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Predicted Weights and Volumes of Firewood in Hardwood Trees in the Southeast

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Conversion factors: English to metric

Multiply	*By*	*To obtain*
Inches	2.540	centimeters
Feet	.3048	meters
Pounds	.4536	kilograms
Cubic feet	.02832	cubic meters
Pounds per cubic foot	16.02	kilograms per cubic meter

All English units of measure in this report can be converted to metric units by multiplying by the appropriate conversion factor listed above.

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Predicted Weights and Volumes of Firewood in Hardwood Trees in the Southeast

by

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Utilization of Southern Timber
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Abstract.–Weights and volumes of firewood 4 inches d.o.b. or larger were determined for 247 hard hardwood and 257 soft hardwood trees from 5 to 28 inches d.b.h. growing in the Southeast. Equations are presented for predicting the green weight of wood and bark and volume of wood in firewood ≥ 4 inches d.o.b. in the total tree above stump, in the main stem to 4-inch top, and in topwood above the saw-log top. Equations predict weight and volume of firewood using d.b.h. and total height, d.b.h. and height to 4-inch top, d.b.h. and saw-log merchantable height, and d.b.h. alone. Tables developed from equations show weight in pounds and volume in cords of firewood in a tree and its components by d.b.h. and height classes.

Keywords: moisture content, specific gravity, yield tables, biomass, equations.

Heating houses and small commercial buildings with wood is again a common practice in the South. Poor-quality hardwoods and topwood from sawtimber-size trees are now harvested for firewood. Equations and yield tables for estimating the weight and volume of firewood in a tree are needed to assist in the equitable marketing of trees for firewood.

To evaluate the timber resource in the Southeast, foresters have conducted studies to collect total-tree component biomass data on the commercially important hard hardwoods–northern red oak (*Quercus rubra* L.), southern red oak (*Q. falcata* Michx.), scarlet oak (*Q. coccinea* Muenchh.), chestnut oak (*Q. prinus* L.), white oak (*Q. alba* L.), water oak (*Q. nigra* L.), and mockernut hickory (*Carya tomentosa* (Poir.) Nutt.), and soft hardwoods–yellow-poplar (*Liriodendron tulipifera* L.), sweetgum (*Liquidambar styraciflua* L.), blackgum (*Nyssa sylvatica* var. *biflora*), red maple (*Acer rubrum* L.), and white ash (*Fraxinus americana* L.) (Clark and others 1980, 1980a, 1980b; Clark and Schroeder 1977). In this paper the total-tree and component weight and volume data are used to develop equations for predicting green wood and bark weights and volumes for firewood 4 inches in diameter outside bark (d.o.b.) and larger in hard hardwood and soft hardwood trees growing in the Southeast. Equations and yield tables predict the weight and volume of firewood in the total tree above stump, in the main stem to 4-inch d.o.b. top, and in branches and stemwood above a saw-log top in sawtimber-size trees. The moisture content, specific gravity, and weight per cubic foot of firewood when harvested are also presented.

PROCEDURE

A total of 247 hard hardwood trees from 5 to 24 inches in diameter at breast height (d.b.h.) and 257 soft hardwood trees from 5 to 28 inches d.b.h. were sampled from various locations on five National Forests in the Southeast and in two counties in Tennessee (table 1). A stratified random sample of three to six trees per 2-inch d.b.h. class was selected at each location from uneven-aged, closed, mixed hardwood stands. Form class of the hard hardwood and soft hardwood sawtimber trees (trees ≥ 11.0 inches d.b.h) averaged 79. The hard hardwood trees ranged from 27 to 160 years old and averaged 72 years, and the soft hardwood trees ranged from 21 to 108 and averaged 54 years old. Means and ranges in dimension of sample trees are shown in table 1 by species and location.

Trees were felled and limbed during the winter, and the main stem of each sawtimber-size tree was bucked into merchantable saw logs 8 to 16 feet long to a 9-inch d.o.b. top or where a Forest Service grade 3 log stopped. Stem diameter inside bark (d.i.b.) at the saw-log top averaged 11.4 inches in the hard hardwoods and 10.5 inches in the soft hardwoods. All material between the saw-log merchantable top and the 4-inch d.o.b. top was classified as stem firewood. All trees had a discernible main stem of a 4-inch top. The stem above the 4-inch top and branches were considered crown. In pulpwood-size trees (trees 5.0 to 10.9 inches) the main stem was bucked at 4-inch d.o.b. top. Crowns of the sample trees were cut up and weighed in two categories: (1) branches ≥ 4.0 inches d.o.b. and (2) branches < 4.0 inches d.o.b. All crown material was

Table 1.--Means and ranges of tree measurements by species and location

Species	Location	Sample tree	D.b.h.		Total height		Height to 4-inch d.o.b. top		Height to saw-log merchantable top [1]		D.i.b. at saw-log merchantable top	
			Average	Range	Average	Range	Average	Range	Average	Range	Average	Range
		Number	-- Inches --		---------- Feet ----------						-- Inches --	
							HARD HARDWOODS					
Northern red oak	Pisgah N.F., NC	71	13.0	5.9-24.7	84	53-118	60	18-98	50	25-78	9.9	7.4-15.0
Southern red oak	Coffee Co., TN	29	12.5	5.4-22.0	70	53- 84	45	13-65	24	18-35	12.4	8.6-16.9
Scarlet oak	Cumberland Co., TN	28	12.1	5.1-20.0	73	50- 94	48	17-69	29	13-45	12.5	9.1-15.1
Chestnut oak	Nantahala N.F., NC	24	13.1	5.6-20.9	82	47-115	61	18-94	46	28-66	11.0	8.5-14.0
White oak	Nantahala N.F., NC	28	13.9	5.1-21.7	84	38-110	60	9-85	46	34-64	12.0	8.4-18.0
White oak	Oconee N.F., GA	23	12.8	5.6-20.9	71	47- 93	47	20-71	33	18-43	11.8	8.3-15.6
Water oak	Francis Marion N.F.,SC	17	12.6	5.2-20.0	72	38- 92	51	19-77	31	26-40	12.1	9.4-16.5
Hickory	Chattahoochee N.F.,GA	27	12.5	5.1-19.4	82	48-108	62	20-91	43	17-59	11.4	9.1-14.3
All hard hardwoods		247	12.9	5.1-24.7	78	38-118	56	9-98	40	13-78	11.4	7.4-16.9
							SOFT HARDWOODS					
Yellow-poplar	Nantahala N.F., NC	26	14.1	5.6-22.4	95	51-128	70	20-104	66	28- 84	10.4	8.4-16.3
Yellow-poplar	Pisgah N.F., NC	39	13.9	5.8-28.4	99	53-147	72	13-129	67	34-102	9.5	8.0-15.2
Yellow-poplar	Oconee N.F., GA	26	13.5	5.5-20.3	84	58-107	62	21- 89	46	24- 67	10.1	8.0-14.5
Yellow-poplar	Francis Marion N.F.,SC	26	12.6	5.5-20.9	82	51-103	60	26- 85	46	27- 56	10.5	8.5-15.0
Sweetgum	Oconee N.F., GA	24	13.1	5.7-20.7	82	48-101	57	17- 81	42	20- 59	10.1	8.1-14.4
Sweetgum	Francis Marion N.F.,SC	23	14.1	5.1-20.0	85	55-108	65	25- 91	45	29- 71	11.4	8.6-15.5
Blackgum	Francis Marion N.F.,SC	32	11.5	5.4-19.5	74	49-101	54	15- 85	38	20- 56	11.3	7.7-14.5
Red maple	Nantahala and Pisgah N.F., NC	30	10.5	5.1-16.8	72	47-104	45	12- 80	27	18- 50	11.0	8.0- 4.9
White ash	Chattahoochee N.F., GA	31	10.8	5.0-18.6	77	44-119	56	15-103	37	17- 73	11.2	9.0-13.9
All soft hardwoods		257	12.6	5.0-28.4	84	44-147	60	12-129	48	17-102	10.5	7.7-16.3

[1] Height to 9-inch d.o.b. top or where Forest Service grade 3 log stopped.

weighed to the nearest one-quarter pound. Saw logs were weighed individually to the nearest pound.

From each sawtimber tree, disks were removed at the butt, at each saw-log bucking point, at the points where d.o.b. measured 9, 6, and 4 inches, and from branches randomly selected from each branch-size category. In pulpwood-size trees, disks were cut at the butt and at quarter points to a 4-inch top. Each disk was sealed in a polyethylene bag for subsequent determinations of moisture content, specific gravity, and bark percentage.

LABORATORY

Specific gravity was computed on a green volume and ovendry weight basis. Moisture content was computed on an ovendry weight basis after samples were dried to a constant weight at 215°F. Moisture content and specific gravity of stem and branches were calculated by weighting disk values in proportion to the volume of the component they represented.

Green weight per cubic foot of wood was calculated from weighted values for specific gravity and moisture content with the equation:

$$\text{Wood green weight per cubic foot} = [1 + \frac{M.C.}{100}] \times (S.G.) \times (C) \quad (1)$$

where: M.C. = weighted moisture content in percent,
S.G. = weighted specific gravity,
C = 62.4 pounds (weight of water per cubic foot).

Cubic-foot volume of green wood was computed by dividing component green wood weight by its green weight per cubic foot.

ANALYSIS

Linear regression equations were developed to predict the green weight of wood and bark and volume of wood in firewood ⩾ 4 inches d.o.b. in the total tree, in the stem to a 4-inch top, and in branches and stem above the saw-log top (topwood). Independent variables were: diameter at breast height (D), total height (Th), saw-log merchantable height (Mh), and height to a 4-inch top (H4), both separately and in various combinations.

Grouping the data into D^2Th and D^2 classes and plotting the variance of Y over D^2 and D^2Th indicated that the variances of predicted weights and volumes increased with increasing D^2 and D^2Th. The logarithmic transformation (to the base 10) was used to obtain a relative homogeneous variance, which is assumed in regression analysis. Thus, regression equations for estimating weights and volumes were calculated using the models:

$$\log Y = b_0 + b_1 \log X + \epsilon \quad (2)$$

$$\log Y = b_0 + b_1 \log X_1 + b_2 \log X_2 + \epsilon \quad (3)$$

where: Y = predicted weight or volume of firewood,
X = D^2, D^2Th, D^2H4, or D^2Mh,
X_1 = D^2,
X_2 = Th, H4, or Mh,
ϵ = sampling error,
b_i = regression coefficients.

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

$$Y = 10^{b_0 + b_1 \log X + \frac{S^2_{y \cdot x} \log_e 10}{2}} + \epsilon \quad (4)$$

and

$$Y = 10^{b_0 + b_1 \log X_1 + b_2 \log X_2 + \frac{S^2_{y \cdot x} \log_e 10}{2}} + \epsilon \quad (5)$$

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

Equations (4) and (5) can be simplified to:

$$Y = a'X^{b_1} \quad (6)$$

and

$$Y = a'X_1^{b_1} X_2^{b_2} \quad (7)$$

where: $a' = 10^{b_0 + \frac{S^2_{y \cdot x} \log_e 10}{2}}$

CHARACTERISTICS OF HARD HARDWOOD AND SOFT HARDWOOD SAMPLE TREES

Hardwoods are generally classified into hard hardwood and soft hardwood groups based on their wood density expressed as specific gravity or dry weight per unit volume. In this study, however, the species were classified into hard and soft hardwood groups based on their green weight per cubic foot and tree form, because the objective was to develop equations for estimating the green weight of firewood in the total tree by species groups. The average green weight of stem wood and bark per cubic foot of wood ranged from 80 pounds for chestnut oak to 73 pounds for hickory and averaged 76 pounds for all the hard hardwood trees sampled (table 2). The green weight of stem wood and bark per cubic foot of wood averaged 65 pounds for the soft hardwoods.

Average stem wood specific gravity was 0.601 for the hard hardwoods compared to 0.462 for the soft hardwoods (table 2). The average stem wood green moisture content was considerably higher in the soft hardwoods (99 percent) than in the hard hardwoods (76 percent). White ash, a hard hardwood with an average specific gravity of 0.572, had a low moisture content (46 percent) resulting in an average green

Table 2.--Average green wood moisture content and specific gravity and green weight of wood and bark per cubic foot of wood for stem to a 4-inch top by species

Species	Average stem wood		Average and standard deviation for weight of wood and bark per cubic foot of stem wood
	Specific gravity	Moisture content	
		Percent	Pounds
		HARD HARDWOODS	
Northern red oak	0.574	83	75 ± 1.9
Southern red oak	.587	79	79 ± 1.9
Scarlet oak	.595	80	78 ± 2.3
Chestnut oak	.622	70	80 ± 3.0
White oak	.621	72	75 ± 2.0
Water oak	.566	88	78 ± 2.9
Hickory	.658	54	73 ± 2.7
Average hard hardwoods	.601	76	76 ± 3.2
		SOFT HARDWOODS	
Yellow-poplar	0.412	108	63 ± 5.0
Sweetgum	.474	118	72 ± 4.0
Blackgum	.475	105	66 ± 6.3
Red maple	.514	80	66 ± 5.6
White ash	.572	46	61 ± 3.6
Average soft hardwoods	.462	99	65 ± 5.9

weight per cubic foot of only 61 pounds, the lowest of all species sampled. Thus, white ash was grouped with the soft hardwoods in this study.

Tree form determines the distribution of wood between stem and crown and consequently the amount of firewood in the crown available for harvesting. The hard hardwood trees sampled exhibited decurrent or deliquescent branching with lateral branches growing almost as fast as the terminal stem, and with the central stem becoming lost in the upper crown. In comparison, the soft hardwood trees generally exhibited excurrent branching with the main stem or terminal bud outgrowing the lateral branches, resulting in cone-shaped crowns. All firewood ⩾ 4 inches d.o.b. was in the stem to a 4-inch top of pulpwood-size trees (5.0 to 10.9 inches d.b.h.) for hard hardwoods or soft hardwoods and none was in the crown (table 3). The proportion of total tree firewood in the crown of hard hardwood sawtimber trees (trees ⩾ 11.0 inches) increased from 2 percent in 12-inch trees to 19 or 20 percent in 22- and 24-inch trees and averaged 13 percent. The soft hardwood sawtimber-size trees had on the average only 6 percent of their total firewood in branches. The proportion of total tree firewood in the stem above the saw-log merchantable top decreased with increasing tree size and averaged 19 and 16 percent respectively for sawtimber-size hard hardwood and soft hardwood trees. The northern red and white oaks sampled had the highest proportion (15 percent) and the yellow-poplar and red maples the lowest proportion (4 percent) of branch firewood (table 4).

PREDICTION EQUATIONS

A series of equations were developed to predict the green weight of wood and bark, volume of wood in firewood 4 inches d.o.b. and larger in the total tree, main stem to a 4-inch top, and topwood in sawtimber-size trees. Since tree heights are measured to different top limits by various organizations, equations were developed using D^2 alone and

Table 3.--Average green weight of wood and bark in firewood in the total tree and distribution of wood and bark by tree components for hard hardwoods and soft hardwoods by d.b.h. classes

D.b.h. class (inches)	Average d.b.h.	Average total height	Sample trees	Total tree fire-wood 1/	Proportion of wood and bark in: Saw-log stem	Stem 2/ or stem above saw-log top	Crown ≥ 4 inches d.b.h.
	Inches	Feet	Number	Pounds	Percent		
			PULPWOOD-SIZE TREES--HARD HARDWOODS				
6	6.0	54	31	243	--	100	0
8	8.1	66	37	614	--	100	0
10	10.1	72	34	1102	--	100	0
Average	--	--	--	664	--	100	0
			PULPWOOD-SIZE TREES--SOFT HARDWOODS				
6	6.0	59	38	218	--	100	0
8	8.0	66	34	492	--	100	0
10	10.0	78	39	957	--	100	0
Average	--	--	--	562	--	100	0
			SAWTIMBER-SIZE TREES--HARD HARDWOODS				
12	12.0	77	29	1,750	68	30	2
14	14.1	86	30	2,760	69	23	8
16	16.0	88	28	3,791	68	21	11
18	18.0	93	27	5,242	68	18	14
20	19.8	95	19	6,243	67	18	15
22	21.9	102	9	8,932	69	11	20
24	24.0	102	3	10,943	70	11	19
Average	--	--	--	4,284	68	19	13
			SAWTIMBER-SIZE TREES--SOFT HARDWOODS				
12	11.9	85	32	1,568	68	31	1
14	14.1	90	32	2,367	76	20	4
16	16.1	95	29	3,349	78	16	6
18	18.1	101	24	4,575	77	15	8
20	20.0	101	19	5,722	75	15	10
22	21.8	122	5	7,588	84	10	6
24	24.3	137	3	9,039	91	6	3
26	25.6	128	1	12,221	83	15	2
28	28.4	129	1	13,453	88	9	3
Average	--	--	--	3,646	78	16	6

1/ Firewood is all wood 4 inches d.o.b. and larger.

2/ Stem from stump to 4-inch top.

Table 4.--Average green weight of firewood in the total tree for sawtimber-size trees and distribution of firewood in stem and branches by species

Species	Average d.b.h. 1/	Total tree firewood weight 2/	Proportion of tree firewood in: Stem 3/	Branches
	Inches	Pounds	- - - - Percent	- - - -
		HARD HARDWOODS		
Northern red oak	17.6	5,603	85	15
Southern red oak	15.6	3,114	88	12
Scarlet oak	15.2	3,273	90	10
Chestnut oak	16.1	4,052	89	11
White oak	15.8	3,824	85	15
Water oak	16.3	3,846	89	11
Hickory	15.5	3,905	93	7
Average hard hardwoods	16.3	4,284	87	13
		SOFT HARDWOODS		
Yellow-poplar	16.8	4,201	96	4
Sweetgum	16.3	3,844	91	9
Blackgum	15.1	2,987	93	7
Red maple	14.2	2,193	96	4
White ash	14.4	2,247	93	7
Average soft hardwoods	16.1	3,646	94	6

1/ Sawtimber trees are trees $\geq$ 11.0 inches d.b.h.

2/ Firewood is all wood 4 inches d.o.b. and larger.

3/ Stem from stump to 4-inch top.

in combination with Th, H4, and Mh as independent variables. When Th and H4 were used with D^2, the one-variable Equation (6) was used to predict firewood weights and volumes. When Mh was used with D^2, the two-variable Equation (7) was used since saw-log merchantable height varies independently of d.b.h.

Table 5 presents equations for predicting the green weight of wood and bark in firewood $\geqslant$ 4 inches d.o.b. in the total tree (stem plus crown), stem to 4-inch top, and sawtimber top using D^2, D^2Th, D^2H4, and D^2 + Mh as independent variables for hard hardwoods and soft hardwoods, respectively. Table 6 presents equations for predicting the volume of wood excluding bark in firewood in the total tree, stem, and sawtimber topwood with each independent variable combination for hard and soft hardwoods, respectively. A method for placing confidence limits about predictions made with the equations is given in the Appendix.

Firewood in branches and the stem above the saw-log top (topwood firewood) is the most variable firewood component of the tree. Equations based on the sawtimber-size trees were developed for predicting weight and volume of topwood firewood with Equations (6) and (7). These equations, however, resulted in poor estimates of topwood firewood at the fringes of the data. Therefore, topwood firewood was estimated by subtracting the predicted weight or volume of the saw-log merchantable stem from the predicted weight or volume of all the firewood in a sawtimber-size tree.

All independent variable combinations were good predictors of firewood in the total tree or main stem, but equations using D^2Th or D^2H4 were the best predictors of

Table 5.--Regression equations for estimating the green weight of wood and bark in firewood $\geq$ 4 inches d.o.b. in the total tree and its components for hard hardwoods and soft hardwoods using d.b.h. alone and d.b.h. and total height, height to 4-inch top, and saw-log merchantable height as independent variables

Weight in pounds (Y)	Regression equation[1/]	Coefficient of determination (R^2)	Standard error ($S_{y.x}$)[2/]	Sample mean of x[2/] ($\bar{x}$)	Corrected sums of squares for x[2/] $\Sigma(x-\bar{x})^2$	Number trees sampled (N)
	HARD HARDWOODS					
Firewood $\geq$ 4-inches d.o.b. in the total tree above stump						
	$Y = 1.81235\ (D^2)^{1.37950}$	0.98	0.0767	2.1530	29.9305	247
	$Y = 0.04964\ (D^2Th)^{1.12146}$	.99	.0523	4.0383	45.9040	247
	$Y = 0.36686\ (D^2H4)^{0.94651}$	.99	.0539	3.8672	64.3917	247
	$Y = 1.81993\ (D^2)^{1.16787}(Mh)^{0.31882}$	.95	.0536	--	--	142
Firewood in the stem from stump to 4-inch d.o.b. top						
	$Y = 2.51832\ (D^2)^{1.30019}$	.97	.0806	2.1530	29.9305	247
	$Y = 0.08313\ (D^2Th)^{1.05899}$	.99	.0538	4.0383	45.9040	247
	$Y = 0.53822\ (D^2H4)^{0.89584}$	.99	.0457	3.8672	64.3917	247
	$Y = 3.54329\ (D^2)^{1.00776}(Mh)^{0.34841}$	.94	.0498	--	--	142
Firewood $\geq$ 4-inches d.o.b. in branches and main stem excluding saw logs						
	$Y = [2.79011\ (D^2)^{1.30051}] - [1.91019\ (D^2)^{1.30062}]$	--	--	--	--	142
	$Y = [0.07890\ (D^2Th)^{1.07503}] - [0.03765\ (D^2Th)^{1.11020}]$	--	--	--	--	142
	$Y = [0.29143\ (D^2H4)^{0.97150}] - [0.13778\ (D^2H4)^{1.00849}]$	--	--	--	--	142
	$Y = [1.81993\ (D^2)^{1.16787}(Mh)^{0.31882}] - [0.66252\ (D^2)^{0.97731}(Mh)^{0.77715}]$	--	--	--	--	142

Continued

Table 5.--Regression equations for estimating the green weight of wood and bark in firewood $\geq$ 4 inches d.o.b. in the total tree and its components for hard hardwoods and soft hardwoods using d.b.h. alone and d.b.h. and total height, height to 4-inch top, and saw-log merchantable height as independent variables--Continued

Weight in pounds (Y)	Regression equation[1/]	Coefficient of determination (R^2)	Standard error ($S_{y \cdot x}$)[2/]	Sample mean of x[2/] ($\bar{x}$)	Corrected sums of squares for x[2/] $\Sigma(x-\bar{x})^2$	Number trees sampled (N)
	SOFT HARDWOODS					
Firewood $\geq$ 4 inches d.o.b. in the total tree above stump						
	$Y = 1.61179\ (D^2)^{1.37569}$	0.97	0.0809	2.1326	32.2723	257
	$Y = 0.05064\ (D^2Th)^{1.09701}$	.98	.0742	4.0432	50.9696	257
	$Y = 0.41510\ (D^2H4)^{0.90911}$	.98	.0767	3.8743	74.1006	257
	$Y = 2.40850\ (D^2)^{1.15531}(Mh)^{0.21263}$	.94	.0597	--	--	146
Firewood in the stem from stump to 4-inch d.o.b. top						
	$Y = 1.83967\ (D^2)^{1.34241}$	.97	.0826	2.1326	32.2723	257
	$Y = 0.06160\ (D^2Th)^{1.07239}$	.98	.0709	4.0432	50.9696	257
	$Y = 0.47816\ (D^2H4)^{0.88942}$	.98	.0708	3.8743	74.1006	257
	$Y = 2.84096\ (D^2)^{1.07049}(Mh)^{0.27808}$	.94	.0568	--	--	146
Firewood $\geq$ 4 inches d.o.b. in branches and stem above saw-log top						
	$Y = [2.73252\ (D^2)^{1.27941}] - [0.86296\ (D^2)^{1.43757}]$	--	--	--	--	146
	$Y = [0.12326\ (D^2Th)^{1.00897}] - [0.01843\ (D^2Th)^{1.16880}]$	--	--	--	--	146
	$Y = [0.30578\ (D^2H4)^{0.94132}] - [0.05039\ (D^2H4)^{1.09502}]$	--	--	--	--	146
	$Y = [2.40850\ (D^2)^{1.15531}(Mh)^{0.21263}] - [0.53556\ (D^2)^{0.99084}(Mh)^{0.76541}]$	--	--	--	--	146

[1/] $Y = a(D^2)^b$ or $Y = a(D^2Th)^b$ or $Y = a(D^2H4)^b$ or $Y = a(D^2)^{b_1}(Mh)^{b_2}$.

where:

Y = component weight in pounds,
D = d.b.h. in inches,
Th = tree total height in feet,
H4 = tree height to 4-inch top in feet,
Mh = saw-log merchantable height in feet,
a, b, b_1, b_2 = regression coefficients.

[2/] $\log_{10}$ form.

Table 6.--Regression equations for estimating the volume of wood excluding bark in firewood $\geq$ 4 inches d.o.b. in the total tree and its components for hard hardwoods and soft hardwoods using d.b.h. alone and d.b.h. and total height, height to 4-inch top, and saw-log merchantable height as independent variables

Cubic-foot volume (Y)	Regression equation[1/]	Coefficient of determination (R^2)	Standard error ($S_{y.x}$)[2/]	Sample mean of x[2/] ($\bar{x}$)	Corrected sums of squares for x[2/] $\Sigma(x-\bar{x})^2$	Number trees sampled (N)
	HARD HARDWOODS					
Firewood $\geq$ 4 inches d.o.b. in the total tree above stump						
	$Y = 0.02322\ (D^2)^{1.38347}$	0.97	0.0820	2.1530	29.9305	247
	$Y = 0.00062\ (D^2Th)^{1.12612}$	.99	.0543	4.0383	45.9040	247
	$Y = 0.00461\ (D^2H4)^{0.95066}$	.99	.0550	3.8672	64.3917	247
	$Y = 0.02194\ (D^2)^{1.15885}(Mh)^{0.35502}$	.94	.0574	--	--	142
Firewood in the stem from stump to 4-inch d.o.b. top						
	$Y = 0.03156\ (D^2)^{1.30939}$	.97	.0852	2.1530	29.9305	247
	$Y = 0.00100\ (D^2Th)^{1.06772}$	.99	.0557	4.0383	24.9040	247
	$Y = 0.00660\ (D^2H4)^{0.90328}$	.99	.0476	3.8672	64.3917	247
	$Y = 0.04065\ (D^2)^{1.01076}(Mh)^{0.38181}$	.94	.0533	--	--	142
Firewood $\geq$ 4 inches d.o.b. in branches and stem above saw-log top						
	$Y = [0.03533\ (D^2)^{1.30654}] - [0.02319\ (D^2)^{1.31629}]$	--	--	--	--	142
	$Y = [0.00092\ (D^2Th)^{1.08624}] - [0.00042\ (D^2Th)^{1.12820}]$	--	--	--	--	142
	$Y = [0.00341\ (D^2H4)^{0.98269}] - [0.00154\ (D^2H4)^{1.02566}]$	--	--	--	--	142
	$Y = [0.02194\ (D^2)^{1.15885}(Mh)^{0.35502}] - [0.00771\ (D^2)^{0.98039}(Mh)^{0.80741}]$	--	--	--	--	142

Continued

Table 6.--Regression equations for estimating the volume of wood excluding bark in firewood $\geq$ 4 inches d.o.b. in the total tree and its components for hard hardwoods and soft hardwoods using d.b.h. alone and d.b.h. and total height, height to 4-inch top, and saw-log merchantable height as independent variables--Continued

Cubic-foot volume (Y)	Regression equation[1/]	Coefficient of determination (R^2)	Standard error ($S_{y.x}$)[2/]	Sample mean of x[2/] ($\bar{x}$)	Corrected sums of squares for x[2/] $\Sigma(x-\bar{x})^2$	Number trees sampled (N)
	SOFT HARDWOODS					
Firewood $\geq$ 4 inches d.o.b. in the total tree above stump						
	$Y = 0.02584\ (D^2)^{1.36734}$	0.97	0.0812	2.1326	32.2723	257
	$Y = 0.00080\ (D^2Th)^{1.09368}$	.98	.0643	4.0432	50.9696	257
	$Y = 0.00655\ (D^2H4)^{0.90589}$	.98	.0689	3.8743	74.1006	257
	$Y = 0.03485\ (D^2)^{1.13539}(Mh)^{0.25475}$	.95	.0552	--	--	146
Firewood in the stem from stump to 4-inch d.o.b. top						
	$Y = 0.02915\ (D^2)^{1.33721}$	.97	.0846	2.1326	32.2723	257
	$Y = 0.00096\ (D^2Th)^{1.07149}$	.98	.0631	4.0432	50.9696	257
	$Y = 0.00745\ (D^2H4)^{0.88813}$	.98	.0652	3.8743	74.1006	257
	$Y = 0.04007\ (D^2)^{1.05670}(Mh)^{0.31952}$	.94	.0560	--	--	146
Firewood $\geq$ 4 inches d.o.b. in branches and stem above saw-log top						
	$Y = [0.04057\ (D^2)^{1.28407}] - [0.01287\ (D^2)^{1.44359}]$	--	--	--	--	146
	$Y = [0.00152\ (D^2Th)^{1.02969}] - [0.00023\ (D^2Th)^{1.18984}]$	--	--	--	--	146
	$Y = [0.00386\ (D^2H4)^{0.96000}] - [0.00064\ (D^2H4)^{1.11420}]$	--	--	--	--	146
	$Y = [0.03485\ (D^2)^{1.13539}(Mh)^{0.25475}] - [0.00778\ (D^2)^{0.97403}(Mh)^{0.80452}]$	--	--	--	--	146

1/ $Y = a(D^2)^b$ or $Y = a(D^2Th)^b$ or $Y = a(D^2H4)^b$ or $Y = a(D^2)^{b_1}(Mh)^{b_2}$.

where:

Y = component volume in cubic feet,
D = d.b.h. in inches,
Th = tree total height in feet,
H4 = tree height to 4-inch top in feet,
Mh = saw-log merchantable height in feet,
a, b, b_1, b_2 = regression coefficients.

2/ $\log_{10}$ form.

total tree and stem firewood. Equations for estimating topwood firewood in sawtimber-size trees by subtracting saw-log stem from total tree weight or volume were developed for all independent variable combinations. However, the best prediction of topwood firewood is the equation based on d.b.h. and saw-log merchantable height, since this is the only equation that contains a direct estimate of the saw-log material removed from the tree. When average tree heights are similar to those of our sample trees, the equations using d.b.h. alone will result in good estimates of total tree and stem firewood. However, when average tree heights are different, the equations that include a height variable should be applied directly or used to develop local weight/volume tables based on d.b.h. only.

FIREWOOD TABLES

Equations based on $D^2 + Mh$, D^2H4, and D^2Th from tables 5 and 6 were used to develop tables of firewood weights in pounds and volume in cords. In this paper, a cord of split, stacked firewood is assumed to contain 78 cubic feet of solid wood. A 2 percent loss in wood and bark as sawdust is assumed when processing the trees into firewood sticks (Monahan and Wartluft 1980). Tables 7 to 12 (Appendix) show predicted green weight of wood and bark and volume of wood in firewood in the total tree (stem plus crown), stem to 4-inch d.o.b. top, and sawtimber top by d.b.h. and saw-log merchantable height classes for hard hardwoods and soft hardwoods. Tables 13 to 16 (Appendix) show firewood weights and volumes by d.b.h. and heights to 4-inch top for the total tree and for the stem to a 4-inch d.o.b. top. Tables 17 to 20 (Appendix) show firewood weights and volumes by d.b.h. and total height classes for the total tree and stem to a 4-inch top. Trees equal to or less than 10 inches d.b.h. had no firewood $\geqslant$ 4-inch d.o.b. in their crowns. Thus, the same equation used to estimate firewood in the stem to 4-inch top was used to estimate total tree firewood in these size trees.

Sawtimber-size trees capable of producing quality saw logs should be marketed for saw logs and only the upper stem and crown utilized for firewood. Tables for estimating firewood in the stem of sawtimber-size trees are presented to facilitate firewood estimation in poor-quality hardwoods.

Firewood in similar-size trees may vary in weight and volume because of species differences in crown size, stem taper, and weight per cubic foot. Therefore, these weight equations and tables have a slight bias when applied to a single species. Table 21 (Appendix) presents factors for correcting for this bias when the tables are applied to a single species. The equations and tables should be applied to trees growing in natural, fully stocked forest stands and not to open-grown trees. The tables will give best results when applied to large numbers of trees.

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COMPUTATION OF CONFIDENCE LIMITS

Tables 5 and 6 contain the standard errors of the estimate, the sample mean of x, and the corrected sums of squares for x for each equation in $\log_{10}$ form. These statistics can be used to calculate approximate confidence limits in pounds or cubic feet by using a modification of Cox's formula (Land 1972) for estimating confidence limits for lognormal means:

$$Y_{U,L} = 10^{\log Y \pm Z \sqrt{S^2_{y \cdot x}\left[\frac{1}{n} + \frac{(x-\bar{x})^2}{\Sigma(x-\bar{x})^2}\right] + \frac{S^4_{y \cdot x}}{2(n+1)}}} \quad (8)$$

where:

$Y_{U,L}$	= upper and lower limits for Y,
Y	= predicted weight or volume of firewood from Equation (6),
Z	= value from the standard normal table for appropriate confidence level,
$S_{y \cdot x}$	= standard error of estimate for prediction equation,
n	= number of observations used to develop equation,
$\bar{x}$	= sample mean of log x – (from table of equations),
$\Sigma(x-\bar{x})^2$	= corrected sums of squares for log x – (from table of equations),
x	= value of independent variable in $\log_{10}$ form.

Cox's method of approximation sufficiently estimates actual confidence limits when applied to samples with small variances as occur in the total tree and stem weight and volume firewood data sets. Thus, Equation (8) should be used to approximate confidence limits for the single variable equations presented in this Paper.

APPENDIX

Table 7.--Predicted green weight of wood and bark and volume of wood in firewood ≥ 4 inches d.o.b. in the stem plus crown for hard hardwoods by d.b.h. and saw-log merchantable height

D.b.h. class (inches)	Merchantable height (logs)[1/] [2/]								
	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
	Pounds[3/]								
11	1187	1346	1473	1580	1674				
12	1454	1650	1805	1936	2051				
13	1753	1989	2176	2334	2473	2596	2708		
14	2084	2365	2588	2776	2940	3087	3220		
15	2449	2778	3040	3261	3454	3626	3783	3926	
16	2847	3230	3535	3792	4016	4216	4398	4565	
17	3281	3721	4072	4368	4627	4858	5067	5260	
18	3749	4253	4654	4992	5288	5551	5791	6011	
19		4825	5280	5664	5999	6299	6570	6820	7051
20		5440	5952	6385	6763	7100	7407	7688	7949
21		6096	6671	7156	7579	7957	8301	8616	8908
22		6796	7437	7977	8449	8871	9253	9605	9931
23		7539	8250	8850	9374	9841	10266	10656	11017
24		8327	9113	9775	10354	10870	11339	11770	12169
25		9160	10024	10753	11389	11958	12473	12947	13386
	Cords[4/]								
11	0.195	0.224	0.247	0.268	0.285				
12	0.238	0.274	0.303	0.327	0.349				
13	0.286	0.330	0.364	0.394	0.420	0.444	0.465		
14	0.340	0.391	0.433	0.468	0.499	0.527	0.552		
15	0.399	0.459	0.508	0.549	0.585	0.618	0.648	0.675	
16	0.464	0.533	0.590	0.638	0.680	0.718	0.752	0.784	
17	0.534	0.614	0.679	0.734	0.782	0.826	0.866	0.902	
18	0.609	0.701	0.775	0.838	0.893	0.943	0.988	1.030	
19		0.794	0.878	0.950	1.013	1.069	1.120	1.168	1.212
20		0.895	0.989	1.070	1.140	1.204	1.262	1.315	1.365
21		1.002	1.108	1.198	1.277	1.348	1.413	1.473	1.529
22		1.116	1.234	1.334	1.422	1.501	1.574	1.640	1.703
23		1.237	1.368	1.479	1.577	1.664	1.744	1.818	1.887
24		1.365	1.509	1.632	1.740	1.837	1.925	2.007	2.083
25		1.501	1.659	1.794	1.913	2.019	2.116	2.206	2.290

[1/] Blocked-in area indicates range of data.

[2/] Includes 0.5-foot stump allowance.

[3/] $Y = [1.81993(D^2)^{1.16787}(Mh)^{0.31882}]0.98.$

[4/] $Y = [0.2194(D^2)^{1.15885}(Mh)^{0.35502}]/79.6.$

Table 8.--Predicted green weight of wood and bark and volume of wood in firewood ≥ 4 inches d.o.b. in the stem plus crown for soft hardwoods by d.b.h. and saw-log merchantable height

D.b.h. class (inches)	Merchantable height (logs)[1/] [2/]								
	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
	Pounds[3/]								
11	1096	1192	1266	1327	1378				
12	1340	1457	1548	1622	1685				
13	1612	1754	1862	1951	2028	2095	2154		
14	1913	2081	2210	2316	2406	2486	2557		
15	2244	2441	2592	2716	2822	2915	2999	3074	
16	2605	2833	3009	3153	3276	3384	3481	3569	
17		3259	3461	3627	3769	3893	4004	4105	4198
18		3720	3950	4139	4301	4443	4570	4685	4790
19		4214	4476	4690	4873	5034	5178	5308	5428
20		4745	5039	5280	5486	5668	5829	5976	6111
21		5311	5640	5910	6141	6344	6525	6689	6840
22		5914	6280	6581	6838	7064	7266	7448	7616
23			6959	7293	7578	7828	8051	8254	8440
24			7678	8046	8361	8637	8883	9107	9312
25			8438	8842	9188	9491	9762	10008	10233
	Cords[4/]								
11	0.208	0.230	0.247	0.262	0.274				
12	0.254	0.280	0.301	0.319	0.334				
13	0.304	0.336	0.361	0.382	0.400	0.416	0.430		
14	0.360	0.398	0.428	0.452	0.474	0.492	0.509		
15	0.421	0.465	0.500	0.529	0.554	0.576	0.596	0.614	
16	0.487	0.539	0.579	0.613	0.641	0.667	0.690	0.710	
17		0.618	0.665	0.703	0.736	0.765	0.791	0.815	0.837
18		0.704	0.757	0.800	0.838	0.871	0.901	0.928	0.953
19		0.796	0.856	0.905	0.947	0.985	1.019	1.050	1.078
20		0.894	0.961	1.017	1.064	1.107	1.145	1.179	1.211
21		0.999	1.074	1.136	1.189	1.236	1.279	1.317	1.353
22		1.111	1.193	1.262	1.322	1.374	1.421	1.464	1.504
23			1.320	1.396	1.462	1.520	1.572	1.620	1.663
24			1.454	1.538	1.610	1.674	1.732	1.784	1.832
25			1.595	1.687	1.767	1.837	1.900	1.957	2.010

[1/] Blocked-in area indicates range of data.

[2/] Includes 0.5-foot stump allowance.

[3/] $Y = [2.40850(D^2)^{1.15531}(Mh)^{0.21263}]0.98$.

[4/] $Y = [0.03485(D^2)^{1.13539}(Mh)^{0.25475}]/79.6$.

Table 9.--Predicted green weight of wood and bark and volume of wood in firewood ≥ 4 inches d.o.b. in the stem to 4-inch top for hard hardwoods by d.b.h. and saw-log merchantable height

D.b.h. class (inches)	Merchantable height (logs)[1/] [2/]								
	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
	Pounds[3/]								
11	1165	1338	1476	1594	1697				
12	1389	1594	1759	1899	2022				
13	1632	1873	2067	2232	2376	2506	2625		
14	1895	2175	2400	2591	2759	2910	3047		
15	2178	2499	2758	2978	3171	3344	3502	3648	
16	2480	2847	3141	3391	3611	3809	3989	4154	
17	2802	3216	3549	3832	4081	4304	4507	4694	
18	3145	3609	3983	4300	4579	4829	5057	5268	5463
19		4025	4441	4795	5106	5385	5639	5874	6092
20		4463	4925	5318	5662	5972	6254	6514	6756
21		4924	5434	5867	6247	6589	6900	7187	7454
22		5408	5968	6444	6862	7236	7578	7893	8187
23		5915	6527	7048	7505	7915	8289	8633	8954
24		6445	7112	7679	8177	8624	9031	9406	9756
25		6998	7722	8337	8878	9363	9805	10213	10592
	Cords[4/]								
11	0.191	0.222	0.248	0.269	0.288				
12	0.228	0.265	0.295	0.321	0.344				
13	0.268	0.311	0.347	0.377	0.404	0.429	0.451		
14	0.311	0.362	0.403	0.438	0.470	0.498	0.524		
15	0.358	0.416	0.463	0.504	0.540	0.572	0.602	0.629	
16	0.408	0.474	0.528	0.574	0.615	0.652	0.686	0.717	
17	0.461	0.536	0.597	0.649	0.695	0.737	0.775	0.811	0.844
18	0.517	0.601	0.670	0.729	0.781	0.827	0.870	0.910	0.947
19		0.671	0.747	0.813	0.871	0.923	0.971	1.015	1.057
20		0.744	0.829	0.902	0.966	1.024	1.077	1.126	1.172
21		0.821	0.915	0.995	1.066	1.130	1.189	1.243	1.293
22		0.902	1.005	1.093	1.171	1.241	1.306	1.365	1.421
23		0.987	1.099	1.196	1.281	1.358	1.428	1.494	1.555
24		1.076	1.198	1.303	1.396	1.480	1.557	1.628	1.694
25		1.168	1.301	1.415	1.516	1.607	1.691	1.768	1.840

[1/] Blocked-in area indicates range of data.

[2/] Includes 0.5-foot stump allowance.

[3/] $Y = [3.54329(D^2)^{1.00776}(Mh)^{0.34841}]0.98$.

[4/] $Y = [0.04065\ (D^2)^{1.01076}(Mh)^{0.38181}]/79.6$.

Table 10.--Predicted green weight of wood and bark and volume of wood in firewood ≥ 4 inches d.o.b. in the stem to 4-inch top for soft hardwoods by d.b.h. and saw-log merchantable top

D.b.h. class (inches)	Merchantable height (logs)[1/] [2/]								
	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
	Pounds[3/]								
11	1035	1156	1250	1329	1397				
12	1247	1392	1506	1601	1683				
13	1480	1652	1788	1900	1998	2085	2163		
14	1735	1937	2095	2227	2342	2443	2535		
15	2011	2245	2428	2582	2714	2832	2938	3035	
16	2309	2577	2788	2964	3117	3252	3374	3485	
17		2935	3175	3375	3549	3702	3841	3968	4086
18		3317	3588	3814	4010	4184	4341	4485	4617
19		3724	4028	4282	4503	4698	4874	5035	5184
20		4156	4496	4780	5025	5243	5440	5620	5786
21		4614	4991	5306	5579	5821	6039	6239	6423
22		5097	5513	5861	6163	6430	6671	6892	7096
23			6064	6447	6778	7072	7338	7580	7804
24			6642	7062	7425	7747	8038	8303	8548
25			7249	7707	8103	8454	8772	9062	9329
	Cords[4/]								
11	0.197	0.223	0.245	0.262	0.278				
12	0.237	0.269	0.294	0.315	0.334				
13	0.280	0.318	0.348	0.373	0.396	0.415	0.433		
14	0.328	0.372	0.407	0.437	0.463	0.486	0.507		
15	0.379	0.430	0.471	0.505	0.535	0.562	0.586	0.609	
16	0.435	0.493	0.540	0.579	0.614	0.644	0.672	0.698	
17		0.561	0.614	0.658	0.697	0.732	0.764	0.793	0.820
18		0.633	0.692	0.743	0.787	0.826	0.862	0.895	0.925
19		0.709	0.776	0.833	0.882	0.926	0.966	1.003	1.037
20		0.790	0.865	0.928	0.983	1.032	1.077	1.118	1.156
21		0.876	0.959	1.029	1.090	1.145	1.194	1.240	1.282
22		0.967	1.058	1.135	1.203	1.263	1.317	1.368	1.414
23			1.163	1.247	1.321	1.387	1.447	1.502	1.553
24			1.272	1.365	1.446	1.518	1.583	1.644	1.700
25			1.387	1.488	1.576	1.655	1.726	1.792	1.853

[1/] Blocked-in area indicates range of data.

[2/] Includes 0.5-foot stump allowance.

[3/] $Y = [2.84096(D^2)^{1.07049}(Mh)^{0.27808}]0.98.$

[4/] $Y = [0.04007(D^2)^{1.05670}(Mh)^{0.31952}]/79.6.$

Table 11.--Predicted green weight of wood and bark and volume of wood in firewood ≥ 4 inches d.o.b. in the stem and crown above the saw-log top for hard hardwoods by d.b.h. and saw-log merchantable height

D.b.h. class (inches)	Merchantable height (logs)[1/] [2/]								
	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
	Pounds[3/]								
11	555	488	404	312	214				
12	706	632	538	432	321				
13	878	799	694	576	449	318	183		
14	1073	989	874	743	601	453	301		
15	1292	1204	1079	935	778	613	443	269	
16	1534	1445	1311	1153	980	798	609	416	
17	1802	1711	1568	1397	1209	1009	801	588	371
18	2096	2005	1854	1670	1466	1248	1021	787	548
19		2327	2168	1972	1751	1515	1269	1014	753
20		2678	2512	2303	2067	1813	1546	1270	986
21		3058	2887	2666	2414	2141	1853	1555	1249
22		3469	3292	3059	2792	2500	2192	1872	1543
23		3910	3730	3486	3203	2893	2564	2221	1868
24		4383	4200	3946	3647	3319	2969	2603	2226
25		4889	4703	4439	4126	3779	3408	3019	2617
	Cords[4/]								
11	0.090	0.081	0.068	0.053	0.037				
12	0.115	0.104	0.089	0.072	0.054				
13	0.142	0.131	0.115	0.096	0.075	0.053	0.031		
14	0.173	0.162	0.144	0.123	0.100	0.075	0.050		
15	0.208	0.196	0.177	0.154	0.129	0.101	0.073	0.043	
16	0.247	0.235	0.215	0.190	0.161	0.131	0.100	0.067	
17	0.289	0.278	0.256	0.229	0.199	0.166	0.131	0.095	0.058
18	0.336	0.325	0.302	0.273	0.240	0.204	0.166	0.127	0.086
19		0.376	0.353	0.322	0.286	0.247	0.206	0.163	0.199
20		0.432	0.408	0.375	0.337	0.295	0.251	0.204	0.156
21		0.493	0.468	0.434	0.393	0.348	0.301	0.250	0.198
22		0.558	0.533	0.497	0.454	0.406	0.355	0.301	0.245
23		0.629	0.603	0.566	0.520	0.470	0.415	0.357	0.297
24		0.704	0.678	0.640	0.592	0.538	0.480	0.419	0.354
25		0.784	0.759	0.719	0.669	0.612	0.551	0.485	0.417

[1/] Blocked-in area indicates range of data.

[2/] Includes 0.5-foot stump allowance.

[3/] $Y = [1.81993(D^2)^{1.16787}(Mh)^{0.31882}] - [0.66252(D^2)^{0.97731}(Mh)^{0.77715}]$.

[4/] $Y = [[0.02194(D^2)^{1.15885}(Mh)^{0.35502}] - [0.00771(D^2)^{0.98039}(Mh)^{0.80741}]]/79.6$.

Table 12.--Predicted green weight of wood and bark and volume of wood in firewood ≥ 4 inches d.o.b. in the stem and crown above the saw-log top for soft hardwoods by d.b.h. and saw-log merchantable height

D.b.h. class (inches)	Merchantable height (logs)[1/] [2/]								
	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
	Pounds[3/]								
11	569	479	381	279	176				
12	714	610	496	377	256				
13	879	761	630	493	353	212	71		
14	1064	931	783	626	467	306	144		
15	1270	1123	955	779	599	416	233	49	
16	1498	1335	1149	952	749	544	338	131	
17		1570	1364	1145	919	690	460	229	
18		1828	1601	1359	1110	856	600	343	87
19		2109	1861	1596	1321	1041	759	476	192
20		2414	2144	1855	1554	1248	938	627	315
21		2743	2452	2137	1810	1475	1137	797	456
22		3098	2784	2443	2088	1725	1357	987	615
23			3141	2774	2391	1997	1599	1198	795
24			3525	3130	2717	2293	1863	1430	994
25			3934	3512	3069	2613	2150	1684	1214
	Cords[4/]								
11	0.107	0.091	0.073	0.053	0.033				
12	0.134	0.116	0.095	0.072	0.049				
13	0.164	0.144	0.120	0.094	0.067	0.039	0.011		
14	0.198	0.176	0.149	0.119	0.089	0.057	0.025		
15	0.236	0.211	0.181	0.148	0.114	0.078	0.042	0.005	
16	0.278	0.251	0.217	0.181	0.142	0.102	0.062	0.020	
17		0.294	0.257	0.217	0.174	0.130	0.085	0.039	
18		0.342	0.302	0.257	0.210	0.161	0.111	0.060	0.009
19		0.393	0.350	0.301	0.250	0.196	0.141	0.085	0.029
20		0.449	0.402	0.350	0.293	0.235	0.175	0.113	0.052
21		0.510	0.459	0.402	0.341	0.277	0.212	0.145	0.078
22		0.575	0.521	0.459	0.393	0.324	0.253	0.181	0.108
23			0.587	0.521	0.449	0.375	0.298	0.220	0.141
24			0.657	0.586	0.510	0.430	0.348	0.264	0.178
25			0.732	0.657	0.576	0.490	0.402	0.311	0.219

[1/] Blocked-in area indicates range of data.

[2/] Includes 0.5-foot stump allowance.

[3/] $Y = [2.40850(D^2)^{1.15531}(Mh)^{0.21263}] - [0.53556(D^2)^{0.99084}(Mh)^{0.76541}]$.

[4/] $Y = [[0.03485(D^2)^{1.13539}(Mh)^{0.25475}] - [0.00778(D^2)^{0.97403}(Mh)^{0.80452}]]/79.6$.

Table 13.--Predicted green weight of wood and bark and volume of wood in firewood ≥ 4 inches d.o.b. in the stem plus crown for hard hardwoods by d.b.h. and height to 4-inch d.o.b. top

D.b.h. class (inches)	Height to 4-inch top (feet)[1/] [2/]								
	10	20	30	40	50	60	70	80	90
	Pounds[3/] [4/]								
5	74	138	199	257	314				
6	103	191	275	356	435	512			
7		252	363	469	573	675	775		
8		320	461	596	728	857	984		
9			569	736	899	1059	1216	1370	
10			687	889	1086	1279	1468	1655	1839
11			842	1105	1365	1622	1877	2130	2381
12			993	1303	1610	1913	2213	2511	2808
13			1155	1516	1873	2226	2575	2922	3267
14			1329	1745	2155	2561	2963	3363	3759
15				1988	2456	2918	3377	3832	4284
16				2247	2775	3298	3816	4330	4840
17				2520	3112	3699	4280	4856	5429
18				2808	3468	4121	4769	5411	6049
19				3110	3842	4565	5282	5994	6701
20					4233	5031	5821	6605	7384
21					4643	5518	6384	7244	8099
22					5071	6026	6972	7911	8844
23					5516	6555	7584	8606	9621
24						7104	8220	9328	10428
25						7675	8881	10077	11266
	Cords[5/] [6/]								
5	0.012	0.023	0.033	0.043	0.052				
6	0.017	0.032	0.046	0.059	0.072	0.085			
7		0.042	0.060	0.078	0.095	0.113	0.129		
8		0.053	0.077	0.099	0.122	0.143	0.165		
9			0.095	0.123	0.150	0.177	0.204	0.230	
10			0.115	0.149	0.182	0.214	0.247	0.278	0.309
11			0.140	0.184	0.228	0.271	0.314	0.356	0.399
12			0.166	0.218	0.269	0.320	0.370	0.421	0.470
13			0.193	0.253	0.313	0.373	0.431	0.490	0.548
14			0.222	0.292	0.361	0.429	0.497	0.564	0.631
15				0.333	0.411	0.489	0.566	0.643	0.719
16				0.376	0.465	0.553	0.640	0.727	0.813
17				0.422	0.522	0.620	0.718	0.816	0.912
18				0.470	0.582	0.692	0.801	0.909	1.017
19				0.521	0.645	0.767	0.888	1.008	1.127
20					0.711	0.845	0.978	1.111	1.242
21					0.780	0.927	1.074	1.219	1.363
22					0.852	1.013	1.173	1.332	1.489
23					0.927	1.102	1.276	1.449	1.621
24						1.195	1.384	1.571	1.757
25						1.292	1.495	1.698	1.899

[1/] Blocked-in area indicates range of data.

[2/] Includes 0.5-foot stump allowance.

[3/] Trees 5-10 inches d.b.h. $Y = [0.53822(D^2H4)^{0.89584}]0.98.$

[4/] Trees > 10 inches d.b.h. $Y = [0.36686(D^2H4)^{0.94651}]0.98.$

[5/] Trees 5-10 inches d.b.h. $Y = [0.00660(D^2H4)^{0.90328}]/79.6.$

[6/] Trees > 10 inches d.b.h. $Y = [0.00461(D^2H4)^{0.95066}]/79.6.$

Table 14.--Predicted green weight of wood and bark and volume of wood in firewood ≥ 4 inches d.o.b. in the stem plus crown for soft hardwoods by d.b.h. and height to 4-inch d.o.b. top

D.b.h. class (inches)	Height to 4-inch top (feet)[1/] [2/]								
	10	20	30	40	50	60	70	80	90
	Pounds[3/] [4/]								
5	64	118	169	218	266				
6	88	163	234	302	368	433			
7		214	308	397	484	570	653		
8		272	390	504	614	722	829	933	
9			481	621	757	891	1022	1151	1278
10			580	749	914	1074	1232	1388	1541
11			701	911	1115	1316	1514	1710	1903
12			821	1067	1307	1542	1774	2003	2229
13			950	1234	1511	1784	2052	2317	2579
14			1087	1412	1729	2041	2348	2651	2951
15				1600	1960	2314	2662	3005	3345
16				1800	2204	2602	2993	3379	3761
17				2009	2461	2905	3342	3773	4200
18				2229	2731	3223	3708	4187	4660
19				2460	3013	3556	4091	4619	5141
20					3307	3904	4491	5071	5644
21					3614	4266	4908	5541	6167
22					3933	4642	5341	6030	6711
23					4264	5033	5790	6538	7276
24						5438	6256	7064	7862
25						5857	6738	7608	8468
	Cords[5/] [6/]								
5	0.013	0.023	0.033	0.043	0.053				
6	0.017	0.032	0.046	0.060	0.073	0.086			
7		0.042	0.061	0.079	0.096	0.113	0.129		
8		0.054	0.077	0.100	0.121	0.143	0.164	0.184	
9			0.095	0.123	0.150	0.176	0.202	0.227	0.252
10			0.115	0.148	0.180	0.212	0.243	0.274	0.304
11			0.138	0.179	0.219	0.259	0.298	0.336	0.374
12			0.162	0.210	0.257	0.303	0.348	0.393	0.437
13			0.187	0.243	0.297	0.350	0.403	0.455	0.506
14			0.214	0.277	0.340	0.401	0.461	0.520	0.578
15				0.314	0.385	0.454	0.522	0.589	0.655
16				0.353	0.433	0.510	0.587	0.662	0.737
17				0.394	0.483	0.569	0.655	0.739	0.822
18				0.437	0.535	0.632	0.726	0.820	0.912
19				0.482	0.591	0.697	0.801	0.904	1.006
20					0.648	0.764	0.879	0.992	1.104
21					0.708	0.835	0.960	1.084	1.206
22					0.770	0.908	1.045	1.179	1.312
23					0.835	0.985	1.132	1.278	1.422
24						1.064	1.223	1.380	1.536
25						1.145	1.317	1.486	1.654

[1/] Blocked-in area indicates range of data.

[2/] Includes 0.5-foot stump allowance.

[3/] Trees 5-10 inches d.b.h. $Y = [0.47816(D^2H4)^{0.88942}]0.98.$

[4/] Trees > 10 inches d.b.h. $Y = [0.41510(D^2H4)^{0.90911}]0.98.$

[5/] Trees 5-10 inches d.b.h. $Y = [0.00745(D^2H4)^{0.88813}]/79.6.$

[6/] Trees > 10 inches d.b.h. $Y = [0.00655(D^2H4)^{0.90589}]/79.6.$

Table 15.--Predicted green weight of wood and bark and volume of wood in firewood ≥ 4 inches d.o.b. in the stem to 4-inch top for hard hardwoods by d.b.h. and height to 4-inch d.o.b. top

D.b.h. class (inches)	Height to 4-inch top (feet)[1/] [2/]								
	10	20	30	40	50	60	70	80	90
	Pounds[3/]								
5	74	138	199	257	314				
6	103	191	275	356	435	512			
7		252	363	469	573	675	775		
8		320	461	596	728	857	984		
9			569	736	899	1059	1216	1370	
10			687	889	1086	1279	1468	1655	1839
11			815	1055	1288	1517	1742	1963	2181
12			953	1233	1506	1773	2035	2294	2549
13			1100	1423	1738	2046	2349	2648	2942
14			1256	1625	1985	2337	2683	3024	3360
15				1839	2246	2644	3036	3422	3802
16				2064	2521	2968	3408	3841	4268
17				2301	2810	3309	3799	4282	4758
18				2549	3113	3666	4209	4743	5271
19				2809	3430	4039	4637	5226	5808
20					3760	4427	5083	5729	6367
21					4104	4832	5547	6252	6948
22					4460	5252	6030	6796	7552
23					4830	5687	6529	7359	8178
24						6138	7047	7942	8826
25						6604	7582	8545	9496
	Cords[4/]								
5	0.012	0.023	0.033	0.043	0.052				
6	0.017	0.032	0.046	0.059	0.072	0.085			
7		0.042	0.060	0.078	0.095	0.113	0.129		
8		0.053	0.077	0.099	0.122	0.143	0.165		
9			0.095	0.123	0.150	0.177	0.204	0.230	
10			0.115	0.149	0.182	0.214	0.247	0.278	0.309
11			0.136	0.177	0.216	0.255	0.293	0.330	0.367
12			0.159	0.207	0.253	0.298	0.343	0.387	0.430
13			0.184	0.239	0.292	0.345	0.396	0.447	0.497
14			0.211	0.273	0.334	0.394	0.453	0.511	0.568
15				0.309	0.378	0.446	0.513	0.579	0.643
16				0.348	0.425	0.501	0.576	0.650	0.723
17				0.388	0.474	0.559	0.643	0.725	0.807
18				0.430	0.526	0.620	0.713	0.804	0.895
19				0.474	0.580	0.684	0.786	0.887	0.986
20					0.636	0.750	0.862	0.973	1.082
21					0.695	0.819	0.942	1.062	1.182
22					0.756	0.891	1.024	1.156	1.285
23					0.819	0.966	1.110	1.252	1.393
24						1.043	1.199	1.352	1.504
25						1.123	1.290	1.456	1.619

[1/] Blocked-in area indicates range of data.

[2/] Includes 0.5-foot stump allowance.

[3/] $Y = [0.53822(D^2H4)^{0.89584}]0.98$.

[4/] $Y = [0.00660(D^2H4)^{0.90328}]/79.6$.

Table 16.--Predicted green weight of wood and bark and volume of wood in firewood ≥ 4 inches d.o.b. in the stem to 4-inch top for soft hardwoods by d.b.h. and height to 4-inch d.o.b. top

D.b.h. class (inches)	Height to 4-inch top (feet)[1/] [2/]								
	10	20	30	40	50	60	70	80	90
	Pounds[3/]								
5	64	118	169	218	266				
6	88	163	234	302	368	433			
7		214	308	397	484	570	653		
8		272	390	504	614	722	829	933	
9			481	621	757	891	1022	1151	1278
10			580	749	914	1074	1232	1388	1541
11			687	888	1082	1273	1460	1644	1826
12			802	1036	1264	1486	1704	1919	2131
13			925	1195	1457	1713	1965	2213	2457
14			1055	1363	1662	1955	2242	2525	2804
15				1541	1879	2210	2535	2854	3170
16				1728	2108	2479	2843	3202	3555
17				1925	2348	2761	3167	3566	3960
18				2131	2599	3057	3506	3948	4384
19				2346	2862	3365	3860	4347	4827
20					3135	3687	4229	4762	5288
21					3419	4021	4612	5194	5767
22					3714	4368	5010	5642	6265
23					4020	4727	5422	6106	6780
24						5099	5848	6586	7313
25						5483	6289	7082	7864
	Cords[4/]								
5	0.013	0.023	0.033	0.043	0.053				
6	0.017	0.032	0.046	0.060	0.073	0.086			
7		0.042	0.061	0.079	0.096	0.113	0.129		
8		0.054	0.077	0.100	0.121	0.143	0.164	0.184	
9			0.095	0.123	0.150	0.176	0.202	0.227	0.252
10			0.115	0.148	0.180	0.212	0.243	0.274	0.304
11			0.136	0.175	0.214	0.251	0.288	0.325	0.360
12			0.158	0.205	0.249	0.293	0.336	0.379	0.421
13			0.183	0.236	0.288	0.338	0.388	0.437	0.485
14			0.208	0.269	0.328	0.386	0.442	0.498	0.553
15				0.304	0.371	0.436	0.500	0.563	0.625
16				0.341	0.416	0.489	0.561	0.631	0.701
17				0.380	0.463	0.545	0.624	0.703	0.781
18				0.421	0.513	0.603	0.691	0.778	0.864
19				0.463	0.564	0.664	0.761	0.857	0.951
20					0.618	0.727	0.833	0.938	1.042
21					0.674	0.793	0.909	1.023	1.136
22					0.732	0.861	0.987	1.112	1.234
23					0.792	0.932	1.068	1.203	1.336
24						1.005	1.152	1.297	1.440
25						1.080	1.239	1.395	1.549

1/ Blocked-in area indicates range of data.

2/ Includes 0.5-foot stump allowance.

3/ $Y = [0.47816(D^2H4)^{0.88942}]0.98$.

4/ $Y = [0.00745(D^2H4)^{0.88813}]/79.6$.

Table 17.--Predicted green weight of wood and bark and volume of wood in firewood ≥ 4 inches d.o.b. in the stem plus crown for hard hardwoods by d.b.h. and total height

D.b.h. class (inches)	Total height (feet)[1/] [2/]								
	40	50	60	70	80	90	100	110	120
	Pounds[3/] [4/]								
5	122	155	188	221					
6	180	228	277	326	375				
7	250	316	384	452	520	589	659		
8	331	420	509	599	690	782	874		
9		539	653	769	886	1004	1122	1241	
10		673	817	961	1107	1255	1403	1552	
11		848	1040	1236	1436	1638	1844	2052	2262
12		1030	1264	1502	1745	1991	2241	2494	2750
13		1233	1512	1798	2088	2383	2682	2985	3290
14		1456	1786	2123	2466	2814	3167	3524	3886
15			2085	2478	2879	3285	3697	4114	4536
16			2410	2864	3327	3797	4273	4755	5242
17			2760	3281	3811	4350	4895	5447	6006
18			3138	3730	4333	4945	5565	6193	6827
19			3543	4211	4891	5582	6282	6991	7708
20				4725	5488	6263	7048	7843	8647
21				5271	6123	6987	7863	8750	9647
22				5851	6796	7755	8728	9713	10708
23				6464	7508	8569	9643	10731	11831
24				7112	8260	9427	10609	11806	13016
25				7793	9052	10331	11626	12938	14264
	Cords[5/] [6/]								
5	0.020	0.025	0.031	0.036					
6	0.030	0.038	0.046	0.054	0.062				
7	0.041	0.052	0.063	0.075	0.086	0.098	0.109		
8	0.055	0.069	0.084	0.099	0.115	0.130	0.146		
9		0.089	0.108	0.128	0.147	0.167	0.187	0.207	
10		0.112	0.136	0.160	0.185	0.209	0.234	0.260	
11		0.141	0.174	0.206	0.240	0.274	0.308	0.343	0.379
12		0.172	0.211	0.251	0.292	0.333	0.375	0.418	0.461
13		0.206	0.253	0.301	0.350	0.399	0.449	0.500	0.552
14		0.243	0.299	0.355	0.413	0.472	0.531	0.591	0.652
15			0.349	0.415	0.482	0.551	0.620	0.691	0.762
16			0.404	0.480	0.558	0.637	0.717	0.799	0.881
17			0.463	0.550	0.640	0.730	0.822	0.915	1.010
18			0.526	0.626	0.727	0.831	0.935	1.041	1.148
19			0.594	0.707	0.822	0.938	1.056	1.176	1.297
20				0.793	0.922	1.053	1.186	1.320	1.456
21				0.886	1.029	1.175	1.323	1.473	1.625
22				0.983	1.143	1.305	1.470	1.636	1.804
23				1.087	1.263	1.443	1.624	1.808	1.994
24				1.196	1.390	1.588	1.788	1.990	2.195
25				1.312	1.524	1.741	1.960	2.182	2.406

[1/] Blocked-in area indicates range of data.

[2/] Includes 0.5-foot stump allowance.

[3/] Trees 5-10 inches d.b.h. $Y = [0.08313(D^2Th)^{1.05899}]0.98.$

[4/] Trees > 10 inches d.b.h. $Y = [0.04964(D^2Th)^{1.12146}]0.98.$

[5/] Trees 5-10 inches d.b.h. $Y = [0.00100(D^2Th)^{1.06772}]/79.6.$

[6/] Trees > 10 inches d.b.h. $Y = [0.00062(D^2Th)^{1.12612}]/79.6.$

Table 18.--Predicted green weight of wood and bark and volume of wood in firewood ≥ 4 inches d.o.b. in the stem plus crown for soft hardwoods by d.b.h. and total height

D.b.h. class (inches)	Total height (feet)[1/] [2/]								
	40	50	60	70	80	90	100	110	120
	Pounds[3/] [4/]								
5	100	126	154	181	209				
6	147	187	227	268	309				
7	205	260	316	373	431	489	547		
8	273	346	421	497	574	651	729	807	
9		446	542	640	738	838	938	1039	1141
10		559	680	802	926	1050	1176	1302	1430
11		699	854	1011	1170	1332	1495	1660	1826
12		846	1033	1223	1416	1612	1809	2009	2210
13		1008	1231	1458	1688	1921	2157	2394	2634
14		1186	1449	1716	1986	2260	2537	2817	3099
15			1686	1996	2311	2630	2952	3277	3606
16			1942	2300	2663	3030	3401	3776	4154
17			2218	2627	3041	3461	3885	4313	4745
18			2515	2978	3448	3923	4404	4889	5379
19			2831	3353	3882	4417	4958	5505	6056
20				3752	4344	4943	5549	6161	6778
21				4176	4835	5502	6176	6857	7544
22				4625	5355	6093	6840	7594	8354
23				5099	5903	6717	7540	8372	9210
24				5598	6481	7375	8278	9191	10111
25				6122	7088	8066	9054	10052	11059
	Cords[5/] [6/]								
5	0.020	0.025	0.031	0.036	0.042				
6	0.029	0.037	0.045	0.053	0.061				
7	0.041	0.052	0.063	0.074	0.085	0.097	0.108		
8	0.054	0.069	0.084	0.099	0.114	0.129	0.144	0.160	
9		0.088	0.108	0.127	0.146	0.166	0.186	0.206	0.226
10		0.111	0.135	0.159	0.183	0.208	0.233	0.258	0.283
11		0.137	0.168	0.199	0.230	0.261	0.293	0.326	0.358
12		0.166	0.203	0.240	0.278	0.316	0.355	0.394	0.433
13		0.198	0.242	0.286	0.331	0.377	0.423	0.469	0.516
14		0.233	0.284	0.337	0.390	0.443	0.497	0.552	0.607
15			0.331	0.391	0.453	0.515	0.578	0.642	0.706
16			0.381	0.451	0.522	0.593	0.666	0.739	0.813
17			0.435	0.515	0.596	0.678	0.760	0.844	0.928
18			0.493	0.583	0.675	0.768	0.862	0.956	1.052
19			0.555	0.656	0.760	0.864	0.970	1.076	1.184
20				0.734	0.850	0.967	1.085	1.204	1.324
21				0.817	0.946	1.076	1.207	1.340	1.473
22				0.905	1.047	1.191	1.336	1.483	1.631
23				0.997	1.154	1.312	1.473	1.635	1.798
24				1.094	1.266	1.440	1.616	1.794	1.973
25				1.197	1.385	1.575	1.767	1.962	2.157

1/ Blocked-in area indicates range of data.

2/ Includes 0.5-foot stump allowance.

3/ Trees 5-10 inches d.b.h. $Y = [0.06160(D^2Th)^{1.07239}]0.98.$

4/ Trees > 10 inches d.b.h. $Y = [0.05064(D^2Th)^{1.09701}]0.98.$

5/ Trees 5-10 inches d.b.h. $Y = [0.00096(D^2Th)^{1.07149}]/79.6.$

6/ Trees > 10 inches d.b.h. $Y = [0.00080(D^2Th)^{1.09368}]/79.6.$

Table 19.--Predicted green weight of wood and bark and volume of wood in firewood ≥ 4 inches d.o.b. in the stem to 4-inch top for hard hardwoods by d.b.h. and total height

D.b.h. class (inches)	Total height (feet)[1/] [2/]								
	40	50	60	70	80	90	100	110	120
	Pounds[3/]								
5	122	155	188	221					
6	180	228	277	326	375				
7	250	316	384	452	520	589	659		
8	331	420	509	599	690	782	874		
9		539	653	769	886	1004	1122	1241	
10		673	817	961	1107	1255	1403	1552	
11		824	999	1176	1355	1535	1716	1899	2082
12		991	1201	1415	1629	1846	2064	2283	2503
13		1174	1423	1676	1930	2187	2445	2705	2966
14		1373	1665	1961	2258	2558	2860	3164	3470
15			1927	2269	2614	2961	3311	3662	4016
16			2210	2602	2997	3395	3795	4199	4604
17			2512	2958	3407	3860	4315	4774	5235
18			2836	3339	3846	4357	4871	5388	5908
19			3180	3744	4312	4885	5462	6042	6625
20				4173	4807	5446	6089	6735	7385
21				4628	5331	6039	6751	7468	8189
22				5107	5882	6664	7451	8242	9037
23				5611	6463	7322	8186	9055	9929
24				6140	7073	8012	8958	9910	10866
25				6695	7712	8736	9767	10804	11847
	Cords[4/]								
5	0.020	0.025	0.031	0.036					
6	0.030	0.038	0.046	0.054	0.062				
7	0.041	0.052	0.063	0.075	0.086	0.098	0.109		
8	0.055	0.069	0.084	0.099	0.155	0.130	0.146		
9		0.089	0.108	0.128	0.147	0.167	0.187	0.207	
10		0.122	0.136	0.160	0.185	0.209	0.234	0.260	
11		0.137	0.167	0.196	0.226	0.257	0.287	0.318	0.349
12		0.165	0.201	0.236	0.273	0.309	0.346	0.383	0.420
13		0.196	0.238	0.280	0.323	0.367	0.410	0.454	0.499
14		0.229	0.279	0.329	0.379	0.430	0.481	0.532	0.584
15			0.323	0.381	0.439	0.498	0.557	0.617	0.677
16			0.371	0.437	0.504	0.571	0.640	0.708	0.777
17			0.422	0.497	0.574	0.650	0.728	0.806	0.884
18			0.477	0.562	0.648	0.735	0.822	0.910	0.999
19			0.535	0.631	0.727	0.825	0.923	1.022	1.121
20				0.704	0.812	0.920	1.030	1.140	1.251
21				0.781	0.901	1.021	1.143	1.265	1.389
22				0.863	0.995	1.128	1.262	1.398	1.534
23				0.948	1.094	1.240	1.388	1.537	1.686
24				1.039	1.198	1.358	1.520	1.683	1.847
25				1.133	1.307	1.482	1.659	1.836	2.015

[1/] Blocked-in area indicates range of data.

[2/] Includes 0.5-foot stump allowance.

[3/] $Y = [0.08313(D^2Th)^{1.05899}]0.98$.

[4/] $Y = [0.00100(D^2Th)^{1.06772}]/79.6$.

Table 20.--Predicted green weight of wood and bark and volume of wood in firewood ≥ 4 inches d.o.b. in the stem to 4-inch top for soft hardwoods by d.b.h. and total height

D.b.h. class (inches)	Total height (feet)[1/] [2/]								
	40	50	60	70	80	90	100	110	120
	Pounds[3/]								
5	100	126	154	181	209				
6	147	187	227	268	309				
7	205	260	316	373	431	489	547		
8	273	346	421	497	574	651	729	807	
9		446	542	640	738	838	938	1039	1141
10		559	680	802	926	1050	1176	1302	1430
11		686	834	984	1136	1288	1443	1598	1754
12		827	1005	1186	1369	1553	1739	1926	2114
13		982	1194	1408	1625	1844	2064	2286	2510
14		1151	1399	1651	1905	2161	2420	2680	2942
15			1622	1914	2209	2506	2806	3108	3412
16			1863	2198	2536	2878	3222	3569	3918
17			2122	2503	2889	3278	3670	4065	4462
18			2399	2830	3265	3705	4148	4595	5044
19			2694	3178	3667	4161	4658	5160	5664
20				3547	4093	4644	5200	5760	6323
21				3939	4545	5157	5774	6395	7020
22				4352	5022	5698	6379	7066	7757
23				4787	5524	6268	7018	7773	8533
24				5245	6052	6867	7688	8516	9349
25				5725	6606	7495	8392	9295	10204
	Cords[4/]								
5	0.020	0.025	0.031	0.036	0.042				
6	0.029	0.037	0.045	0.053	0.061				
7	0.041	0.052	0.063	0.074	0.085	0.097	0.108		
8	0.054	0.069	0.084	0.099	0.114	0.129	0.144	0.160	
9		0.088	0.108	0.127	0.146	0.166	0.186	0.206	0.226
10		0.111	0.135	0.159	0.183	0.208	0.233	0.258	0.283
11		0.136	0.165	0.195	0.225	0.255	0.286	0.316	0.347
12		0.164	0.199	0.235	0.271	0.308	0.344	0.381	0.419
13		0.195	0.236	0.279	0.322	0.365	0.409	0.453	0.497
14		0.228	0.277	0.327	0.377	0.428	0.479	0.531	0.583
15			0.321	0.379	0.437	0.496	0.555	0.615	0.675
16			0.369	0.435	0.502	0.570	0.638	0.706	0.775
17			0.420	0.496	0.572	0.649	0.726	0.804	0.883
18			0.475	0.560	0.646	0.733	0.821	0.909	0.998
19			0.533	0.629	0.726	0.823	0.922	1.021	1.121
20				0.702	0.810	0.919	1.029	1.140	1.251
21				0.780	0.899	1.020	1.142	1.265	1.389
22				0.861	0.994	1.127	1.262	1.398	1.534
23				0.947	1.093	1.240	1.388	1.538	1.688
24				1.038	1.197	1.359	1.521	1.684	1.849
25				1.133	1.307	1.483	1.660	1.838	2.018

[1/] Blocked-in area indicates range of data.

[2/] Includes 0.5-foot stump allowance.

[3/] $Y = [0.06160(D^2Th)^{1.07239}]0.98$.

[4/] $Y = [0.00096(D^2Th)^{1.07149}]/79.6$.

Table 21.--Factors for correcting single species bias in firewood weight tables

Species	Weight correction factor[1/]
	HARD HARDWOODS
Northern red oak	0.987
Southern red oak	1.039
Scarlet oak	1.026
Chestnut oak	1.053
White oak	.987
Water oak	1.026
Hickory	.960
	SOFT HARDWOODS
Yellow-poplar	.969
Sweetgum	1.108
Blackgum	1.015
Red maple	1.015
White ash	.938

[1/] To use correction factor, multiply the sum of the predicted firewood weights for a species by its correction factor.

*U.S. Government Printing Office: 1982-539-000/4001

Clark, Alexander, III.
Predicted weights and volumes of firewood in hardwood trees in the Southeast. Res. Pap. SE-226. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southeastern Forest Experiment Station; 1982. 28 p.

Equations are presented for predicting the green weight of wood and bark and volume of wood in firewood ≥ 4 inches d.o.b. in the total tree above stump, in the main stem to 4-inch top, and in topwood above the saw-log top. Equations predict weight and volume of firewood by d.b.h. and total height, d.b.h. and height to 4-inch top, d.b.h. and saw-log merchantable height, and d.b.h. alone. Tables developed from equations show weight in pounds and volume in cords of firewood in a tree and its components by d.b.h. and height classes.

KEYWORDS: moisture content, specific gravity, yield tables, biomass, equations.

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KEYWORDS: moisture content, specific gravity, yield tables, biomass, equations.

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