dry                 | 2.30393                             | 1.23852 | 6.86747                                  | 1.01079 | 0.99                                   | 0.0669                                    | 87                   |
| All Species              | Green               | 3.95891                             | 1.22794 | 3.67112                                  | 1.24367 | 0.99                                   | 0.0900                                    | 486                  |
|                          | Dry                 | 2.27767                             | 1.23522 | 2.61138                                  | 1.20671 | 0.99                                   | 0.0956                                    | 486                  |
| <b>TOTAL-TREE WOOD</b>   |                     |                                     |         |  |         |  |   |                      |
| Soft Hardwoods           | Green               | 2.87796                             | 1.26330 | 3.19198                                  | 1.24171 | 0.98                                   | 0.1069                                    | 122                  |
|                          | Dry                 | 1.65387                             | 1.24218 | 1.37392                                  | 1.28085 | 0.98                                   | 0.1134                                    | 122                  |
| Sweetgum                 | Green               | 2.44440                             | 1.30566 | 2.84007                                  | 1.27437 | 0.99                                   | 0.0738                                    | 39                   |
|                          | Dry                 | 1.16893                             | 1.31205 | 1.16774                                  | 1.31226 | 0.99                                   | 0.0741                                    | 39                   |
| Yellow-poplar            | Green               | 1.01298                             | 1.51062 | 5.88365                                  | 1.14379 | 0.98                                   | 0.0700                                    | 19                   |
|                          | Dry                 | 0.31578                             | 1.63008 | 4.50433                                  | 1.07590 | 0.97                                   | 0.0822                                    | 19                   |

Continued

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

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

<sup>1</sup>Trees < 11.0 inches d.b.h.

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

<sup>2</sup>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

<sup>3</sup>log<sub>10</sub> form

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

| Species<br>or<br>species<br>group | Weight<br>green<br>or<br>dry | Regression equation coefficients    |         |                                     |         | Coefficient<br>of<br>determination<br>(R <sup>2</sup> ) | Standard<br>error <sup>3</sup><br>(S <sub>y,x</sub> ) | No. of<br>trees<br>sampled |
|-----------------------------------|------------------------------|-------------------------------------|---------|-------------------------------------|---------|---|---|----------------------------|
|                                   |                              | Trees < 11.0 in d.b.h. <sup>1</sup> |         | Trees ≥ 11.0 in d.b.h. <sup>2</sup> |         |   |   |                            |
|                                   |                              | a <sup>1</sup>                      | b       | a <sup>2</sup>                      | b       |   |   |                            |
| <b>TOTAL-STEM WOOD AND BARK</b>   |                              |                                     |         |                                     |         |   |   |                            |
| Soft Hardwoods                    | Green                        | 3.06818                             | 1.25087 | 6.08427                             | 1.10811 | 0.98  | 0.1019  | 122                        |
|                                   | Dry                          | 1.76433                             | 1.22669 | 2.56326                             | 1.14881 | 0.98  | 0.1036  | 122                        |
| Sweetgum                          | Green                        | 2.99399                             | 1.26356 | 4.45413                             | 1.18073 | 0.99  | 0.0773  | 39                         |
|                                   | Dry                          | 1.39136                             | 1.27827 | 1.90083                             | 1.21321 | 0.99  | 0.0776  | 39                         |
| Yellow-poplar                     | Green                        | 0.99452                             | 1.54032 | 27.95174                            | 0.84472 | 0.98  | 0.0642  | 19                         |
|                                   | Dry                          | 0.30828                             | 1.65371 | 20.33017                            | 0.78027 | 0.98  | 0.0747  | 19                         |
| Hard Hardwoods                    | Green                        | 3.26963                             | 1.21895 | 5.42981                             | 1.11318 | 0.99  | 0.0879  | 364                        |
|                                   | Dry                          | 1.90929                             | 1.23052 | 4.47873                             | 1.05274 | 0.99  | 0.0863  | 364                        |
| Hickory                           | Green                        | 3.26299                             | 1.18973 | 0.27607                             | 1.70471 | 0.99  | 0.0650  | 37                         |
|                                   | Dry                          | 1.97974                             | 1.20411 | 0.24648                             | 1.63853 | 0.99  | 0.0584  | 37                         |
| Post oak                          | Green                        | 2.66234                             | 1.24130 | 12.23908                            | 0.92322 | 0.98  | 0.0584  | 26                         |
|                                   | Dry                          | 1.69741                             | 1.23153 | 7.48033                             | 0.92226 | 0.98  | 0.0567  | 26                         |
| Scarlet oak                       | Green                        | 5.55694                             | 1.13364 | 3.18970                             | 1.24940 | 0.97  | 0.0695  | 42                         |
|                                   | Dry                          | 3.68422                             | 1.10559 | 2.38800                             | 1.19600 | 0.97  | 0.0655  | 42                         |
| South. red oak                    | Green                        | 2.75099                             | 1.27903 | 7.67526                             | 1.06509 | 0.98  | 0.0489  | 34                         |
|                                   | Dry                          | 1.60722                             | 1.28419 | 5.99985                             | 1.00952 | 0.98  | 0.050   | 34                         |
| White oak                         | Green                        | 3.29276                             | 1.20873 | 11.91547                            | 0.94055 | 0.98  | 0.0713  | 87                         |
|                                   | Dry                          | 2.16839                             | 1.19319 | 7.28460                             | 0.94051 | 0.98  | 0.0729  | 87                         |
| All Species                       | Green                        | 3.23553                             | 1.22507 | 5.38233                             | 1.11895 | 0.99  | 0.0918  | 486                        |
|                                   | Dry                          | 1.86650                             | 1.23090 | 4.03918                             | 1.06993 | 0.99  | 0.0922  | 486                        |
| <b>TOTAL-STEM WOOD</b>            |                              |                                     |         |                                     |         |   |   |                            |
| Soft Hardwoods                    | Green                        | 2.42210                             | 1.27710 | 5.58303                             | 1.10297 | 0.98  | 0.1105  | 122                        |
|                                   | Dry                          | 1.38138                             | 1.25733 | 2.45365                             | 1.13754 | 0.98  | 0.1146  | 122                        |
| Sweetgum                          | Green                        | 2.29915                             | 1.29698 | 4.65394                             | 1.14994 | 0.99  | 0.0794  | 39                         |
|                                   | Dry                          | 1.09577                             | 1.30410 | 2.00097                             | 1.17854 | 0.99  | 0.0793  | 39                         |

Continued

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

| Species<br>or<br>species<br>group | Weight<br>green<br>or<br>dry | Regression equation coefficients |         |          |         | Coefficient<br>of<br>determination<br>(R <sup>2</sup> ) | Standard<br>error <sup>3</sup><br>(S <sub>y,x</sub> ) | No. of<br>trees<br>sampled |
|-----------------------------------|------------------------------|----------------------------------|---------|----------|---------|---|---|----------------------------|
|                                   |                              | a'                               | b       | a"       | b       |   |   |                            |
| Yellow-poplar                     | Green                        | 0.76350                          | 1.55963 | 17.93171 | 0.90147 | 0.98  | 0.0692  | 19                         |
|                                   | Dry                          | 0.23399                          | 1.68334 | 14.83040 | 0.81818 | 0.97  | 0.0808  | 19                         |
| Hard Hardwoods                    | Green                        | 2.63218                          | 1.23229 | 4.53964  | 1.11864 | 0.99  | 0.0942  | 364                        |
|                                   | Dry                          | 1.57213                          | 1.23710 | 3.99397  | 1.04269 | 0.99  | 0.0898  | 364                        |
| Hickory                           | Green                        | 2.05646                          | 1.25043 | 0.20302  | 1.73323 | 0.99  | 0.0766  | 37                         |
|                                   | Dry                          | 1.32501                          | 1.25430 | 0.17262  | 1.67926 | 0.99  | 0.0707  | 37                         |
| Post oak                          | Green                        | 2.29090                          | 1.23866 | 9.79069  | 0.93579 | 0.98  | 0.0651  | 26                         |
|                                   | Dry                          | 1.53010                          | 1.21644 | 5.81338  | 0.93810 | 0.98  | 0.0700  | 26                         |
| Scarlet oak                       | Green                        | 4.32486                          | 1.15311 | 2.47377  | 1.26959 | 0.97  | 0.0757  | 42                         |
|                                   | Dry                          | 2.86586                          | 1.12118 | 1.84078  | 1.21348 | 0.97  | 0.0727  | 42                         |
| South. red oak                    | Green                        | 2.28777                          | 1.27543 | 5.42999  | 1.09520 | 0.98  | 0.0532  | 34                         |
|                                   | Dry                          | 1.38511                          | 1.26487 | 4.17916  | 1.03460 | 0.98  | 0.0568  | 34                         |
| White oak                         | Green                        | 2.49577                          | 1.24221 | 10.84485 | 0.93588 | 0.98  | 0.0694  | 87                         |
|                                   | Dry                          | 1.66285                          | 1.22473 | 7.09486  | 0.92221 | 0.98  | 0.0711  | 87                         |
| All Species                       | Green                        | 2.59891                          | 1.24079 | 4.52737  | 1.12506 | 0.98  | 0.0993  | 486                        |
|                                   | Dry                          | 1.52322                          | 1.24211 | 3.56592  | 1.06475 | 0.99  | 0.0973  | 486                        |

<sup>1</sup>Trees < 11.0 inches d.b.h.

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

<sup>2</sup>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

<sup>3</sup>log<sub>10</sub> form

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

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

<sup>1</sup>Trees < 11.0 inches d.b.h.

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

<sup>2</sup>Trees ≥ 11.0 inches d.b.h.

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

Where: Y = component volume in cubic feet

D = tree d.b.h. in inches

a', a'', b = regression coefficients

<sup>3</sup>log<sub>10</sub> form

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

| Species<br>or<br>species<br>group | Volume<br>wood & bark<br>or<br>wood only | Regression equation coefficients    |         |                 |         | Coefficient<br>of<br>determination<br>(R <sup>2</sup> ) | Standard<br>error <sup>3</sup><br>(S <sub>y,x</sub> ) | No. of<br>trees<br>sampled |
|-----------------------------------|--|-------------------------------------|---------|-----------------|---------|---|---|----------------------------|
|                                   |  | Trees < 11.0 in d.b.h. <sup>1</sup> | b       | a" <sup>2</sup> | b       |   |   |                            |
| TOTAL STEM                        |  |                                     |         |                 |         |   |   |                            |
| Soft Hardwoods                    | Wd&Bk                                    | 0.05285                             | 1.26575 | 0.10311         | 1.12640 | 0.99  | 0.0960  | 122                        |
|                                   | Wood                                     | 0.04012                             | 1.29801 | 0.09175         | 1.12553 | 0.98  | 0.1011  | 122                        |
| Sweetgum                          | Wd&Bk                                    | 0.05325                             | 1.25934 | 0.06568         | 1.21561 | 0.99  | 0.0735  | 39                         |
|                                   | Wood                                     | 0.03900                             | 1.29651 | 0.06551         | 1.18838 | 0.99  | 0.0740  | 39                         |
| Yellow-poplar                     | Wd&Bk                                    | 0.01899                             | 1.55391 | 0.64612         | 0.81849 | 0.98  | 0.0581  | 19                         |
|                                   | Wood                                     | 0.01531                             | 1.56345 | 0.42596         | 0.86990 | 0.98  | 0.0604  | 19                         |
| Hard Hardwoods                    | Wd&Bk                                    | 0.05512                             | 1.21273 | 0.09808         | 1.09258 | 0.99  | 0.0821  | 364                        |
|                                   | Wood                                     | 0.04331                             | 1.22761 | 0.07816         | 1.10453 | 0.99  | 0.0862  | 364                        |
| Hickory                           | Wd&Bk                                    | 0.05852                             | 1.17801 | 0.00601         | 1.65242 | 0.99  | 0.0690  | 37                         |
|                                   | Wood                                     | 0.03863                             | 1.22470 | 0.00404         | 1.69525 | 0.99  | 0.0723  | 37                         |
| Post oak                          | Wd&Bk                                    | 0.04116                             | 1.25449 | 0.19370         | 0.93155 | 0.99  | 0.0556  | 26                         |
|                                   | Wood                                     | 0.03094                             | 1.27574 | 0.15933         | 0.93402 | 0.99  | 0.0549  | 26                         |
| Scarlet oak                       | Wd&Bk                                    | 0.09125                             | 1.12148 | 0.05567         | 1.22451 | 0.98  | 0.0638  | 42                         |
|                                   | Wood                                     | 0.06949                             | 1.14390 | 0.04285         | 1.24474 | 0.98  | 0.0657  | 42                         |
| South. red oak                    | Wd&Bk                                    | 0.04733                             | 1.26251 | 0.15024         | 1.02168 | 0.99  | 0.0465  | 34                         |
|                                   | Wood                                     | 0.03824                             | 1.26097 | 0.10149         | 1.05743 | 0.98  | 0.0514  | 34                         |
| White oak                         | Wd&Bk                                    | 0.05719                             | 1.18974 | 0.13923         | 1.00422 | 0.98  | 0.0673  | 87                         |
|                                   | Wood                                     | 0.03973                             | 1.23985 | 0.12270         | 1.00472 | 0.99  | 0.0645  | 87                         |
| All Species                       | Wd&Bk                                    | 0.05522                             | 1.22243 | 0.09217         | 1.11561 | 0.99  | 0.0903  | 486                        |
|                                   | Wood                                     | 0.04319                             | 1.24059 | 0.07394         | 1.12846 | 0.99  | 0.0962  | 486                        |

<sup>1</sup>Trees < 11.0 inches d.b.h.

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

<sup>2</sup>Trees > 11.0 inches d.b.h.

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

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

<sup>3</sup>log<sub>10</sub> form

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

| Species or species group           | Weight green or dry | Regression equation coefficients    |         |  |         |                |      | Coefficient of determination ( $R^2$ ) | Standard error <sup>3</sup> ( $S_{y,x}$ ) | No. of trees sampled |
|------------------------------------|---------------------|-------------------------------------|---------|--|---------|----------------|------|--|---|----------------------|
|                                    |                     | Trees < 11.0 in d.b.h. <sup>1</sup> |         | Trees $\geq$ 11.0 in d.b.h. <sup>2</sup> |         | a <sup>"</sup> | b    |  |   |                      |
| TOTAL-TREE WOOD, BARK, AND FOLIAGE |                     |                                     |         |  |         |                |      |  |   |                      |
| Soft Hardwoods                     | Green               | 0.36115                             | 0.89632 | 0.14042                                  | 1.09330 | 0.89632        | 0.99 | 0.0875                                 | 122                                       | 122                  |
|                                    | Dry                 | 0.20927                             | 0.88203 | 0.06179                                  | 1.13639 | 0.88203        | 0.98 | 0.0965                                 | 122                                       |                      |
| Sweetgum                           | Green               | 0.23532                             | 0.94646 | 0.06941                                  | 1.20103 | 0.94646        | 0.99 | 0.0526                                 | 39  | 39                   |
|                                    | Dry                 | 0.10413                             | 0.95735 | 0.02658                                  | 1.24205 | 0.95735        | 0.99 | 0.0515                                 | 39  |                      |
| Yellow-poplar                      | Green               | 0.23024                             | 0.94707 | 0.12145                                  | 1.08044 | 0.94707        | 0.98 | 0.0678                                 | 19  | 19                   |
|                                    | Dry                 | 0.05927                             | 1.02331 | 0.06152                                  | 1.01555 | 1.02331        | 0.98 | 0.0715                                 | 19  |                      |
| Hard Hardwoods                     | Green               | 0.31320                             | 0.93858 | 0.10004                                  | 1.17655 | 0.93858        | 0.99 | 0.0823                                 | 364                                       | 364                  |
|                                    | Dry                 | 0.16886                             | 0.95281 | 0.07269                                  | 1.12855 | 0.95281        | 0.99 | 0.0792                                 | 364                                       |                      |
| Hickory                            | Green               | 0.36164                             | 0.91033 | 0.01704                                  | 1.54726 | 0.91033        | 0.99 | 0.0854                                 | 37  | 37                   |
|                                    | Dry                 | 0.20243                             | 0.92544 | 0.01344                                  | 1.49088 | 0.92544        | 0.99 | 0.0895                                 | 37  |                      |
| Post oak                           | Green               | 0.19430                             | 1.00662 | 0.23601                                  | 0.96607 | 1.00662        | 0.98 | 0.0609                                 | 26  | 26                   |
|                                    | Dry                 | 0.12835                             | 0.99690 | 0.14308                                  | 0.97425 | 0.99690        | 0.98 | 0.0647                                 | 26  |                      |
| Scarlet oak                        | Green               | 0.21961                             | 0.99568 | 0.18321                                  | 1.03347 | 0.99568        | 0.99 | 0.0420                                 | 42  | 42                   |
|                                    | Dry                 | 0.14984                             | 0.97802 | 0.13591                                  | 0.99836 | 0.97802        | 0.99 | 0.0432                                 | 42  |                      |
| South. red oak                     | Green               | 0.11897                             | 1.04858 | 0.06815                                  | 1.16476 | 1.04858        | 0.98 | 0.0554                                 | 34  | 34                   |
|                                    | Dry                 | 0.06592                             | 1.05647 | 0.04590                                  | 1.13197 | 1.05647        | 0.98 | 0.0572                                 | 34  |                      |
| White oak                          | Green               | 0.25611                             | 0.96644 | 0.18888                                  | 1.02993 | 0.96644        | 0.99 | 0.0562                                 | 87  | 87                   |
|                                    | Dry                 | 0.16690                             | 0.95837 | 0.11699                                  | 1.03246 | 0.95837        | 0.99 | 0.0569                                 | 87  |                      |
| All Species                        | Green               | 0.32574                             | 0.92803 | 0.11479                                  | 1.14552 | 0.92803        | 0.99 | 0.0914                                 | 486                                       | 486                  |
|                                    | Dry                 | 0.17932                             | 0.93579 | 0.07785                                  | 1.10977 | 0.93579        | 0.98 | 0.1046                                 | 486                                       |                      |
| TOTAL-TREE WOOD AND BARK           |                     |                                     |         |  |         |                |      |  |   |                      |
| Soft Hardwoods                     | Green               | 0.32357                             | 0.90550 | 0.13065                                  | 1.09460 | 0.90550        | 0.99 | 0.0876                                 | 122                                       | 122                  |
|                                    | Dry                 | 0.19618                             | 0.88726 | 0.05924                                  | 1.13694 | 0.88726        | 0.98 | 0.0968                                 | 122                                       |                      |

Continued

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

| Species<br>or<br>species<br>group | Weight<br>green<br>or<br>dry | Regression equation coefficients    |         |         |                                     |         |      | Coefficient<br>of<br>determination<br>(R <sup>2</sup> ) | Standard<br>error <sup>3</sup><br>(S <sub>y,x</sub> ) | No. of<br>trees<br>sampled |  |  |  |
|-----------------------------------|------------------------------|-------------------------------------|---------|---------|-------------------------------------|---------|------|---|---|----------------------------|--|--|--|
|                                   |                              | Trees < 11.0 in d.b.h. <sup>1</sup> |         |         | Trees ≥ 11.0 in d.b.h. <sup>2</sup> |         |      |   |   |                            |  |  |  |
|                                   |                              | a'                                  | b       | a''     | b                                   | c       |      |   |   |                            |  |  |  |
| Sweetgum                          | Green                        | 0.21394                             | 0.95284 | 0.06248 | 1.20951                             | 0.95284 | 0.99 | 0.0478  | 39  |                            |  |  |  |
|                                   | Dry                          | 0.09695                             | 0.96283 | 0.02517 | 1.24401                             | 0.96283 | 0.99 | 0.0487  | 39  |                            |  |  |  |
| Yellow-poplar                     | Green                        | 0.20548                             | 0.95804 | 0.11558 | 1.07802                             | 0.95804 | 0.98 | 0.0657  | 19  |                            |  |  |  |
|                                   | Dry                          | 0.05501                             | 1.03065 | 0.05976 | 1.01336                             | 1.03065 | 0.98 | 0.0704  | 19  |                            |  |  |  |
| Hard Hardwoods                    | Green                        | 0.27912                             | 0.94699 | 0.09209 | 1.17821                             | 0.94699 | 0.99 | 0.0800  | 364   |                            |  |  |  |
|                                   | Dry                          | 0.15731                             | 0.95736 | 0.06728 | 1.13448                             | 0.95736 | 0.99 | 0.0777  | 364   |                            |  |  |  |
| Hickory                           | Green                        | 0.29833                             | 0.92890 | 0.01769 | 1.51800                             | 0.92890 | 0.99 | 0.0809  | 37  |                            |  |  |  |
|                                   | Dry                          | 0.17792                             | 0.93778 | 0.01385 | 1.46999                             | 0.93778 | 0.99 | 0.0868  | 37  |                            |  |  |  |
| Post oak                          | Green                        | 0.18791                             | 1.00655 | 0.22936 | 0.96498                             | 1.00655 | 0.98 | 0.0611  | 26  |                            |  |  |  |
|                                   | Dry                          | 0.12487                             | 0.99690 | 0.14035 | 0.97254                             | 0.99690 | 0.98 | 0.0649  | 26  |                            |  |  |  |
| Scarlet oak                       | Green                        | 0.19944                             | 1.00199 | 0.16245 | 1.04476                             | 1.00199 | 0.99 | 0.0426  | 42  |                            |  |  |  |
|                                   | Dry                          | 0.13874                             | 0.98382 | 0.12294 | 1.00904                             | 0.98382 | 0.99 | 0.0430  | 42  |                            |  |  |  |
| South. red oak                    | Green                        | 0.11014                             | 1.05261 | 0.06056 | 1.17735                             | 1.05261 | 0.98 | 0.0558  | 34  |                            |  |  |  |
|                                   | Dry                          | 0.06299                             | 1.05871 | 0.04188 | 1.14380                             | 1.05871 | 0.98 | 0.0572  | 34  |                            |  |  |  |
| White oak                         | Green                        | 0.23948                             | 0.96887 | 0.17887 | 1.02972                             | 0.96887 | 0.99 | 0.0593  | 87  |                            |  |  |  |
|                                   | Dry                          | 0.15919                             | 0.95963 | 0.11236 | 1.03227                             | 0.95963 | 0.99 | 0.0593  | 87  |                            |  |  |  |
| All Species                       | Green                        | 0.29055                             | 0.93665 | 0.10571 | 1.14747                             | 0.93665 | 0.99 | 0.0892  | 486   |                            |  |  |  |
|                                   | Dry                          | 0.16723                             | 0.94050 | 0.07249 | 1.11482                             | 0.94050 | 0.98 | 0.1028  | 486   |                            |  |  |  |
| <b>TOTAL-TREE WOOD</b>            |                              |                                     |         |         |                                     |         |      |   |   |                            |  |  |  |
| Soft Hardwoods                    | Green                        | 0.23621                             | 0.92468 | 0.11041 | 1.08326                             | 0.92468 | 0.99 | 0.0923  | 122   |                            |  |  |  |
|                                   | Dry                          | 0.14172                             | 0.90909 | 0.05020 | 1.12550                             | 0.90909 | 0.98 | 0.1007  | 122   |                            |  |  |  |
| Sweetgum                          | Green                        | 0.15232                             | 0.97556 | 0.05739 | 1.17910                             | 0.97556 | 0.99 | 0.0485  | 39  |                            |  |  |  |
|                                   | Dry                          | 0.07191                             | 0.98024 | 0.02313 | 1.21678                             | 0.98024 | 0.99 | 0.0492  | 39  |                            |  |  |  |
| Yellow-poplar                     | Green                        | 0.14161                             | 0.97772 | 0.07582 | 1.10797                             | 0.97772 | 0.98 | 0.0653  | 19  |                            |  |  |  |
|                                   | Dry                          | 0.03583                             | 1.06110 | 0.04203 | 1.02780                             | 1.06110 | 0.98 | 0.0719  | 19  |                            |  |  |  |

Continued

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

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

<sup>1</sup>Trees < 11.0 inches d.b.h.

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

<sup>2</sup>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

<sup>3</sup>log<sub>10</sub> form

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

| Species or species group        | Weight green or dry | Regression equation coefficients    |         |  |         |         | Coefficient of determination ( $R^2$ ) | Standard error <sup>3</sup> ( $S_{y,x}$ ) | No. of trees sampled |
|---------------------------------|---------------------|-------------------------------------|---------|--|---------|---------|--|---|----------------------|
|                                 |                     | Trees < 11.0 in d.b.h. <sup>1</sup> |         | Trees $\geq$ 11.0 in d.b.h. <sup>2</sup> |         |         |  |   |                      |
|                                 |                     | a'                                  | b       | a''                                      | b       | c       |  |   |                      |
| <b>TOTAL-STEM WOOD AND BARK</b> |                     |                                     |         |  |         |         |  |   |                      |
| Soft Hardwoods                  | Green               | 0.25113                             | 0.91865 | 0.22629                                  | 0.94037 | 0.91865 | 0.99                                   | 0.0718                                    | 122                  |
|                                 | Dry                 | 0.15247                             | 0.90026 | 0.10080                                  | 0.98656 | 0.90026 | 0.99                                   | 0.0787                                    | 122                  |
| Sweetgum                        | Green               | 0.19936                             | 0.94686 | 0.10475                                  | 1.08105 | 0.94686 | 0.99                                   | 0.0436                                    | 39                   |
|                                 | Dry                 | 0.08996                             | 0.95762 | 0.04268                                  | 1.11308 | 0.95762 | 0.99                                   | 0.0443                                    | 39                   |
| Yellow-poplar                   | Green               | 0.12997                             | 1.00023 | 0.33457                                  | 0.80307 | 1.00023 | 0.99                                   | 0.0550                                    | 19                   |
|                                 | Dry                 | 0.03353                             | 1.07770 | 0.17805                                  | 0.72957 | 1.07770 | 0.98                                   | 0.0615                                    | 19                   |
| Hard Hardwoods                  | Green               | 0.22328                             | 0.94509 | 0.14030                                  | 1.04198 | 0.94509 | 0.99                                   | 0.0634                                    | 364                  |
|                                 | Dry                 | 0.12731                             | 0.95389 | 0.11160                                  | 0.98135 | 0.95389 | 0.99                                   | 0.0620                                    | 364                  |
| Hickory                         | Green               | 0.28445                             | 0.90361 | 0.02884                                  | 1.38086 | 0.90361 | 0.99                                   | 0.0639                                    | 37                   |
|                                 | Dry                 | 0.16984                             | 0.91313 | 0.02461                                  | 1.31586 | 0.91313 | 0.99                                   | 0.0709                                    | 37                   |
| Post oak                        | Green               | 0.14156                             | 1.00641 | 0.26456                                  | 0.87602 | 1.00641 | 0.99                                   | 0.0479                                    | 26                   |
|                                 | Dry                 | 0.09446                             | 0.99578 | 0.16531                                  | 0.87908 | 0.99578 | 0.99                                   | 0.0505                                    | 26                   |
| Scarlet oak                     | Green               | 0.21820                             | 0.96294 | 0.19784                                  | 0.98336 | 0.96294 | 0.99                                   | 0.0396                                    | 42                   |
|                                 | Dry                 | 0.15824                             | 0.93801 | 0.15837                                  | 0.93784 | 0.93801 | 0.99                                   | 0.0361                                    | 42                   |
| South. red oak                  | Green               | 0.08848                             | 1.05729 | 0.13946                                  | 0.96242 | 1.05729 | 0.99                                   | 0.0420                                    | 34                   |
|                                 | Dry                 | 0.05008                             | 1.06363 | 0.10728                                  | 0.90476 | 1.06363 | 0.99                                   | 0.0422                                    | 34                   |
| White oak                       | Green               | 0.23197                             | 0.94188 | 0.22015                                  | 0.95278 | 0.94188 | 0.99                                   | 0.0462                                    | 87                   |
|                                 | Dry                 | 0.15699                             | 0.93059 | 0.14218                                  | 0.95124 | 0.93059 | 0.99                                   | 0.0462                                    | 87                   |
| All Species                     | Green               | 0.23039                             | 0.93834 | 0.16198                                  | 1.01179 | 0.93834 | 0.99                                   | 0.0687                                    | 486                  |
|                                 | Dry                 | 0.13342                             | 0.94104 | 0.11762                                  | 0.96734 | 0.94104 | 0.99                                   | 0.0799                                    | 486                  |
| <b>TOTAL-STEM WOOD</b>          |                     |                                     |         |  |         |         |  |   |                      |
| Soft Hardwoods                  | Green               | 0.18724                             | 0.93840 | 0.19494                                  | 0.93000 | 0.93840 | 0.99                                   | 0.0799                                    | 122                  |
|                                 | Dry                 | 0.11114                             | 0.92387 | 0.09026                                  | 0.96727 | 0.92387 | 0.99                                   | 0.0865                                    | 122                  |
| Sweetgum                        | Green               | 0.14291                             | 0.97154 | 0.09876                                  | 1.04859 | 0.97154 | 0.99                                   | 0.0465                                    | 39                   |
|                                 | Dry                 | 0.06718                             | 0.97669 | 0.04150                                  | 1.07713 | 0.97669 | 0.99                                   | 0.0467                                    | 39                   |

Continued

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

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

<sup>1</sup>Trees < 11.0 inches d.b.h.

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

<sup>2</sup>Trees ≥ 11.0 inches d.b.h.

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

Where: Y = component weight in pounds

D = tree d.b.h. in inches

Th = tree total height in feet

a', a'', b, c = regression coefficients

<sup>3</sup>log<sub>10</sub> form

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

| Species<br>or<br>species<br>group | Volume<br>wood & bark<br>or<br>wood only | Regression equation coefficients    |         |                                     |         |         |      | Coefficient<br>of<br>determination<br>(R <sup>2</sup> ) | Standard<br>error <sup>3</sup><br>(S <sub>y,x</sub> ) | No. of<br>trees<br>sampled |
|-----------------------------------|--|-------------------------------------|---------|-------------------------------------|---------|---------|------|---|---|----------------------------|
|                                   |  | Trees < 11.0 in d.b.h. <sup>1</sup> |         | Trees ≥ 11.0 in d.b.h. <sup>2</sup> |         | a"      | b    | c   |   |                            |
| TOTAL TREE                        |  |                                     |         |                                     |         |         |      |   |   |                            |
| Soft Hardwoods                    | Wd&Bk                                    | 0.00555                             | 0.91352 | 0.00225                             | 1.10191 | 0.91352 | 0.99 | 0.0774  | 122   |                            |
|                                   | Wood                                     | 0.00385                             | 0.93723 | 0.00178                             | 1.09782 | 0.93723 | 0.99 | 0.0769  | 122   |                            |
| Sweetgum                          | Wd&Bk                                    | 0.00390                             | 0.94730 | 0.00099                             | 1.23425 | 0.94730 | 0.99 | 0.0451  | 39  |                            |
|                                   | Wood                                     | 0.00261                             | 0.97370 | 0.00085                             | 1.20700 | 0.97370 | 0.99 | 0.0451  | 39  |                            |
| Yellow-poplar                     | Wd&Bk                                    | 0.00388                             | 0.96524 | 0.00252                             | 1.05566 | 0.96524 | 0.99 | 0.0462  | 19  |                            |
|                                   | Wood                                     | 0.00282                             | 0.98015 | 0.00170                             | 1.08579 | 0.98015 | 0.99 | 0.0415  | 19  |                            |
| Hard Hardwoods                    | Wd&Bk                                    | 0.00486                             | 0.94018 | 0.00175                             | 1.15251 | 0.94018 | 0.99 | 0.0683  | 364   |                            |
|                                   | Wood                                     | 0.00358                             | 0.95048 | 0.00130                             | 1.16142 | 0.95048 | 0.99 | 0.0662  | 364   |                            |
| Hickory                           | Wd&Bk                                    | 0.00554                             | 0.91970 | 0.00033                             | 1.50669 | 0.91970 | 0.99 | 0.0909  | 37  |                            |
|                                   | Wood                                     | 0.00331                             | 0.94932 | 0.00020                             | 1.53200 | 0.94932 | 0.99 | 0.0776  | 37  |                            |
| Post oak                          | Wd&Bk                                    | 0.00294                             | 1.01112 | 0.00348                             | 0.97649 | 1.01112 | 0.99 | 0.0562  | 26  |                            |
|                                   | Wood                                     | 0.00202                             | 1.02657 | 0.00234                             | 0.99582 | 1.02657 | 0.99 | 0.0547  | 26  |                            |
| Scarlet oak                       | Wd&Bk                                    | 0.00333                             | 0.99473 | 0.00301                             | 1.01585 | 0.99473 | 0.99 | 0.0371  | 42  |                            |
|                                   | Wood                                     | 0.00233                             | 1.01241 | 0.00214                             | 1.03074 | 1.01241 | 0.99 | 0.0396  | 42  |                            |
| South. red oak                    | Wd&Bk                                    | 0.00196                             | 1.04024 | 0.00125                             | 1.13479 | 1.04024 | 0.98 | 0.0535  | 34  |                            |
|                                   | Wood                                     | 0.00162                             | 1.03396 | 0.00090                             | 1.15637 | 1.03396 | 0.98 | 0.0554  | 34  |                            |
| White oak                         | Wd&Bk                                    | 0.00442                             | 0.95184 | 0.00241                             | 1.07811 | 0.95184 | 0.99 | 0.0513  | 87  |                            |
|                                   | Wood                                     | 0.00274                             | 0.98507 | 0.00171                             | 1.08362 | 0.98507 | 0.99 | 0.0492  | 87  |                            |
| All Species                       | Wd&Bk                                    | 0.00502                             | 0.93368 | 0.00192                             | 1.13430 | 0.93368 | 0.99 | 0.0724  | 486   |                            |
|                                   | Wood                                     | 0.00365                             | 0.94707 | 0.00142                             | 1.14365 | 0.94707 | 0.99 | 0.0694  | 486   |                            |

<sup>1</sup>Trees < 11.0 inches d.b.h.

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

<sup>2</sup>Trees ≥ 11.0 inches d.b.h.

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

Where: Y = component volume in cubic feet

D = tree d.b.h. in inches

Th = tree total height in feet

a', a'', b, c = regression coefficients

<sup>3</sup>log<sub>10</sub> form

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

| Species or species group | Volume wood & bark or wood only | Regression equation coefficients      |         |  |         |         |      | Coefficient of determination ( $R^2$ ) | Standard error <sup>3</sup> ( $S_{y,x}$ ) | No. of trees sampled |  |
|--------------------------|---------------------------------|---------------------------------------|---------|--|---------|---------|------|--|---|----------------------|--|
|                          |                                 | Trees $< 11.0$ in d.b.h. <sup>1</sup> |         | Trees $\geq 11.0$ in d.b.h. <sup>2</sup> |         |         |      |  |   |                      |  |
| Species or species group | Volume wood & bark or wood only | a''                                   | b       | a''                                      | b       | c       |      |  |   |                      |  |
| TOTAL STEM               |                                 |                                       |         |  |         |         |      |  |   |                      |  |
| Soft Hardwoods           | Wd&Bk                           | 0.00420                               | 0.92948 | 0.00368                                  | 0.95702 | 0.92948 | 0.99 | 0.0628                                 | 122                                       |                      |  |
|                          | Wood                            | 0.00297                               | 0.95403 | 0.00304                                  | 0.94878 | 0.95403 | 0.99 | 0.0632                                 | 122                                       |                      |  |
| Sweetgum                 | Wd&Bk                           | 0.00360                               | 0.94307 | 0.00156                                  | 1.11796 | 0.94307 | 0.99 | 0.0403                                 | 39  |                      |  |
|                          | Wood                            | 0.00244                               | 0.97048 | 0.00138                                  | 1.08898 | 0.97048 | 0.99 | 0.0407                                 | 39  |                      |  |
| Yellow-poplar            | Wd&Bk                           | 0.00237                               | 1.01242 | 0.00753                                  | 0.77123 | 1.01242 | 0.99 | 0.0427                                 | 19  |                      |  |
|                          | Wood                            | 0.00184                               | 1.02105 | 0.00487                                  | 0.81860 | 1.02105 | 0.99 | 0.0418                                 | 19  |                      |  |
| Hard Hardwoods           | Wd&Bk                           | 0.00381                               | 0.94038 | 0.00258                                  | 1.02144 | 0.94038 | 0.99 | 0.0545                                 | 364                                       |                      |  |
|                          | Wood                            | 0.00287                               | 0.95283 | 0.00198                                  | 1.03009 | 0.95283 | 0.99 | 0.0516                                 | 364                                       |                      |  |
| Hickory                  | Wd&Bk                           | 0.00529                               | 0.89334 | 0.00063                                  | 1.33677 | 0.89334 | 0.99 | 0.0795                                 | 37  |                      |  |
|                          | Wood                            | 0.00312                               | 0.93041 | 0.00039                                  | 1.36100 | 0.93041 | 0.99 | 0.0690                                 | 37  |                      |  |
| Post oak                 | Wd&Bk                           | 0.00215                               | 1.01535 | 0.00400                                  | 0.88621 | 1.01535 | 0.99 | 0.0474                                 | 26  |                      |  |
|                          | Wood                            | 0.00154                               | 1.03216 | 0.00308                                  | 0.88845 | 1.03216 | 0.99 | 0.0469                                 | 26  |                      |  |
| Scarlet oak              | Wd&Bk                           | 0.00382                               | 0.94928 | 0.00354                                  | 0.96525 | 0.94928 | 0.99 | 0.0352                                 | 42  |                      |  |
|                          | Wood                            | 0.00270                               | 0.96937 | 0.00258                                  | 0.97899 | 0.96937 | 0.99 | 0.0354                                 | 42  |                      |  |
| South. red oak           | Wd&Bk                           | 0.00159                               | 1.04400 | 0.00288                                  | 0.92004 | 1.04400 | 0.99 | 0.0390                                 | 34  |                      |  |
|                          | Wood                            | 0.00126                               | 1.04474 | 0.00195                                  | 0.95429 | 1.04474 | 0.99 | 0.0433                                 | 34  |                      |  |
| White oak                | Wd&Bk                           | 0.00418                               | 0.92756 | 0.00274                                  | 1.01548 | 0.92756 | 0.99 | 0.0388                                 | 87  |                      |  |
|                          | Wood                            | 0.00264                               | 0.96507 | 0.00204                                  | 1.01899 | 0.96507 | 0.99 | 0.0384                                 | 87  |                      |  |
| All Species              | Wd&Bk                           | 0.00391                               | 0.93764 | 0.00283                                  | 1.00487 | 0.93764 | 0.99 | 0.0568                                 | 486                                       |                      |  |
|                          | Wood                            | 0.00290                               | 0.95282 | 0.00218                                  | 1.01248 | 0.95282 | 0.99 | 0.0549                                 | 486                                       |                      |  |

<sup>1</sup>Trees  $< 11.0$  inches d.b.h.

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

<sup>2</sup>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

<sup>3</sup>log<sub>10</sub> form

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

| Species or species group                  | Weight green or dry | Regression equation coefficients    |         |                                     |         |         |      | Coefficient of determination ( $R^2$ ) | Standard error <sup>3</sup> ( $S_{y,x}$ ) | No. of trees sampled |  |  |  |
|---|---------------------|-------------------------------------|---------|-------------------------------------|---------|---------|------|--|---|----------------------|--|--|--|
|   |                     | Trees < 11.0 in d.b.h. <sup>1</sup> |         | Trees ≥ 11.0 in d.b.h. <sup>2</sup> |         |         |      |  |   |                      |  |  |  |
|   |                     | a'                                  | b       | a''                                 | b       | c       |      |  |   |                      |  |  |  |
| <b>TOTAL-TREE WOOD, BARK, AND FOLIAGE</b> |                     |                                     |         |                                     |         |         |      |  |   |                      |  |  |  |
| Soft Hardwoods                            | Green               | 3.54118                             | 0.66535 | 0.32725                             | 1.16192 | 0.66535 | 0.97 | 0.0836                                 | 82  |                      |  |  |  |
|   | Dry                 | 1.76873                             | 0.67019 | 0.16990                             | 1.15871 | 0.67019 | 0.97 | 0.0860                                 | 82  |                      |  |  |  |
| Sweetgum                                  | Green               | 2.89896                             | 0.68989 | 0.19264                             | 1.25524 | 0.68989 | 0.99 | 0.0552                                 | 29  |                      |  |  |  |
|   | Dry                 | 1.33772                             | 0.69653 | 0.07635                             | 1.29360 | 0.69653 | 0.99 | 0.0500                                 | 29  |                      |  |  |  |
| Yellow-poplar                             | Green               | 1.64985                             | 0.75147 | 0.22730                             | 1.16479 | 0.75147 | 0.98 | 0.0699                                 | 19  |                      |  |  |  |
|   | Dry                 | 0.48641                             | 0.81473 | 0.12289                             | 1.10159 | 0.81473 | 0.98 | 0.0706                                 | 19  |                      |  |  |  |
| Hard Hardwoods                            | Green               | 3.90351                             | 0.67938 | 0.30159                             | 1.21330 | 0.67938 | 0.97 | 0.0792                                 | 262                                       |                      |  |  |  |
|   | Dry                 | 2.44712                             | 0.67450 | 0.20537                             | 1.19117 | 0.67450 | 0.97 | 0.0749                                 | 262                                       |                      |  |  |  |
| Hickory                                   | Green               | 4.74083                             | 0.65169 | 0.07900                             | 1.50544 | 0.65169 | 0.98 | 0.0715                                 | 22  |                      |  |  |  |
|   | Dry                 | 3.02318                             | 0.64985 | 0.05637                             | 1.48016 | 0.64985 | 0.98 | 0.0734                                 | 22  |                      |  |  |  |
| Post oak                                  | Green               | 2.65935                             | 0.73349 | 0.85732                             | 0.96954 | 0.73349 | 0.99 | 0.0561                                 | 26  |                      |  |  |  |
|   | Dry                 | 1.70907                             | 0.72670 | 0.51422                             | 0.97714 | 0.72670 | 0.98 | 0.0598                                 | 26  |                      |  |  |  |
| Scarlet oak                               | Green               | 2.62263                             | 0.74803 | 0.52781                             | 1.08232 | 0.74803 | 0.98 | 0.0593                                 | 41  |                      |  |  |  |
|   | Dry                 | 1.65131                             | 0.73922 | 0.38845                             | 1.04097 | 0.73922 | 0.98 | 0.0573                                 | 41  |                      |  |  |  |
| South. red oak                            | Green               | 3.76756                             | 0.68697 | 0.27921                             | 1.22957 | 0.68697 | 0.98 | 0.0636                                 | 34  |                      |  |  |  |
|   | Dry                 | 2.11764                             | 0.69359 | 0.19065                             | 1.19562 | 0.69359 | 0.98 | 0.0642                                 | 34  |                      |  |  |  |
| White oak                                 | Green               | 3.31255                             | 0.69981 | 0.58930                             | 1.05982 | 0.69981 | 0.98 | 0.0603                                 | 75  |                      |  |  |  |
|   | Dry                 | 2.27314                             | 0.68385 | 0.34213                             | 1.07873 | 0.68385 | 0.98 | 0.0638                                 | 75  |                      |  |  |  |
| All Species                               | Green               | 4.04651                             | 0.66876 | 0.31363                             | 1.20201 | 0.66876 | 0.96 | 0.0897                                 | 344                                       |                      |  |  |  |
|   | Dry                 | 2.48892                             | 0.66273 | 0.20442                             | 1.18390 | 0.66273 | 0.94 | 0.1032                                 | 344                                       |                      |  |  |  |
| <b>TOTAL-TREE WOOD AND BARK</b>           |                     |                                     |         |                                     |         |         |      |  |   |                      |  |  |  |
| Soft Hardwoods                            | Green               | 3.07487                             | 0.67891 | 0.31725                             | 1.15252 | 0.67891 | 0.97 | 0.0808                                 | 82  |                      |  |  |  |
|   | Dry                 | 1.62822                             | 0.67795 | 0.16680                             | 1.15304 | 0.67795 | 0.97 | 0.0845                                 | 82  |                      |  |  |  |

Continued

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

| Species or species group | Weight green or dry | Regression equation coefficients    |         |  |         |         |      | Coefficient of determination ( $R^2$ ) | Standard error <sup>3</sup> ( $S_{y,x}$ ) | No. of trees sampled |
|--------------------------|---------------------|-------------------------------------|---------|--|---------|---------|------|--|---|----------------------|
|                          |                     | Trees < 11.0 in d.b.h. <sup>1</sup> |         | Trees $\geq$ 11.0 in d.b.h. <sup>2</sup> |         | a'      | b    |  |   |                      |
|                          |                     | a'                                  | b       | a''                                      | b       |         |      |  |   |                      |
| Sweetgum                 | Green               | 2.59048                             | 0.69929 | 0.18286                                  | 1.25204 | 0.69929 | 0.99 | 0.0520                                 | 29  |                      |
|                          | Dry                 | 1.23894                             | 0.70331 | 0.07481                                  | 1.28862 | 0.70331 | 0.99 | 0.0485                                 | 29  |                      |
| Yellow-poplar            | Green               | 1.50540                             | 0.76027 | 0.21799                                  | 1.16320 | 0.76027 | 0.98 | 0.0678                                 | 19  |                      |
|                          | Dry                 | 0.45786                             | 0.82067 | 0.12004                                  | 1.09982 | 0.82067 | 0.98 | 0.0693                                 | 19  |                      |
| Hard Hardwoods           | Green               | 3.68781                             | 0.68079 | 0.27341                                  | 1.22330 | 0.68079 | 0.97 | 0.0795                                 | 262                                       |                      |
|                          | Dry                 | 2.32058                             | 0.67712 | 0.19005                                  | 1.19889 | 0.67712 | 0.97 | 0.0754                                 | 262                                       |                      |
| Hickory                  | Green               | 4.28859                             | 0.65886 | 0.07706                                  | 1.49689 | 0.65886 | 0.98 | 0.0710                                 | 22  |                      |
|                          | Dry                 | 2.82527                             | 0.65455 | 0.05547                                  | 1.47412 | 0.65455 | 0.98 | 0.0740                                 | 22  |                      |
| Post oak                 | Green               | 2.56866                             | 0.73359 | 0.83382                                  | 0.96819 | 0.73359 | 0.99 | 0.0561                                 | 26  |                      |
|                          | Dry                 | 1.66112                             | 0.72683 | 0.50476                                  | 0.97521 | 0.72683 | 0.98 | 0.0598                                 | 26  |                      |
| Scarlet oak              | Green               | 2.40363                             | 0.75357 | 0.47158                                  | 1.09317 | 0.75357 | 0.98 | 0.0600                                 | 41  |                      |
|                          | Dry                 | 1.55375                             | 0.74338 | 0.35318                                  | 1.05229 | 0.74338 | 0.98 | 0.0578                                 | 41  |                      |
| South. red oak           | Green               | 3.57751                             | 0.68813 | 0.24867                                  | 1.24409 | 0.68813 | 0.98 | 0.0650                                 | 34  |                      |
|                          | Dry                 | 2.07055                             | 0.69313 | 0.17379                                  | 1.20977 | 0.69313 | 0.98 | 0.0656                                 | 34  |                      |
| White oak                | Green               | 3.26277                             | 0.69530 | 0.54277                                  | 1.06931 | 0.69530 | 0.98 | 0.0641                                 | 75  |                      |
|                          | Dry                 | 2.22303                             | 0.68177 | 0.32403                                  | 1.08332 | 0.68177 | 0.97 | 0.0664                                 | 75  |                      |
| All Species              | Green               | 3.73809                             | 0.67333 | 0.28657                                  | 1.20887 | 0.67333 | 0.96 | 0.0886                                 | 344                                       |                      |
|                          | Dry                 | 2.33910                             | 0.66674 | 0.19087                                  | 1.18927 | 0.66674 | 0.95 | 0.1021                                 | 344                                       |                      |
| <b>TOTAL-TREE WOOD</b>   |                     |                                     |         |  |         |         |      |  |   |                      |
| Soft Hardwoods           | Green               | 2.38544                             | 0.69084 | 0.25886                                  | 1.15392 | 0.69084 | 0.97 | 0.0832                                 | 82  |                      |
|                          | Dry                 | 1.24036                             | 0.69379 | 0.13922                                  | 1.14984 | 0.69379 | 0.97 | 0.0865                                 | 82  |                      |
| Sweetgum                 | Green               | 1.80713                             | 0.72679 | 0.19016                                  | 1.19629 | 0.72679 | 0.99 | 0.0518                                 | 29  |                      |
|                          | Dry                 | 0.86769                             | 0.72999 | 0.07943                                  | 1.22855 | 0.72999 | 0.99 | 0.0466                                 | 29  |                      |
| Yellow-poplar            | Green               | 1.08824                             | 0.77505 | 0.14425                                  | 1.19642 | 0.77505 | 0.98 | 0.0685                                 | 19  |                      |
|                          | Dry                 | 0.31915                             | 0.84430 | 0.08591                                  | 1.11796 | 0.84430 | 0.98 | 0.0716                                 | 19  |                      |

Continued

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

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

<sup>1</sup>Trees < 11.0 inches d.b.h.

$$Y = a'(D^2 H^4)^b$$

<sup>2</sup>Trees  $\geq$  11.0 inches d.b.h.

$$Y = a''(D^2)^b (H^4)^c$$

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

<sup>3</sup>log<sub>10</sub> form

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

| Species or species group        | Weight green or dry | Regression equation coefficients    |                |                                     |                |         |      | Coefficient of determination ( $R^2$ ) | Standard error <sup>3</sup> ( $S_{y,x}$ ) | No. of trees sampled |
|---------------------------------|---------------------|-------------------------------------|----------------|-------------------------------------|----------------|---------|------|--|---|----------------------|
|                                 |                     | Trees < 11.0 in d.b.h. <sup>1</sup> |                | Trees ≥ 11.0 in d.b.h. <sup>2</sup> |                |         |      |  |   |                      |
|                                 |                     | a <sup>1</sup>                      | b <sup>1</sup> | a <sup>2</sup>                      | b <sup>2</sup> | c       |      |  |   |                      |
| <b>TOTAL-STEM WOOD AND BARK</b> |                     |                                     |                |                                     |                |         |      |  |   |                      |
| Soft Hardwoods                  | Green               | 2.07910                             | 0.71004        | 0.60943                             | 0.96593        | 0.71004 | 0.98 | 0.0625                                 | 82  |                      |
|                                 | Dry                 | 1.09182                             | 0.71037        | 0.32012                             | 0.96620        | 0.71037 | 0.98 | 0.0641                                 | 82  |                      |
| Sweetgum                        | Green               | 2.28022                             | 0.70028        | 0.31865                             | 1.11062        | 0.70028 | 0.99 | 0.0421                                 | 29  |                      |
|                                 | Dry                 | 1.09326                             | 0.70418        | 0.13041                             | 1.14754        | 0.70418 | 0.99 | 0.0398                                 | 29  |                      |
| Yellow-poplar                   | Green               | 1.03987                             | 0.79370        | 0.64878                             | 0.89207        | 0.79370 | 0.98 | 0.0578                                 | 19  |                      |
|                                 | Dry                 | 0.30693                             | 0.85834        | 0.36959                             | 0.81960        | 0.85834 | 0.98 | 0.0599                                 | 19  |                      |
| Hard Hardwoods                  | Green               | 2.77076                             | 0.68663        | 0.41666                             | 1.08168        | 0.68663 | 0.97 | 0.0671                                 | 262                                       |                      |
|                                 | Dry                 | 1.76422                             | 0.68111        | 0.31325                             | 1.04152        | 0.68111 | 0.98 | 0.0615                                 | 262                                       |                      |
| Hickory                         | Green               | 3.97910                             | 0.63209        | 0.09718                             | 1.40614        | 0.63209 | 0.98 | 0.0610                                 | 22  |                      |
|                                 | Dry                 | 2.65333                             | 0.62698        | 0.07544                             | 1.36932        | 0.62698 | 0.98 | 0.0643                                 | 22  |                      |
| Post oak                        | Green               | 1.98856                             | 0.72994        | 0.94179                             | 0.88578        | 0.72994 | 0.99 | 0.0500                                 | 26  |                      |
|                                 | Dry                 | 1.28931                             | 0.72233        | 0.58096                             | 0.88855        | 0.72233 | 0.99 | 0.0523                                 | 26  |                      |
| Scarlet oak                     | Green               | 2.18326                             | 0.73512        | 0.55923                             | 1.01912        | 0.73512 | 0.98 | 0.0565                                 | 41  |                      |
|                                 | Dry                 | 1.43303                             | 0.72101        | 0.44084                             | 0.96682        | 0.72101 | 0.98 | 0.0504                                 | 41  |                      |
| South. red oak                  | Green               | 3.10349                             | 0.68362        | 0.56705                             | 1.03806        | 0.68362 | 0.98 | 0.0600                                 | 34  |                      |
|                                 | Dry                 | 1.77778                             | 0.68887        | 0.44099                             | 0.97955        | 0.68887 | 0.98 | 0.0594                                 | 34  |                      |
| White oak                       | Green               | 2.79743                             | 0.68171        | 0.64114                             | 0.98889        | 0.68171 | 0.99 | 0.0465                                 | 75  |                      |
|                                 | Dry                 | 1.92818                             | 0.66675        | 0.39235                             | 0.99875        | 0.66675 | 0.98 | 0.0484                                 | 75  |                      |
| All Species                     | Green               | 2.68331                             | 0.68754        | 0.44987                             | 1.05991        | 0.68754 | 0.97 | 0.0699                                 | 344                                       |                      |
|                                 | Dry                 | 1.67917                             | 0.68044        | 0.31739                             | 1.02781        | 0.68044 | 0.96 | 0.0794                                 | 344                                       |                      |
| <b>TOTAL-STEM WOOD</b>          |                     |                                     |                |                                     |                |         |      |  |   |                      |
| Soft Hardwoods                  | Green               | 1.70902                             | 0.71769        | 0.49111                             | 0.97771        | 0.71769 | 0.98 | 0.0659                                 | 82  |                      |
|                                 | Dry                 | 0.87647                             | 0.72227        | 0.27134                             | 0.96677        | 0.72227 | 0.98 | 0.0676                                 | 82  |                      |
| Sweetgum                        | Green               | 1.63635                             | 0.72702        | 0.33459                             | 1.05801        | 0.72702 | 0.99 | 0.0444                                 | 29  |                      |
|                                 | Dry                 | 0.78081                             | 0.73093        | 0.14543                             | 1.08137        | 0.73093 | 0.99 | 0.0388                                 | 29  |                      |

Continued

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

| Species<br>or<br>species<br>group | Weight<br>green<br>or<br>dry | Regression equation coefficients    |         |                                     |         |         | Coefficient<br>of<br>determination<br>(R <sup>2</sup> ) | Standard<br>error <sup>3</sup><br>(S <sub>y,x</sub> ) | No. of<br>trees<br>sampled |
|-----------------------------------|------------------------------|-------------------------------------|---------|-------------------------------------|---------|---------|---|---|----------------------------|
|                                   |                              | Trees < 11.0 in d.b.h. <sup>1</sup> |         | Trees ≥ 11.0 in d.b.h. <sup>2</sup> |         |         |   |   |                            |
|                                   |                              | a'                                  | b       | a''                                 | b       | c       |   |   |                            |
| Yellow-poplar                     | Green                        | 0.79244                             | 0.80460 | 0.39902                             | 0.94766 | 0.80460 | 0.98  | 0.0619  | 19                         |
|                                   | Dry                          | 0.22935                             | 0.87556 | 0.25336                             | 0.85480 | 0.87556 | 0.98  | 0.0642  | 19                         |
| Hard Hardwoods                    | Green                        | 2.26533                             | 0.69150 | 0.33301                             | 1.09129 | 0.69150 | 0.97  | 0.0688  | 262                        |
|                                   | Dry                          | 1.47634                             | 0.68238 | 0.27223                             | 1.03492 | 0.68238 | 0.98  | 0.0619  | 262                        |
| Hickory                           | Green                        | 3.08399                             | 0.63520 | 0.04897                             | 1.49902 | 0.63520 | 0.98  | 0.0662  | 22                         |
|                                   | Dry                          | 2.09622                             | 0.63019 | 0.03908                             | 1.46054 | 0.63019 | 0.98  | 0.0658  | 22                         |
| Post oak                          | Green                        | 1.70733                             | 0.72875 | 0.75914                             | 0.89775 | 0.72875 | 0.98  | 0.0571  | 26                         |
|                                   | Dry                          | 1.15250                             | 0.71499 | 0.47005                             | 0.90200 | 0.71499 | 0.98  | 0.0641  | 26                         |
| Scarlet oak                       | Green                        | 1.78669                             | 0.73961 | 0.41832                             | 1.04235 | 0.73961 | 0.98  | 0.0615  | 41                         |
|                                   | Dry                          | 1.16989                             | 0.72363 | 0.33083                             | 0.98699 | 0.72363 | 0.98  | 0.0560  | 41                         |
| South. red oak                    | Green                        | 2.57606                             | 0.68189 | 0.40428                             | 1.06804 | 0.68189 | 0.97  | 0.0633  | 34                         |
|                                   | Dry                          | 1.50390                             | 0.68060 | 0.32090                             | 1.00269 | 0.68060 | 0.97  | 0.0631  | 34                         |
| White oak                         | Green                        | 2.24862                             | 0.69226 | 0.52268                             | 0.99651 | 0.69226 | 0.99  | 0.0483  | 75                         |
|                                   | Dry                          | 1.56062                             | 0.67688 | 0.34497                             | 0.99161 | 0.67688 | 0.98  | 0.0490  | 75                         |
| All Species                       | Green                        | 2.18122                             | 0.69393 | 0.35901                             | 1.07015 | 0.69393 | 0.97  | 0.0704  | 344                        |
|                                   | Dry                          | 1.37237                             | 0.68583 | 0.27205                             | 1.02328 | 0.68583 | 0.97  | 0.0760  | 344                        |

<sup>1</sup>Trees < 11.0 inches d.b.h.

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

<sup>2</sup>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

<sup>3</sup>log<sub>10</sub> form

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

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

<sup>1</sup>Trees < 11.0 inches d.b.h.

$$Y = a'(D^2 H^4)^b$$

<sup>2</sup>Trees ≥ 11.0 inches d.b.h.

$$Y = a''(D^2)^b (H^4)^c$$

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

<sup>3</sup>log<sub>10</sub> form

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

| Species<br>or<br>species<br>group | Volume<br>wood & bark<br>or<br>wood only | Regression equation coefficients    |         |                                     |         |         |      | Coefficient<br>of<br>determination<br>(R <sup>2</sup> ) | Standard<br>error <sup>3</sup><br>(S <sub>y,x</sub> ) | No. of<br>trees<br>sampled |
|-----------------------------------|--|-------------------------------------|---------|-------------------------------------|---------|---------|------|---|---|----------------------------|
|                                   |  | Trees < 11.0 in d.b.h. <sup>1</sup> |         | Trees ≥ 11.0 in d.b.h. <sup>2</sup> |         | a'      | b    | a"  | b   | c                          |
| TOTAL STEM                        |  |                                     |         |                                     |         |         |      |   |   |                            |
| Soft Hardwoods                    | Wd&Bk                                    | 0.03536                             | 0.72107 | 0.01109                             | 0.96293 | 0.72107 | 0.99 |   | 0.0572  | 82                         |
|                                   | Wood                                     | 0.02779                             | 0.73273 | 0.00865                             | 0.97607 | 0.73273 | 0.99 |   | 0.0530  | 82                         |
| Sweetgum                          | Wd&Bk                                    | 0.04685                             | 0.67939 | 0.00419                             | 1.18259 | 0.67939 | 0.99 |   | 0.0404  | 29                         |
|                                   | Wood                                     | 0.03134                             | 0.71125 | 0.00433                             | 1.12420 | 0.71125 | 0.99 |   | 0.0340  | 29                         |
| Yellow-poplar                     | Wd&Bk                                    | 0.01870                             | 0.80795 | 0.01508                             | 0.85284 | 0.80795 | 0.99 |   | 0.0371  | 19                         |
|                                   | Wood                                     | 0.01494                             | 0.81393 | 0.00977                             | 0.90258 | 0.81393 | 0.99 |   | 0.0380  | 19                         |
| Hard Hardwoods                    | Wd&Bk                                    | 0.03875                             | 0.70805 | 0.00867                             | 1.02015 | 0.70805 | 0.98 |   | 0.0534  | 262                        |
|                                   | Wood                                     | 0.03026                             | 0.71687 | 0.00674                             | 1.03010 | 0.71687 | 0.98 |   | 0.0545  | 262                        |
| Hickory                           | Wd&Bk                                    | 0.05571                             | 0.66135 | 0.00308                             | 1.26495 | 0.66135 | 0.98 |   | 0.0683  | 22                         |
|                                   | Wood                                     | 0.04054                             | 0.67322 | 0.00174                             | 1.32929 | 0.67322 | 0.98 |   | 0.0703  | 22                         |
| Post oak                          | Wd&Bk                                    | 0.03103                             | 0.73612 | 0.01437                             | 0.89661 | 0.73612 | 0.99 |   | 0.0502  | 26                         |
|                                   | Wood                                     | 0.02348                             | 0.74714 | 0.01122                             | 0.90116 | 0.74714 | 0.99 |   | 0.0525  | 26                         |
| Scarlet oak                       | Wd&Bk                                    | 0.03454                             | 0.73300 | 0.01001                             | 0.99129 | 0.73300 | 0.98 |   | 0.0495  | 41                         |
|                                   | Wood                                     | 0.02744                             | 0.74010 | 0.00739                             | 1.01374 | 0.74010 | 0.98 |   | 0.0507  | 41                         |
| South. red oak                    | Wd&Bk                                    | 0.05216                             | 0.67748 | 0.01154                             | 0.99194 | 0.67748 | 0.98 |   | 0.0556  | 34                         |
|                                   | Wood                                     | 0.04169                             | 0.67796 | 0.00784                             | 1.02624 | 0.67796 | 0.98 |   | 0.0586  | 34                         |
| White oak                         | Wd&Bk                                    | 0.04575                             | 0.67960 | 0.00820                             | 1.03809 | 0.67960 | 0.99 |   | 0.0348  | 75                         |
|                                   | Wood                                     | 0.03448                             | 0.69609 | 0.00611                             | 1.05686 | 0.69609 | 0.99 |   | 0.0363  | 75                         |
| All Species                       | Wd&Bk                                    | 0.03809                             | 0.71052 | 0.00907                             | 1.00957 | 0.71052 | 0.98 |   | 0.0541  | 344                        |
|                                   | Wood                                     | 0.02957                             | 0.72099 | 0.00704                             | 1.02036 | 0.72099 | 0.98 |   | 0.0542  | 344                        |

<sup>1</sup>Trees < 11.0 inches d.b.h.

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

<sup>2</sup>Trees ≥ 11.0 inches d.b.h.

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

Where: Y = component volume in cubic feet

D = tree d.b.h. in inches

H4 = tree height to 4-inch top in feet

a', a'', b, c = regression coefficients

<sup>3</sup>log<sub>10</sub> form

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

| Species<br>or<br>species<br>group  | Weight<br>green<br>or<br>dry | Regression equation coefficients <sup>1</sup> |         |          | Coefficient<br>of<br>determination<br>(R <sup>2</sup> ) | Standard<br>error <sup>2</sup><br>(S <sub>y,x</sub> ) | No. of<br>trees<br>sampled |
|------------------------------------|------------------------------|---|---------|----------|---|---|----------------------------|
|                                    |                              | a   | b       | c        |   |   |                            |
| TOTAL-TREE WOOD, BARK, AND FOLIAGE |                              |   |         |          |   |   |                            |
| Soft Hardwoods                     | Green                        | 5.91933                                       | 0.96698 | 0.28273  | 0.76  | 0.0827  | 27                         |
|                                    | Dry                          | 4.89337                                       | 0.96429 | 0.16103  | 0.78  | 0.0725  | 27                         |
| Hard Hardwoods                     | Green                        | 4.34257                                       | 1.10688 | 0.19424  | 0.79  | 0.0906  | 64                         |
|                                    | Dry                          | 3.29859                                       | 1.06372 | 0.19016  | 0.82  | 0.0812  | 64                         |
| Scarlet oak                        | Green                        | 4.50008                                       | 1.26048 | -0.01801 | 0.90  | 0.0671  | 16                         |
|                                    | Dry                          | 3.48482                                       | 1.22997 | -0.06071 | 0.90  | 0.0664  | 16                         |
| South. red oak                     | Green                        | 4.25548                                       | 1.06916 | 0.29694  | 0.95  | 0.0430  | 17                         |
|                                    | Dry                          | 2.83728                                       | 1.04561 | 0.29471  | 0.94  | 0.0485  | 17                         |
| All Species                        | Green                        | 5.39733                                       | 1.11055 | 0.11443  | 0.78  | 0.0897  | 91                         |
|                                    | Dry                          | 5.14974                                       | 1.10864 | -0.03275 | 0.78  | 0.0869  | 91                         |
| TOTAL-TREE WOOD AND BARK           |                              |   |         |          |   |   |                            |
| Soft Hardwoods                     | Green                        | 5.71324                                       | 0.96349 | 0.2914   | 0.76  | 0.0834  | 27                         |
|                                    | Dry                          | 4.76444                                       | 0.96090 | 0.16921  | 0.78  | 0.0730  | 27                         |
| Hard Hardwoods                     | Green                        | 4.23125                                       | 1.10605 | 0.19293  | 0.79  | 0.0924  | 64                         |
|                                    | Dry                          | 3.24135                                       | 1.06483 | 0.18669  | 0.81  | 0.0834  | 64                         |
| Scarlet oak                        | Green                        | 4.37179                                       | 1.26034 | -0.01798 | 0.90  | 0.0671  | 16                         |
|                                    | Dry                          | 3.40532                                       | 1.23184 | -0.06136 | 0.89  | 0.0671  | 16                         |
| South. red oak                     | Green                        | 4.13143                                       | 1.06916 | 0.29694  | 0.95  | 0.0430  | 17                         |
|                                    | Dry                          | 2.79562                                       | 1.04562 | 0.29468  | 0.94  | 0.0485  | 17                         |
| All Species                        | Green                        | 5.13749                                       | 1.10571 | 0.12745  | 0.77  | 0.0907  | 91                         |
|                                    | Dry                          | 4.96493                                       | 1.10631 | -0.02442 | 0.77  | 0.0878  | 91                         |
| TOTAL-TREE WOOD                    |                              |   |         |          |   |   |                            |
| Soft Hardwoods                     | Green                        | 5.44089                                       | 0.96642 | 0.26127  | 0.75  | 0.0849  | 27                         |
|                                    | Dry                          | 4.42698                                       | 0.95742 | 0.15880  | 0.78  | 0.0717  | 27                         |
| Hard Hardwoods                     | Green                        | 2.71907                                       | 1.12091 | 0.24511  | 0.79  | 0.0945  | 64                         |
|                                    | Dry                          | 2.00532                                       | 1.06563 | 0.26913  | 0.80  | 0.0872  | 64                         |
| Scarlet oak                        | Green                        | 3.20591                                       | 1.28066 | -0.00997 | 0.87  | 0.0779  | 16                         |
|                                    | Dry                          | 2.51719                                       | 1.25444 | -0.06459 | 0.86  | 0.0793  | 16                         |
| South. red oak                     | Green                        | 2.96362                                       | 1.07662 | 0.32177  | 0.95  | 0.0472  | 17                         |
|                                    | Dry                          | 1.89340                                       | 1.05079 | 0.32947  | 0.92  | 0.0571  | 17                         |
| All Species                        | Green                        | 3.55229                                       | 1.10768 | 0.18087  | 0.77  | 0.0915  | 91                         |
|                                    | Dry                          | 3.23781                                       | 1.09063 | 0.07210  | 0.78  | 0.0868  | 91                         |

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

Where: Y = component weight in pounds

D = tree d.b.h. in inches

Mh = tree saw-log merchantable height in feet

a,b,c = regression coefficients

<sup>2</sup>log<sub>10</sub> form

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

| Species<br>or<br>species<br>group | Weight<br>green<br>or<br>dry | Regression equation coefficients <sup>1</sup> |         |         | Coefficient<br>of<br>determination<br>(R <sup>2</sup> ) | Standard<br>error <sup>2</sup><br>(S <sub>y,x</sub> ) | No. of<br>trees<br>sampled |
|-----------------------------------|------------------------------|---|---------|---------|---|---|----------------------------|
|                                   |                              | a   | b       | c       |   |   |                            |
| SAW-LOG STEM WOOD AND BARK        |                              |   |         |         |   |   |                            |
| Soft Hardwoods                    | Green                        | 0.67303                                       | 0.84073 | 0.90211 | 0.90  | 0.0666  | 27                         |
|                                   | Dry                          | 0.56427                                       | 0.83732 | 0.78145 | 0.90  | 0.0611  | 27                         |
| Hard Hardwoods                    | Green                        | -0.20187                                      | 0.98322 | 0.76167 | 0.88  | 0.0712  | 63                         |
|                                   | Dry                          | 0.50667                                       | 0.92670 | 0.76344 | 0.91  | 0.0571  | 63                         |
| Scarlet oak                       | Green                        | 0.74621                                       | 0.96120 | 0.78381 | 0.99  | 0.0177  | 15                         |
|                                   | Dry                          | 0.55653                                       | 0.93154 | 0.74518 | 0.99  | 0.0204  | 15                         |
| South. red oak                    | Green                        | 0.99274                                       | 0.72002 | 1.09571 | 0.96  | 0.0394  | 17                         |
|                                   | Dry                          | 0.69032                                       | 0.68510 | 1.09425 | 0.95  | 0.0447  | 17                         |
| All Species                       | Green                        | 0.81418                                       | 1.01247 | 0.62653 | 0.85  | 0.0777  | 90                         |
|                                   | Dry                          | 0.78474                                       | 0.99729 | 0.49733 | 0.84  | 0.0766  | 90                         |
| SAW-LOG STEM WOOD                 |                              |   |         |         |   |   |                            |
| Soft Hardwoods                    | Green                        | 0.67706                                       | 0.83804 | 0.87425 | 0.88  | 0.0699  | 27                         |
|                                   | Dry                          | 0.57297                                       | 0.82271 | 0.76992 | 0.90  | 0.0592  | 27                         |
| Hard Hardwoods                    | Green                        | 0.46094                                       | 0.98576 | 0.81067 | 0.88  | 0.0709  | 63                         |
|                                   | Dry                          | 0.35069                                       | 0.91487 | 0.84405 | 0.91  | 0.0608  | 63                         |
| Scarlet oak                       | Green                        | 0.63282                                       | 0.96894 | 0.77919 | 0.99  | 0.0182  | 15                         |
|                                   | Dry                          | 0.47509                                       | 0.93755 | 0.73525 | 0.99  | 0.0223  | 15                         |
| South. red oak                    | Green                        | 0.73337                                       | 0.73219 | 1.11587 | 0.96  | 0.0425  | 17                         |
|                                   | Dry                          | 0.49109                                       | 0.69192 | 1.12206 | 0.94  | 0.0516  | 17                         |
| All Species                       | Green                        | 0.63334                                       | 1.00616 | 0.66992 | 0.86  | 0.0761  | 90                         |
|                                   | Dry                          | 0.58154                                       | 0.97246 | 0.58073 | 0.85  | 0.0736  | 90                         |

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

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

<sup>2</sup>log<sub>10</sub> form

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

| Species<br>or<br>species<br>group | Volume<br>wood & bark<br>or<br>wood only | Regression equation coefficients <sup>1</sup> |         |          | Coefficient<br>of<br>determination<br>(R <sup>2</sup> ) | Standard<br>error <sup>2</sup><br>(S <sub>y,x</sub> ) | No. of<br>trees<br>sampled |
|-----------------------------------|--|---|---------|----------|---|---|----------------------------|
|                                   |  | a   | b       | c        |   |   |                            |
| TOTAL TREE                        |  |   |         |          |   |   |                            |
| Soft Hardwoods                    | Wd&Bk                                    | 0.10825                                       | 0.88495 | 0.40355  | 0.78  | 0.0773  | 27                         |
|                                   | Wood                                     | 0.10687                                       | 0.87712 | 0.37884  | 0.80  | 0.0712  | 27                         |
| Hard Hardwoods                    | Wd&Bk                                    | 0.08048                                       | 1.04004 | 0.25118  | 0.84  | 0.0741  | 64                         |
|                                   | Wood                                     | 0.04838                                       | 1.05517 | 0.31805  | 0.84  | 0.0771  | 64                         |
| Scarlet oak                       | Wd&Bk                                    | 0.08075                                       | 1.24411 | -0.04762 | 0.93  | 0.0537  | 16                         |
|                                   | Wood                                     | 0.05731                                       | 1.26574 | -0.03565 | 0.92  | 0.0596  | 16                         |
| South. red oak                    | Wd&Bk                                    | 0.08059                                       | 1.05753 | 0.24323  | 0.95  | 0.0441  | 17                         |
|                                   | Wood                                     | 0.05694                                       | 1.06597 | 0.26516  | 0.94  | 0.0481  | 17                         |
| All Species                       | Wd&Bk                                    | 0.08150                                       | 1.00491 | 0.30523  | 0.82  | 0.0745  | 91                         |
|                                   | Wood                                     | 0.05324                                       | 1.00093 | 0.38141  | 0.83  | 0.0754  | 91                         |

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

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

<sup>2</sup>log<sub>10</sub> form

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

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

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

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

<sup>2</sup>log<sub>10</sub> form

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

| Species        | Regression equation and coefficients <sup>1</sup> |         |          |            |         |          |
|----------------|---|---------|----------|------------|---------|----------|
|                | Green weight                                      |         |          | Dry weight |         |          |
|                | a   | b       | c        | a          | b       | c        |
| WOOD AND BARK  |   |         |          |            |         |          |
| Soft Hardwoods | -1.66655  | 4.50927 | -4.50649 | -1.59620   | 4.52339 | -4.50157 |
| Sweetgum       | -2.19544  | 4.75749 | -4.82010 | -2.07716   | 4.77234 | -4.80657 |
| Yellow-poplar  | -2.07710  | 4.79969 | -4.93471 | -1.97288   | 4.84199 | -4.95434 |
| Hard Hardwoods | -2.28360  | 4.46072 | -4.68636 | -2.23719   | 4.46112 | -4.67358 |
| Hickory        | -3.09629  | 4.28856 | -4.67482 | -3.10193   | 4.32745 | -4.70710 |
| Post oak       | -1.91840  | 4.08257 | -4.33818 | -1.91071   | 4.10398 | -4.35362 |
| Scarlet oak    | -1.95138  | 4.47389 | -4.71628 | -2.00681   | 4.41270 | -4.66309 |
| South. red oak | -3.77533  | 4.00045 | -4.43757 | -3.83036   | 3.96024 | -4.39942 |
| White oak      | -2.07303  | 4.96243 | -5.09445 | -2.03925   | 4.97981 | -5.10296 |
| All Species    | -2.15806  | 4.41291 | -4.60247 | -2.10097   | 4.42002 | -4.59413 |
| WOOD ONLY      |   |         |          |            |         |          |
| Soft Hardwoods | -1.58330  | 4.63552 | -4.60547 | -1.52136   | 4.63089 | -4.58383 |
| Sweetgum       | -2.03043  | 4.91715 | -4.93948 | -1.93715   | 4.91375 | -4.91348 |
| Yellow-poplar  | -2.15028  | 4.95273 | -5.09859 | -1.99918   | 4.96877 | -5.08179 |
| Hard Hardwoods | -2.22363  | 4.57247 | -4.78530 | -2.20462   | 4.55367 | -4.75886 |
| Hickory        | -3.08555  | 4.39543 | -4.77378 | -3.13482   | 4.40292 | -4.78594 |
| Post oak       | -1.83092  | 4.17275 | -4.40532 | -1.83838   | 4.18398 | -4.41261 |
| Scarlet oak    | -1.88930  | 4.56232 | -4.78981 | -1.97765   | 4.48821 | -4.73111 |
| South. red oak | -3.72423  | 4.09132 | -4.52401 | -3.85832   | 4.02836 | -4.47336 |
| White oak      | -1.96767  | 5.13852 | -5.24179 | -1.95384   | 5.13262 | -5.23190 |
| All Species    | -2.09586  | 4.52930 | -4.70413 | -2.05976   | 4.51731 | -4.68120 |

<sup>1</sup>Where:  $Y_R$  = stem weight to top d.o.b./total-stem weight ratio

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

D = tree diameter at breast height in inches

a,b,c = regression coefficients

e = 2.71828 (base of log E)

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

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

<sup>1</sup>Where:  $Y_R$  = stem volume to top d.o.b./total-stem volume ratio

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

D = tree diameter at breast height in inches

a,b,c = regression coefficients

e = 2.71828 (base of log E)

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

| Species        | Ratio equation and coefficients <sup>1</sup> |          |         |            |          |         |   |
|----------------|--|----------|---------|------------|----------|---------|---|
|                | Green weight                                 |          |         | Dry weight |          |         |   |
|                | a  | b        | c       |            | a        | b       | c |
| WOOD AND BARK  |  |          |         |            |          |         |   |
| Soft Hardwoods | 8.47209                                      | -0.87551 | 0.38432 | 11.59248   | -0.96035 | 0.36964 |   |
| Hard Hardwoods | 38.51019                                     | -1.42602 | 0.31682 | 41.82526   | -1.44736 | 0.32237 |   |
| Scarlet oak    | 4.91463                                      | -0.76090 | 0.29384 | 5.88406    | -0.80828 | 0.30559 |   |
| South. red oak | 10.40046                                     | -0.98021 | 0.30150 | 11.98108   | -1.01939 | 0.30963 |   |
| All Species    | 17.10465                                     | -1.14320 | 0.33495 | 20.83442   | -1.19897 | 0.33719 |   |
| WOOD ONLY      |  |          |         |            |          |         |   |
| Soft Hardwoods | 8.18203                                      | -0.87109 | 0.38393 | 11.13685   | -0.95361 | 0.37066 |   |
| Hard Hardwoods | 37.96981                                     | -1.42608 | 0.31456 | 37.98114   | -1.42243 | 0.31609 |   |
| Scarlet oak    | 4.72979                                      | -0.75216 | 0.29180 | 4.70978    | -0.74676 | 0.29296 |   |
| South. red oak | 10.13408                                     | -0.97664 | 0.29890 | 10.08205   | -0.97124 | 0.30035 |   |
| All Species    | 17.42472                                     | -1.16221 | 0.33146 | 19.26726   | -1.18010 | 0.33297 |   |

<sup>1</sup>Where:  $Y_R$  = ratio of stem weight to top d.o.b. saw-stem

Mh = saw-log merchantable height in feet

d = stem specified top diameter in inches

D = tree diameter at breast height in inches

.78 = constant based on average form class

a,b,c = regression coefficients

e = 2.71828 (base of log E)

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

| Species        | Ratio equation and coefficients <sup>1</sup> |          |         |           |          |         |
|----------------|--|----------|---------|-----------|----------|---------|
|                | Wood and bark                                |          |         | Wood only |          |         |
|                | a  | b        | c       | a         | b        | c       |
| Soft Hardwoods | 7.80439                                      | -0.86234 | 0.38757 | 7.35628   | -0.85166 | 0.38766 |
| Hard Hardwoods | 35.95983                                     | -1.41022 | 0.31304 | 39.34780  | -1.45316 | 0.30980 |
| Scarlet oak    | 3.88915                                      | -0.69449 | 0.28986 | 3.82096   | -0.69744 | 0.29027 |
| South. red oak | 7.42641                                      | -0.87619 | 0.29843 | 6.88938   | -0.85730 | 0.29543 |
| All Species    | 16.22161                                     | -1.13382 | 0.33255 | 15.94696  | -1.13532 | 0.33040 |

<sup>1</sup>Where:  $Y_R = \text{ratio of stem volume to top d.o.b. saw-stem}$

Mh = saw-log merchantable height in feet

d = stem specified top diameter in inches

D = tree diameter at breast height in inches

.78 = constant based on average form class

a,b,c = regression coefficients

e = 2.71828 (base of log E)



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

The weight, volume, and physical properties of trees 1 to 20 inches d.b.h. were determined for sweetgum, yellow-poplar, hickory, post oak, scarlet oak, southern red oak, and white oak in northern Alabama and Mississippi, eastern Arkansas, southern Kentucky and Tennessee. Hard hardwoods, soft hardwoods, and individual species equations are presented for predicting green and dry weight and green volume of the total tree above stump and its components. Input variables are d.b.h. and total height, d.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.

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

The weight, volume, and physical properties of trees 1 to 20 inches d.b.h. were determined for sweetgum, yellow-poplar, hickory, post oak, scarlet oak, southern red oak, and white oak in northern Alabama and Mississippi, eastern Arkansas, southern Kentucky and Tennessee. Hard hardwoods, soft hardwoods, and individual species equations are presented for predicting green and dry weight and green volume of the total tree above stump and its components. Input variables are d.b.h. and total height, d.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 Forest Service, U.S. Department of Agriculture, is dedicated to the principle of multiple use management of the Nation's forest resources for sustained yields of wood, water, forage, wildlife, and recreation. Through forestry research, cooperation with the States and private forest owners, and management of the National Forests and National Grasslands, it strives—as directed by Congress—to provide increasingly greater service to a growing Nation.

USDA policy does not permit discrimination because of race, color, national origin, sex or religion. Any person who believes he or she has been discriminated against in any USDA-related activity should write immediately to the Secretary of Agriculture, Washington, D.C. 20250.