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James G. Schroeder

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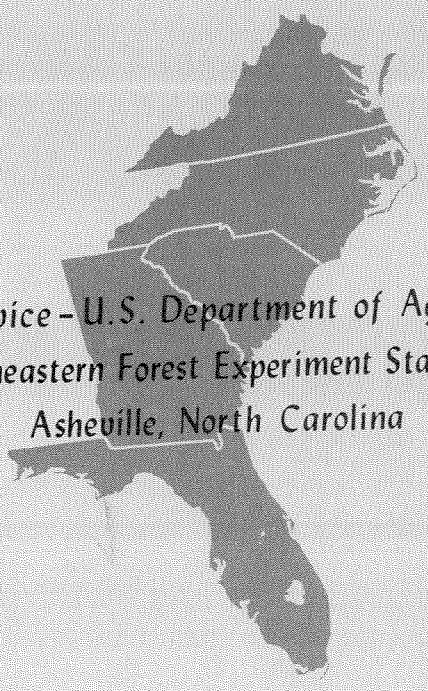
Alexander Clark III



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Southeastern Forest Experiment Station

Asheville, North Carolina

Stem and Primary Product Weights for Longleaf Pine Sawtimber Trees

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James G. Schroeder, Principal Wood Scientist
Michael A. Taras, Principal Wood Scientist
Alexander Clark III, Wood Scientist

Forestry Sciences Laboratory
Athens, Georgia

Most appraisals of standing timber are based on estimates taken from volume tables and applied to the timber cruised. Volume tables apparently provide adequate estimates of lumber volumes, but they ignore other primary products generated during sawmilling. A volume table does not show the amount of bark, sawdust, and chippable residue from slabs, edgings, and end trim that will be produced from a tree of a given size. These primary products are important to the sawmilling industry and to people concerned with determining current timber volumes and production.

Since weight-scaling is the accepted method of buying and selling pine logs in the South, it appears that tables based on weight should also be an acceptable means of estimating the proportion of lumber and other primary products in pine sawtimber trees. The study described here was conducted to determine stem and primary product weights for longleaf pine (*Pinus palustris* Mill.) sawtimber trees and to develop predicting equations to estimate these weights when the logs from the trees are processed at a sawmill.

This study was conducted by the Southeastern Forest Experiment Station in cooperation with and through the financial assistance of the Range, Timber, and Wildlife Program Area of Region 8 of the National Forest System. Field personnel were provided by the Conecuh District of the Conecuh National Forest. Cooperation and assistance were also received from the Windham Lumber Company.

PROCEDURE

Field

Forty-eight longleaf pine sawtimber trees were selected from a natural stand on the Conecuh National Forest in southern Alabama. Trees were selected to represent the range in timber size on the Forest; average tree characteristics are listed below.

Item	Average	Range
D. b. h. (inches)	14.4	9.8 - 19.4
Total height (feet)	83	59 - 97
Merchantable height (feet)	54	34 - 73
Form class	83	75 - 92
Age (years, at d. b. h.)	48	30 - 60

Sample trees were felled and bucked into saw logs to an approximate minimum top diameter (merchantable top) of 6 inches inside bark. Upper log merchantability was stopped at a point where the diameter exceeded 6 inches when stem branchiness prevented utilization to the lower diameter; the average top diameter in this study was 7.2 inches. Pulpwood above the merchantable saw-log top was cut to 4- and 2-inch top diameters. The pulpwood was weighed in the woods to the nearest pound on a portable scale.

Saw logs were weighed individually in the millyard before and after debarking; bark weight of each log was computed by subtraction and totaled for each tree.

Moisture content and specific gravity of wood and bark were determined from cross-section disks taken at each bucking point along the stem. Moisture content samples were dried at 103" C until a constant weight was reached. Moisture content is expressed on an ovendry basis; specific gravity is expressed on a green volume-ovendry weight basis. Stemwood cubic-foot volumes were determined by applying Smalian's formula to individual log measurements and summing these values for individual trees.

Sawmill

Debarked logs were sawed into 4/4 and 8/4 lumber on a circular headsaw which had a 5/16-inch kerf. As the logs were sawed, the chippable residues (slabs, edgings, and end trim) were collected and weighed. The lumber from each log was also tallied by weight and volume. A 6-foot 1 by 4 was the smallest board retained by the mill.

Analysis

Regression equations were developed to estimate stem weight with and without bark and cubic volume to a 6-, 4-, and 2-inch top. Additional equations estimate lumber volume and the weight of lumber, chippable residue, bark, and sawdust produced during sawing.

All equations are of the form:

$$Y = b_0 + b_1 D^2 Mh + e$$

where:

Y = weight or volume of the tree component

b_0, b_1 = regression coefficients

D = tree diameter at breast height in inches

Mh = tree height to the merchantable top in feet

e = experimental error.

Grouping of the data into D^2Mh classes indicated that the variance of the dependent variable was homogeneous and did not increase with increasing tree size. Since the basic assumptions of regression analysis were met, the unweighted linear model was used to predict weights and volumes of the tree components.

RESULTS AND DISCUSSION

General

The saw-log portions of the 48 trees weighed a total of 120,413 pounds and yielded an average of 9 percent bark residue, 16 percent sawdust, 54 percent lumber, and 21 percent chippable residue (table 1).

The percentage of merchantable stem weight in sawdust was essentially constant at 16 percent across the range of tree sizes sampled. Bark percentage also varied little with tree size, ranging from 8 to 10 percent and averaging 9 percent of stem weight.

Lumber recovery factor, the ratio of lumber produced per cubic foot of saw-log material, averaged 6.48 board feet per cubic foot and increased from a low of 5.80 for lo-inch trees to a high of 6.84 for 18-inch trees.

Table 1.--Average size, weight, volume, and proportion of primary product recovery for longleaf pine sawtimber trees

D.b.h. class (inches)	Merchantable height[1]	Merchantable stem weight[2]	Primary product recovery				Lumber tally	Volume merchantable stem[3]	Lumber recovery factor	Sample size
			Lumber	Chippable residue	Sawdust	Bark residue				
	Feet	Pounds	Percent				Board feet	Cubic feet	Board feet/ cubic feet	Number
10	40	968	48	26	17	9	80	13.8	5.80	8
12	55	1,721	51	23	17	9	156	25.6	6.09	8
14	56	2,277	52	22	17	9	210	33.4	6.29	8
15	66	2,994	57	17	17	9	308	46.0	6.70	1
16	60	3,155	54	22	16	8	312	47.9	6.51	11
17	53	3,272	56	19	16	9	336	49.3	6.82	8
18	54	3,584	55	21	16	8	364	53.2	6.84	2
19	70	4,822	52	22	16	10	471	71.0	6.63	2
Study average		2,509	54	21	16	9	243	37.5	6.48	--

[1] Merchantable height to 6-inch or merchantable top includes 1-foot stump allowance.
[2] Weight of saw-log portion of stem with bark.
[3] Stemwood volume, inside bark.

Physical Properties of Wood and Bark

The moisture content, specific gravity, and green weight per cubic foot of wood and bark are shown in the following tabulation. Since specific gravity, moisture content, and weight per cubic foot of wood and bark did not vary with tree size, only the study averages and standard deviations are shown.

Type of material	Moisture content (percent)	Specific gravity	Weight / cubic foot (pounds)
Wood			
Saw-log portion	79.4 ± a.8	0.559 ± 0.034	62.4 ± 2.1
Pulpwood portion	108.1 ± 16.0	0.501 ± 0.041	64.8 ± 2.5
Bark			
Saw-log portion	57.3 ± 7.7	0.408 ± 0.027	40.0 ± 2.7
Pulpwood portion	84.1 ± 13.2	0.391 ± 0.030	44.8 ± 3.5

The moisture contents of both wood and bark were higher in the pulpwood portion of the tree than in the saw-log portion, while the specific gravities of both wood and bark were lower in the pulpwood portion of the tree. Green weight per cubic foot of wood and bark was higher in the pulpwood section because the moisture content in this section of the tree was higher.

Prediction Equations and Yield Tables

Regression equations to predict weight or volume of the merchantable stem and the primary products are shown in table 2. All equations had coefficients of determination of 0.90 or larger; coefficients of variation ranged from 7.3 to 12.5 percent. The equations in table 2 were used to generate tables of stem weights and volumes and the weight of primary products produced in sawmilling.

Appendix tables show estimates of weight or volume of the main stem of longleaf pine trees and the weight or volume of lumber, bark, sawdust, and chippable residue produced when the logs from the trees are sawed.

Table 2. --Regression equations and associated statistics to predict longleaf pine stem weights, volumes, and primary product yields

Dependent variable and unit of measure	Equation	Coefficient of determination (R^2)	Standard error of estimate ($S_{y \cdot x}$)	Coefficient of variation (CV)
Stem weight with bark (pounds)				
Saw -log top	$Y = 258.37218 + 0.18648\ D^2Mh$	0.97	182.0	7.3
4-inch top	$Y = 455.33218 + 0.18695\ D^2Mh$	0.92	307.0	11.3
2-inch top	$Y = 486.69792 + 0.18651\ D^2Mh$	0.92	308.1	11.3
Stem weight without bark (pounds)				
Saw-log top	$Y = 231.89438 + 0.17036\ D^2Mh$	0.97	177.2	7.7
4-inch top	$Y = 411.04012 + 0.17073\ D^2Mh$	0.92	287.5	11.6
2-inch top	$Y = 439.86186 + 0.17032\ D^2Mh$	0.91	288.6	11.6
Stem bark weight (pounds)				
4-inch top	$Y = 44.29207 + 0.01622\ D^2Mh$	0.90	30.0	12.5
2-inch top	$Y = 46.83605 + 0.01619\ D^2Mh$	0.90	30.1	12.4
Stem wood volume (cubic feet)				
Saw-log top	$Y = 3.17916 + 0.00284\ D^2Mh$	0.97	2.9	7.8
4-inch top	$Y = 6.00302 + 0.00286\ D^2Mh$	0.91	4.9	12.1
2-inch top	$Y = 6.43921 + 0.00285\ D^2Mh$	0.91	4.9	12.0
Primary product weight (pounds)				
Bark residue	$Y = 26.47780 + 0.01613\ D^2Mh$	0.95	20.8	9.4
Sawdust	$Y = 54.98038 + 0.02950\ D^2Mh$	0.96	33.5	8.2
Lumber	$Y = 74.81510 + 0.10473\ D^2Mh$	0.94	146.6	11.0
Chippable residue	$Y = 102.09890 + 0.03613\ D^2Mh$	0.91	62.9	11.7
Lumber volume (board feet)	$Y = 3.74017 + 0.01983\ D^2Mh$	0.95	25.7	10.6

Appendix tables 3-6 give predicted green weights of chippable residue, bark residue, sawdust, and lumber, respectively. The predicted lumber volume in board feet is presented in Appendix table 7 for trees 10-22 inches d. b. h.

Appendix tables 8-15 present stem weights with and without bark and bark weight for longleaf pine trees utilized to a saw-log top, a 4-inch top, or a 2-inch top. Appendix tables 16-18 present the cubic-foot wood volume in the stems of the trees utilized to the three different top diameters.

The use of these tables should be limited to stands where the physical properties of the trees are similar to those reported in this paper. Primary product yields are strongly influenced by the type of equipment used to process the logs and by processing techniques. Thus, it is unlikely that our predictions of the amount of primary products recoverable from longleaf pine trees apply where processing techniques differ considerably from those of the study.

Appendix

Table 3. --Predicted[1] weight of chippable residue from the saw-log portion of longleaf pine trees[2]

D.b.h. class (inches)	Merchantable height (number of 16-foot logs)[3]								
	1	1-1/2	2	2-1/2	3	3-1/2	4	4-1/2	5
	Pounds								
10	164	192	221	250	279	308			
11	176	211	246	281	316	351	386		
12	191	232	274	315	357	399	440	482	
13	206	255	304	352	401	450	499	548	
14	222	279	336	392	449	506	562	619	676
15	240	305	370	435	500	565	631	696	761
16	259	333	407	481	555	629	703	777	851
17		363	447	530	614	697	781	864	948
18		395	488	582	676	769	863	957	1,050
19		428	533	637	741	846	950	1,054	1,159
20		463	579	695	810	926	1,041	1,157	1,273
21			628	755	883	1,010	1,138	1,265	1,393
22			679	819	959	1,099	1,239	1,379	1,519

[1] Based on the equation $\hat{Y} = 102.09890 + 0.03613\ D^2Mh$.
[2] Blocked-in areas indicate range of our data.
[3] Includes l-foot stump allowance.

Table 4. --Predicted[1] bark weight from the saw-log portion of longleaf pine trees[2]

D. b. h. class (inches)	Merchantable height (number of 16-foot logs)[3]								
	1	1-1/2	2	2-1/2	3	3-1/2	4	4-1/2	5
	Pounds								
10	54	67	80	93	106	118			
11	60	75	91	106	122	138	153		
12	66	85	103	122	140	159	177	196	
13	73	95	116	138	160	182	204	225	
14	80	106	131	156	181	207	232	257	283
15	88	117	146	175	204	233	262	291	320
16	97	130	163	196	229	262	295	328	361
17		143	180	218	255	292	329	367	404
18		157	199	241	283	324	366	408	450
19		172	219	265	312	358	405	452	498
20		188	239	291	343	394	446	497	549
21			261	318	375	432	489	546	603
22			284	347	409	471	534	596	659

[1] Based on the equation $\hat{Y} = 26.47780 + 0.01613\ D^2Mh$.
[2] Blocked-in areas indicate range of our data.
[3] Includes l-foot stump allowance.

Table 5. --Predicted [1] weight of sawdust from the saw-log portion of longleaf pine trees[2]

D.b.h. class (inches)	Merchantable tree height (number of 16-foot logs)[3]								
	1	1-1/2	2	2-1/2	3	3-1/2	4	4-1/2	5
	Pounds								
10	105	129	152	176	200	223			
11	116	144	173	201	230	258	287		
12	127	161	195	229	263	297	331	365	
13	140	180	220	259	299	339	379	419	
14	153	200	246	292	338	385	431	477	523
15	168	221	274	327	380	433	486	540	593
16	183	244	304	365	425	485	546	606	667
17		268	336	405	473	541	609	677	746
18		294	370	447	523	600	676	753	829
19		321	406	492	577	662	747	832	918
20		350	444	539	633	728	822	916	1,011
21			484	588	692	797	901	1,005	1,109
22			526	640	755	869	983	1,097	1,211

[1]Based on the equation $\hat{Y} = 54.98038 + 0.02950\ D^2Mh$.
[2]Blocked-in areas indicate range of our data.
[3]Includes 1-foot stump allowance.

Table 6. --Predicted[1] weight of lumber from the saw-log portion of longleaf pine trees[2]

D.b.h. class (inches)	Merchantable tree height (number of 16-foot logs)[3]								
	1	1-1/2	2	2-1/2	3	3-1/2	4	4-1/2	5
	Pounds								
10	253	337	420	504	588	672			
11	290	392	493	594	696	797	899		
12	331	452	572	693	814	934	1,055	1,176	
13	376	517	659	800	942	1,084	1,225	1,367	
14	424	588	752	916	1,081	1,245	1,409	1,573	1,738
15	475	664	852	1,041	1,229	1,418	1,606	1,795	1,984
16	531	745	960	1,174	1,389	1,603	1,818	2,032	2,246
17		831	1,074	1,316	1,558	1,800	2,042	2,284	2,526
18		923	1,195	1,466	1,738	2,009	2,280	2,552	2,823
19		1,020	1,322	1,625	1,927	2,230	2,532	2,835	3,137
20		1,122	1,451	1,792	2,128	2,463	2,798	3,133	3,468
21			1,599	1,968	2,338	2,707	3,077	3,446	3,816
22			1,740	2,153	2,559	2,964	3,370	3,775	4,181

[1]Based on the equation $\hat{Y} = 74.81510 + 0.10473\ D^2Mh$.
[2]Blocked-in areas indicate range of our data.
[3]Includes 1-foot stump allowance.

Table 7. --Predicted[1] lumber volume from the saw-log portion of longleaf pine trees[2]

D. b. h. class (inches)	Merchantable tree height (number of 16-foot logs)[3]								
	1	1-1/2	2	2-1/2	3	3-1/2	4	4-1/2	5
	Board feet								
10	37	53	69	85	101	117			
11	45	64	83	102	121	141	160		
12	52	75	98	121	144	167	189	212	
13	61	88	114	141	168	195	222	248	
14	70	101	132	163	194	225	256	287	319
15	80	115	151	187	222	258	294	329	365
16	90	131	171	212	252	293	334	374	415
17		147	193	239	285	330	376	422	468
18		164	216	267	319	370	421	473	524
19		183	240	297	355	412	469	526	584
20		202	265	329	392	456	519	583	646
21			292	362	432	502	572	642	712
22			320	397	474	551	628	704	781

[1]Based on the equation $\hat{Y} = 3.74017 + 0.01983\ D^2Mh$.
[2]Blocked-in areas indicate range of our data.
[3]Includes 1-foot stump allowance.

Table 8. --Predicted[1] stem weight with bark to merchantable saw-log top for longleaf pine trees[2]

D. b. h. class (inches)	Merchantable tree height (number of 16-foot logs)[3]								
	1	1-1/2	2	2-1/2	3	3-1/2	4	4-1/2	5
	pounds								
10	575	725	874	1,023	1,172	1,321			
11	642	822	1,003	1,183	1,364	1,545	1,725		
12	715	930	1,145	1,359	1,574	1,789	2,004	2,219	
13	794	1,046	1,298	1,550	1,803	2,055	2,307	2,559	
14	880	1,172	1,465	1,757	2,049	2,342	2,634	2,927	3,219
15	972	1,307	1,643	1,979	2,314	2,650	3,986	3,657	
16	1,070	1,452	1,834	2,216	2,598	2,979	3,361	3,743	4,125
17		1,606	2,037	2,468	2,899	3,330	3,761	4,193	4,624
18		1,769	2,252	2,736	3,219	3,702	4,186	4,669	5,152
19		1,941	2,480	3,018	3,557	4,096	4,634	5,173	5,711
20		2.123	2,720	3,317	3,913	4,510	5,107	5,704	6,300
21			2,972	3,630	4,288	4,946	5,604	6,262	6,920
22			3,237	3,959	4,681	5,403	6,125	6,847	7,569

[1]Based on the equation $\hat{Y} = 258.37218 + 0.18648\ D^2Mh$.
[2]Blocked-in areas indicate range of our data.
[3]Includes 1-foot stump allowance.

Table 9. --Predicted[1] stem weight without bark to merchantable saw-log top for longleaf pine trees[2]

D. b. h. class (inches)	Merchantable tree height (number of 16-foot logs)[3]								
	1	1-1/2	2	2-1/2	3	3-1/2	4	4-1/2	5
	Pounds								
10	322	658	794	930	1,067	1,203			
11	582	747	912	1,077	1,242	1,407	1,572		
12	649	845	1,041	1,238	1,434	1,630	1,826	2,023	
13	721	952	1,182	1,412	1,643	1,873	2,103	2,334	
14	800	1,067	1,334	1,601	1,868	2,135	2,402	2,669	2,937
15	884	1,190	1,497	1,803	2,110	2,417	2,723	3,030	3,337
16	973	1,322	1,671	2,020	2,369	2,718	3,067	3,416	3,764
17		1,463	1,857	2,250	2,644	3,038	3,432	3,826	4,220
18		1,612	2,053	2,495	2,937	3,378	3,820	4,261	4,703
19		1,769	2,261	2,753	3,245	3,737	4,229	4,721	5,213
20		1.935	2,481	3,026	3,571	4,116	4,661	5,206	5,752
21			2,711	3,312	3,913	4,514	5,115	5,716	6,317
22			2,953	3,613	4,272	4,932	5,591	6,251	6,911

[1]Based on the equation $\hat{Y} = 231.89438 + 0.17036\ D^2Mh$.
[2]Blocked-in areas indicate range of our data.
[3]Includes l-foot stump allowance.

Table 10. --Predicted[1] stem weight with hark to a 4-inch top diameter for longleaf pine trees[2]

D. b. h. class (inches)	Merchantable tree height (number of 16-foot logs)[3]								
	1	1-1/2	2	2-1/2	3	3-1/2	4	4-1/2	5
	Pounds								
10	773	923	1,072	1,222	1,371	1,521			
11	840	1,021	1,202	1,383	1,564	1,745	1,926		
12	913	1,128	1,344	1,559	1,774	1,990	2,205	2,421	
13	992	1,245	1,498	1,751	2,003	2,256	2,509	2,762	
14	1,078	1,371	1,665	1,958	2,251	2,544	2,837	3,130	3,423
15	1,170	1,507	1,843	2,180	2,516	2,853	3,189	3,526	3,862
16	1,269	1,652	2,035	2,418	2,800	3,183	3,566	3,949	4,332
17		1,806	2,238	2,671	3,103	3,535	3,967	4,399	4,832
18		1,970	2,454	2,939	3,423	3,908	4,392	4,877	5,362
19		2,143	2,682	3,222	3,762	4,302	4,842	5,382	5,922
20		2,325	2,923	3,521	4,120	4,718	5,316	5,914	6,513
21			3,176	3,836	4,495	5,155	5,614	6,474	7,133
22			3,441	4,165	4,889	5,613	6,337	7,061	7,785

[1]Based on the equation $\hat{Y} = 455.33218 + 0.18695\ D^2Mh$.
[2]Blocked-in areas indicate range of our data.
[3]Includes l-foot stump allowance.

Table 11. --Predicted' stem weight without bark to a 4-inch top diameter for longleaf pine trees[2]

D.b.h. class (inches)	Merchantable tree height (number of 16-foot logs)"								
	1	1-1/2	2	2-1/2	3	3-1/2	4	4-1/2	5
	Pounds								
10	701	838	974	1,111	1,248	1,384			
11	762	927	1,093	1,258	1,423	1,589	1,754		
12	829	1,026	1,222	1,419	1,616	1,812	2,009	2,206	
13	902	1,132	1,363	1,594	1,825	2,056	2,287	2,517	
14	980	1,248	1,515	1,783	2,051	2,318	2,586	2,854	3,122
15	1,064	1,371	1.679	1,986	2,293	2,601	2,908	3,215	3,523
16	1,154	1,504	1,853	2.203	2.553	2.902	3,252	3,602	3,951
17		1,645	2,039	2,434	2,829	3,223	3,618	4,013	4,408
18		1,794	2,236	2,679	3,122	3,564	4,007	4,449	4,892
19		1,952	2,445	2,938	3,431	3,924	4,417	4,910	5,403
20		2,118	2,665	3,211	3,157	4,304	4,850	5,396	5,943
21			2,896	3,498	4,100	4,703	5,305	5,907	6,510
22			3,138	3,799	4,460	5,121	5,782	6,443	7,104

'Based on the equation $\hat{Y} = 411.04012 + 0.17073\ D^2Mh$.
'Blocked-in areas indicate range of our data.
[3] Includes l-foot stump allowance.

Table 12. --Predicted' weight of bark to a 4-inch top diameter for longleaf pine trees[2]

D.b.h. class (inches)	Merchantable tree height (number of 16-foot logs)'								
	1	1-1/2	2	2-1/2	3	3-1/2	4	4-1/2	5
	Pounds								
10	72	85	98	111	124	137			
11	78	93	109	125	140	156	172		
12	84	103	121	140	159	177	196	215	
13	91	113	135	157	179	201	222	244	
14	98	124	149	175	200	226	251	276	302
15	106	136	165	194	223	252	282	311	340
16	115	148	181	215	248	281	314	347	381
17		161	199	236	274	311	349	386	424
18		176	218	260	302	344	386	428	470
19		191	238	284	331	378	425	472	519
20		206	258	310	362	414	466	518	570
21			280	338	395	452	509	566	624
22			303	366	429	492	555	617	680

'Based on the equation $\hat{Y} = 44.29207 + 0.01622\ D^2Mh$.
"Blocked-in areas indicate range of our data.
[3] Includes l-foot stump allowance.

Table 13. --Predicted' stem weight with bark to a 2-inch top diameter for longleaf pine trees[2]

D. b. h. class (inches)	Merchantable tree height (number of IS-foot logs)[3]								
	1	1-1/2	2	2-1/2	3	3-1/2	4	4-1/2	5
	Pounds								
10	804	953	1,102	1,251	1,401	1.550			
11	8'70	1,051	1,231	1,412	1,593	1.773	1,954		
12	943	1,158	1,373	1,588	1,803	2,018	2,232	2,447	
13	1,023	1,275	1,527	1,779	2.031	2,283	2,536	2,788	
14	1,108	1,401	1,693	1,985	2,278	2,570	2.863	3,155	3,448
15	1,200	1,536	1,872	2,207	2,543	2,879	3,214	3,550	3,886
16	1,298	1,680	2,062	2,444	2,826	3,208	3,590	3,972	4,354
17		1,834	2,265	2,697	3,128	3,559	3,990	4,421	4,853
18		1,997	2,481	2,964	3,448	3,931	4,415	4,898	5,381
19		2,170	2,709	3,247	3,786	4,325	4,863	5,402	5,940
20		2,352	2,949	3'545	4,142	4,739	5,336	5,933	6,530
21			3,201	3,859	4,517	5,175	5,833	6,491	7,149
22			3,466	4.188	4,910	5,632	6,354	7,076	7,799

'Based on the equation $\hat{Y} = 486.69792 + 0.18651\ D^2Mh$.
'Blocked-in areas indicate ranges of our data.
[3]Includes l-foot stump allowance.

Table 14. --Predicted' stem weight without bark to a 2-inch top diameter for longleaf pine trees'

D. b. h. class (inches)	Merchantable tree height (number of 16-foot logs)[3]								
	1	1-1/2	2	2-1/2	3	3-1/2	4	4-1/2	5
	Pounds								
10	729	866	1,002	1,138	1,274	1,411			
11	790	955	1,120	1.285	1,450	1.615	1,779		
12	857	1,053	1.249	1,445	-1,642	1,838	2,034	2,230	
13	929	1,159	I.390	1,620	1,850	2,081	2,311	2,541	
14	1,007	1,274	1,541	1,809	2,076	2,343	2,610	2,877	3,144
15	1,091	1,398	1,704	2,011	2,318	2,624	2,931	3,237	3,544
16	1,181	1,530	1,879	2,228	2,576	2,925	3,274	3,623	3,972
17		1,670	2,064	2,458	2,852	3,246	3,639	4,033	4,427
18		1,819	2,261	2,702	3,144	3,585	4,027	4,468	4,910
19		1,977	2,469	2,961	3,453	3,945	4,436	4,928	5,420
20		2,143	2,688	3,233	3,778	4,323	4,868	5,413	5,958
21			2,919	3,519	4,120	4,721	5,322	5,923	6,524
22			3,160	3,820	4,479	5,139	5,798	6,458	7,117

'Based on the equation $\hat{Y} = 439.86186 + 0.17032\ D^2Mh$.
[2]Blocked-in areas indicate ranges of our data.
'Includes l-foot stump allowance.

Table 15. --Predicted[1] weight of bark to a 2-inch top diameter for longleaf pine trees'

D. b. h. class (inches)	Merchantable tree height (number of 16-foot logs)[3]								
	1	1-1/2	2	2-1/2	3	3-1/2	4	4-1/2	5
	Pounds								
10	74	87	100	113	126	139			
11	80	36	111	127	143	158	174		
12	86	105	124	142	161	180	198	217	
13	33	115	137	159	181	203	225	247	
14	101	126	152	177	202	228	253	278	304
15	109	138	167	196	225	254	284	313	342
16	117	150	184	217	250	283	316	343	383
17		164	201	239	276	314	351	388	426
18		178	220	262	304	346	388	430	472
19		193	240	286	333	380	427	473	520
20		209	261	312	364	416	468	520	571
21			282	340	397	454	511	568	625
22			305	368	431	493	556	619	682

[1]Based on the equation $\hat{Y} = 46.83605 + 0.01619\ D^2Mh$.
[2]Blocked-in areas indicate range of our data.
[3]Includes l-foot stump allowance.

Table 16. --Predicted[1] cubic volume of wood in the merchantable saw-log stem of longleaf pine trees[2]

D. b. h. class (inches)	Merchantable tree height (number of 16-foot logs)[3]								
	1	I-112	2	2-1/2	3	3-1/2	4	4-1/2	5
	Cubic feet								
10	8.0	10.3	12.6	14.8	17.1	19.4			
11	9.0	11.8	14.5	17.3	20.0	22.8	25.5		
12	10.1	13.4	16.7	19.9	23.2	26.5	29.8	33.0	
13	11.3	15.2	19.0	22.3	26.7	30.5	34.4	38.2	
14	12.6	17.1	21.5	26.0	30.5	34.3	39.4	43.8	48.3
15	14.0	19.2	24.3	29.4	34.5	39.6	44.7	43.8	54.3
16	15.5	21.4	27.2	33.0	38.8	44.6	50.4	56.3	62.1
17		23.7	30.3	36.8	43.4	50.0	56.5	63.1	69.7
18		26.2	33.5	40.9	48.3	55.6	63.0	70.4	77.7
19		28.8	37.0	45.2	53.4	61.6	69.8	78.0	86.2
20		31.6	40.7	49.8	58.8	67.9	77.0	86.1	35.2
21			44.5	54.5	64.5	74.6	84.6	34.6	104.6
22			48.5	59.5	70.5	81.5	92.5	103.5	114.5

[1]Based on the equation $\hat{Y} = 3.17916 + 0.00284\ D^2Mh$.
[2]Blocked-in areas indicate range of our data.
[3]Includes l-foot stump allowance.

Table 17. --Predicted[1] cubic volume of wood to a 4-inch top for longleaf pine trees[2]

D. b. h. class (inches)	Merchantable tree height (number of 16-foot logs)[3]								
	1	1-1/2	2	2-1/2	3	3-1/2	4	4-1/2	5
	Cubic feet								
10	10.9	13.2	15.4	17.7	20.0	22.3			
11	11.9	14.7	17.4	20.2	23.0	25.7	28.5		
12	13.0	16.3	19.6	22.9	26.2	29.5	32.8	36.1	
13	14.2	18.1	22.0	25.8	29.7	33.6	37.4	41.3	
14	15.5	20.0	24.5	29.0	33.5	38.0	42.4	46.9	51.4
15	16.9	22.1	27.2	32.4	37.5	42.7	47.8	53.0	58.1
16	18.4	24.3	30.2	36.0	41.9	47.7	53.6	59.5	65.3
17		26.7	33.3	39.9	46.5	53.1	59.7	66.3	73.0
18		29.2	36.6	44.0	51.4	58.8	66.2	73.6	81.1
19		31.8	40.1	48.3	56.6	64.9	73.1	81.4	89.6
20		34.6	43.8	52.9	62.1	71.2	80.4	89.5	98.7
21			47.6	57.7	67.8	77.9	88.0	98.1	108.2
22			51.7	62.8	73.8	84.9	96.0	107.1	118.1

[1]Based on the equation $\hat{Y} = 6.00302 + 0.00286\ D^2Mh$.
[2]Blocked-in areas indicate range of our data.
[3]Includes 1-foot stump allowance.

Table 18. --Predicted[1] cubic volume of wood to a 2-inch top for longleaf pine trees[2]

D. b. h. class (inches)	Merchantable tree height (number of 16-foot logs)[3]								
	1	1-1/2	2	2-1/2	3	3-1/2	4	4-1/2	5
	Cubic feet								
10	11.3	13.6	15.8	18.1	20.4	22.7			
11	12.3	15.1	17.8	20.6	23.3	26.1	28.9		
12	13.4	16.7	20.0	23.3	26.5	29.8	33.1	36.4	
13	14.6	18.5	22.3	26.2	30.0	33.9	37.7	41.6	
14	15.9	20.4	24.9	29.3	33.8	38.3	42.7	47.2	51.7
15	17.3	22.5	27.6	32.7	37.9	43.0	48.1	53.3	58.4
16	18.8	24.7	30.5	36.4	42.2	48.0	53.9	59.7	65.5
17		27.0	33.6	40.2	46.8	53.4	60.0	66.6	73.2
18		29.5	36.9	44.3	51.7	59.1	66.5	73.8	81.2
19		32.2	40.4	48.6	56.9	65.1	73.3	81.5	89.8
20		34.9	44.1	53.2	62.3	71.4	80.5	89.7	98.8
21			47.9	58.0	68.0	78.1	88.1	98.2	108.2
22			52.0	63 .O	74.0	85.1	96.1	107.1	118.2

[1]Based on the equation $\hat{Y} = 6.43921 + 0.00285\ D^2Mh$.
[2]Blocked-in areas indicate range of our data.
[3]Includes 1-foot stump allowance.

Schroeder, James G., Michael A. Taras, and Alexander Clark III

1975. Stem and primary product weights for longleaf pine sawtimber trees. USDA For. Serv. Res. Pap. SE-139, 15 p. Southeast. For. Exp. Stn., Asheville, N.C.

Forty-eight longleaf pine (Pinus palustris Mill.) sawtimber trees 10 to 19 inches d.b.h. were processed into lumber on a circular sawmill in south Alabama. Stem and product weights and volumes were determined and regression equations developed to predict stem weight, volume, and the weight of bark, sawdust, lumber, and chippable residue produced in the sawmill. Tables showing estimates of these weights and volumes are provided for trees 10 to 22 inches d.b.h.

The saw-log portions of the trees yielded an average of 9 percent bark, 16 percent sawdust, 21 percent chippable residue, and 54 percent lumber by weight.

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