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SOFTWOOD TREE VOLUME EQUATIONS FOR MAJOR CALIFORNIA SPECIES

by

Colin D. MacLean, *Mensurationist*

and

John M. Berger, *Mensurationist*

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ABSTRACT

New cubic-foot, International 1/4-inch board-foot, and Scribner board-foot tree volume equations and tables are presented for eight species: Douglas-fir, Jeffrey pine, ponderosa pine, sugar pine, lodgepole pine, white fir, California red fir, and incense-cedar.

KEYWORDS: Cubic-foot volume tables (stand), board-foot stand volume tables.

INTRODUCTION

We have developed, for use in the Forest Survey of California,^{1/} new cubic-foot, International 1/4-inch board-foot, and Scribner board-foot tree volume equations for eight conifer species: Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco), ponderosa pine (*Pinus ponderosa* Laws.), Jeffrey pine (*Pinus jeffreyi* Grev. & Balf.), sugar pine (*Pinus lambertiana* Dougl.), lodgepole pine (*Pinus contorta* Dougl.), white fir (*Abies concolor* (Gord. & Glend.) Lindl.), California red fir (*Abies magnifica* A. Murr.), and incense-cedar (*Libocedrus decurrens* Torr.).

Previously, Forest Survey has relied on a series of local volume tables (California Forest and Range Experiment Station, Forest Survey 1956) to compile timber volume statistics for California.^{2/} These tables assume average heights and form classes by site class based on Forest Survey data collected in the 1940's. The old tables no longer meet Forest Survey needs because (1) we are now interested in an accurate assessment of the volume on individual plots, for which we need volume estimates that take into account individual tree height variation; (2) height over d.b.h. and form class over d.b.h. ratios based on 25-year-old data may not accurately describe today's forest; and (3) the International 1/4-inch board-foot local volume tables assume a top utilization that does not conform with Forest Survey standards.

To replace the old tables, we needed volume equations that would provide comparable estimates of cubic, International 1/4-inch, and Scribner volume to Forest Survey utilization standards. The only existing tables suitable for statewide use (Clements and others 1949a, 1949b) were available only for the Scribner rule and varied by merchantable log height--a variable that is less desirable than total height for use on permanent plots. We therefore chose to develop our own equations.

THE BASIC DATA

Our need was for volume equations suitable for use on trees throughout California. Ideally, for this purpose, we would have preferred a large sample of recently measured trees, drawn from the complete range of forest conditions found in the State. In practice, we were limited to available tree measurement data, since we had neither time nor funds to undertake our own measurements. The most readily available tree measurement data were assembled by Clements and others (1949a, 1949b) during the preparation of their form class volume tables for ponderosa pine, Douglas-fir, white fir, sugar pine, and red fir. The tables themselves are inadequate for our purposes because they are based on log height rather than total height and because they are developed only for the Scribner log rule. However, complete stem profiles are available for all the 2,110 trees used to develop the tables.

^{1/} A nationwide project of the U.S. Forest Service. The Pacific Northwest Forest and Range Experiment Station conducts the survey in Alaska, California, Hawaii, Oregon, and Washington.

^{2/} Unpublished cubic and International 1/4-inch rule volume tables on file at the Pacific Northwest Forest and Range Experiment Station.

The felled tree measurements used for the form class volume tables were, for the most part, taken 50-70 years ago. Both young- and old-growth trees were included from a range of sites scattered from the Modoc plateau south along the Sierra Nevada to the Sierra National Forest. To this sample, we added 957 dendrometer-measured trees from recent inventories of the Eldorado and Sierra National Forests. The latter trees included small samples of lodgepole pine and incense cedar--two species not included in the form class volume tables.

Although the size of our sample was more than adequate, the reader should be aware of some important data deficiencies. First, two-thirds of the sample was drawn from trees measured many years ago. While we recognized the danger of bias inherent in the use of old data, that risk seemed preferable to relying on a much smaller sample with a limited geographical distribution. Second, we were unable to find measured-tree data from the Coast Ranges or, more important, for trees under 11.0 inches in diameter breast high. In the case of California red fir, all our sample trees were over 14 inches. This lack of small-tree data posed a particular problem in developing cubic-foot equations, since volumes were needed for all trees 5.0 inches and larger. We were forced to extrapolate, using comparisons of existing tables as a guide to reasonableness. Finally, our sample data for lodgepole pine and incense-cedar were limited--26 trees of the former species and 46 of the latter--and confined to the southern Sierra Nevada. In spite of these scanty data, we decided to develop volume equations for both species, as an alternative preferable to using equations developed for some other species.

DEVELOPING THE EQUATIONS

The STX program (Grosenbaugh 1967) was used to calculate three volumes for each of the sample trees: (1) CV_4 --cubic-foot volume to a 4-inch minimum top d.i.b., (2) $IV_{1/4, 6.5}$ --International 1/4-inch board-foot volume to a 6.5-inch minimum top d.i.b., and (3) SV_U --Scribner board-foot volume to a California utilized top as defined by a 1945 Forest Service study (California Forest and Range Experiment Station, Forest Survey 1956). The relationship of the utilized top d.i.b. to d.b.h. is shown in figure 1.

Figure 1.--Relation-
ship of utilized
top d.i.b. to
d.b.h. (Based on
1945 Forest Service
study.)

The method of analysis was essentially that used by Bruce and DeMars (1974). For each species and each log rule, tree volumes were fitted by weighted least squares by means of a stepwise multiple regression analysis. In order to obtain homogeneity of variance, each variable was divided by $0.005454154 \text{ (d.b.h.)}^2$ (total height)--the volume of a cylinder with a basal area and height equal to that of the sample tree. Our choice of independent variables was limited by the information available about the sample trees. Variables tested included d.b.h., total height, their powers, and cross products. Site class and age class (young growth or old growth) were also tried but dropped because their relative contribution to precision was small and their inclusion in the equations would have required the user to obtain site and age information.

The volume equations follow. Where applicable, restraints have been added to insure reasonable extrapolation. The following symbols have been used:

- V = volume
- D = diameter breast high
- H = total height
- F = form factor (the ratio of a tree's volume to that of a cylinder of the same diameter and height)
- CF_4 = cubic-foot form factor
- $IF1/4_{6.5}$ = International 1/4-inch board-foot form factor to a 6.5-inch top d.i.b.
- SF_u = Scribner form factor (16-foot logs) to a California utilized top.^{3/}

To determine the volume of a given tree, first calculate the tree form factor, (transformed volume) using the appropriate equation for the species. Then multiply the form factor by the volume of a cylinder with the same height and basal area as the tree. Thus: $V = 0.005454154 D^2 H F$, where F is equal to the form factor appropriate for the species and log rule. The form factor equations are:

<u>Species</u>	<u>Equation</u>
Douglas-fir	$CF_4^{4/} = 0.248569 + 0.0253524 \left(\frac{H}{D}\right) - 0.0000560175 \left(\frac{H^2}{D}\right)$ $IF1/4_{6.5} \text{ (when } H \geq 57 \text{ feet)} = 1.575350 - 1269.84 \left(\frac{1}{DH}\right)$ $+ 20.4816 \left(\frac{1}{D}\right) + 0.0000135387 H^2$

^{3/} See figure 1.

^{4/} For all species except incense-cedar, CF_4 will be set equal to 0.4 whenever the equation value is higher than 0.4. When the equation value for CF_4 is lower than 0.3, it is set equal to 0.3. This will insure reasonable extrapolation beyond the limits of the study data.

Douglas-fir

$$\begin{aligned} \text{IF1/4}_{6.5} \text{ (when } H < 57 \text{ feet)} &= 1.575350 - 1269.84 \left(\frac{1}{DH}\right) \\ &+ 20.4816 \left(\frac{1}{D}\right) + 0.0000135387 H^2 \\ &+ 7333.86 \left(\frac{1}{D^2H}\right) - 128.342 \left(\frac{1}{D^2}\right) \\ SF_u &= 2.58530 - 83.5000 \left(\frac{1}{H}\right) \end{aligned}$$

Ponderosa and
Jeffrey pine

$$\begin{aligned} CF_4 &= 0.402060 - 0.899914 \left(\frac{1}{D}\right) \\ \text{IF1/4}_{6.5} &= 3.02027 - 22.0313 \left(\frac{1}{D}\right) + 0.00201362 (H) \\ SF_u \frac{5}{} &= 3.22940 - 585.500 \left(\frac{1}{DH}\right) - 21.7575 \left(\frac{1}{D}\right) \end{aligned}$$

Sugar pine

$$\begin{aligned} CF_4 &= 0.358550 - 0.488134 \left(\frac{1}{D}\right) \\ \text{IF1/4}_{6.5} &= 2.75889 - 18.1229 \left(\frac{1}{D}\right) + 0.000225065 \left(\frac{H^2}{D}\right) \\ SF_u &= 2.88706 - 25.2838 \left(\frac{1}{D}\right) \end{aligned}$$

Lodgepole pine

$$\begin{aligned} CF_4 &= 0.422709 - 0.0000612236 \left(\frac{H^2}{D}\right) \\ \text{IF1/4}_{6.5} &= 2.86258 - 716.659 \left(\frac{1}{DH}\right) \\ SF_u &= 2.63048 - 850.630 \left(\frac{1}{DH}\right) \end{aligned}$$

White fir

$$\begin{aligned} CF_4 &= 0.299039 - 1.91272 \left(\frac{1}{H}\right) + 0.000367217 \left(\frac{H^2}{D}\right) \\ \text{IF1/4}_{6.5} \text{ (when } D \geq 11.0 \text{ inches)} &= 2.08637 - 119.839 \left(\frac{1}{D^2}\right) \\ &+ 0.000620285 \left(\frac{H^2}{D}\right) \\ \text{IF1/4}_{6.5} \text{ (when } D < 11.0 \text{ inches)} &= (0.45 + 0.05 D) (1.09597 \\ &+ 0.000056389 H^2) \\ SF_u &= 2.31733 - 16.9592 \left(\frac{1}{D}\right) + 0.000548156 \left(\frac{H^2}{D}\right) \end{aligned}$$

$\frac{5}{} SF_u$ will be set equal to 0.7 whenever it drops below this value to insure reasonable extrapolation from small trees. The volume of a tree with a minimum saw log diameter of 8 inches/inside bark by 12 feet long is 23 board feet.

California
red fir

$$CF_4 = 0.231237 + 0.028176 \left(\frac{H}{D}\right)$$

$$IF1/4_{6.5} = 1.54320 + 0.00133466 \left(\frac{H^2}{D}\right)$$

$$SF_u = 1.59669 - 464.752 \left(\frac{1}{DH}\right) + 0.00105105 \left(\frac{H^2}{D}\right)$$

Incense-cedar

$$CF_4 \frac{6}{4} = 0.225786 + 4.44236 \left(\frac{1}{H}\right)$$

$$IF1/4_{6.5} = 1.39269 + 0.0000259631 H^2$$

$$SF_u = 1.82080 - 11.7184 \left(\frac{1}{D}\right)$$

Volumes calculated from these equations are in tables 1-21.

RELIABILITY OF THE EQUATIONS

One measure of the reliability of an equation is the extent to which the individual observations deviate from the regression surfaces. A measure of this residual variation is the root mean squared error--the square root of the mean squared difference between the predicted and actual values. Table 22 shows the root mean squared error of each form factor equation, expressed both in absolute terms and as a percent of the average form factor.

It is generally desirable to test new equations against an independent source of data--data not used in the construction of the equations. We tested the equations on 441 trees from the Stanislaus National Forest which had been measured with an optical dendrometer. The results of this test, together with the results of a test of the old Forest Survey local volume tables, appear in table 23. Figures 2-9 illustrate the relationship between estimated and actual volume of the test trees. As expected, the new equations, based on d.b.h. and total height, account for more of the variation in individual tree volume than do the old tables based on d.b.h. alone. The old lodgepole pine and incense-cedar tables gave very biased estimates of tree volume in this test. Tests against different trees in other geographic areas might well produce different biases. However, the new equations, which reflect differences in individual tree heights, should carry less risk of bias than the old tables, which rely on assumptions about the average relationships between heights and d.b.h. within a site class.

We also developed a complete set of volume equations which used Girard form class as one of the independent variables. When individual tree, Girard form class is known without error, these equations are more precise than the ones presented here. In practice, however, actual form class is seldom known. A common procedure is to use average form classes by species and sometimes by diameter class. We wondered whether the addition of form class would improve the estimate of individual tree volume when average form class was substituted for actual form class.

^{6/} When the equation value for CF_4 is < 0.27 , it is set equal to 0.27 to insure reasonable extrapolation.

Figure 2.--Relationship between the measured cubic-foot volume of 146 ponderosa and Jeffrey pine trees and estimates from the new equation.

Figure 3.--Relationship between the measured cubic-foot volume of 146 ponderosa and Jeffrey pine trees and estimates from Forest Survey local volume tables.

Figure 4.--Relationship between the measured cubic-foot volume of 60 lodgepole pine trees and estimated volume from the new equation.

Figure 5.--Relationship between the measured cubic-foot volume of 60 lodgepole pine trees and estimates from the Forest Survey local volume tables.

Figure 6.--Relationship between the measured International 1/4-inch board-foot volume of 146 ponderosa and Jeffrey pine trees and estimates from the new equation.

Figure 7.--Relationship between the measured International 1/4-inch board-foot volume of 146 ponderosa and Jeffrey pine trees and estimates from the Forest Survey local volume tables.

Figure 8.--Relationship between the measured International 1/4-inch board-foot volume of 60 lodgepole pine trees and estimates from the new equation.

Figure 9.--Relationship between the measured International 1/4-inch board-foot volume of 60 lodgepole pine trees and estimates from the Forest Survey local volume tables.

To answer this question, we tested equations with and without form class against our 441 Stanislaus National Forest trees. The results of this test are in table 24. In this test, the extra precision gained by adding a form class variable was lost completely when average form class was substituted for actual form class, even though the actual average form classes of the test trees were used. We therefore decided not to include the form class equations in this note. We will be glad to supply the form class equations on request. However, we do not recommend their use unless form class is known for every tree.

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Table 1.—Cubic-foot volume of Douglas-fir

Top diameter, 4 inches
Stump height, 1 foot

Stump and top excluded		Total height--Feet																			Top diameter, 4 inches Stump height, 1 foot	
Diameter breast height outside bark-- inches		40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240
6	3																					
8	5																					
10	7																					
12	10																					
14	13																					
16	17																					
18	21																					
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1/ Diameter classes are midpoint; e.g., 12-inch class includes 11.0-12.9.
NOTE.--Block indicates extent of data.

Table 2.—Board-foot volume of Douglas-fir by International 1/4-inch rule

Top diameter, 6.5 inches
Stump height, 1 foot

Stump and top excluded

Diameter breast height outside bark-- inches ^{1/2}	Total height--Feet																					
	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	
10	22	35	51	72	93	114	136	158	181	204	228	252	277									
12	33	52	74	101	129	157	185	215	245	275	307	339	373									
14	46	72	101	135	170	206	242	280	318	357	397	439	482									
16	62	96	132	175	218	262	307	353	400	449	499	551	605									
18	81	123	168	219	271	324	379	435	492	551	612	675	740									
20	102	154	208	269	330	393	458	525	593	664	736	812	890	971	1,055	1,142						
22	127	188	252	323	395	469	545	623	703	786	872	961	1,053	1,148	1,247	1,350						
24	154	226	301	382	466	551	639	730	823	919	1,019	1,122	1,229	1,340	1,455	1,575						
26	184	267	353	447	543	640	741	845	952	1,062	1,177	1,295	1,418	1,546	1,679	1,818						
28	218	312	410	516	625	736	850	968	1,090	1,216	1,346	1,481	1,621	1,767	1,919	2,077						
30	256	360	472	591	713	838	967	1,100	1,237	1,379	1,526	1,679	1,838	2,003	2,175	2,354	2,541	2,735	2,938	3,150	3,371	
32	302	411	537	670	807	947	1,091	1,240	1,394	1,553	1,718	1,890	2,068	2,253	2,447	2,648	2,858	3,077	3,306	3,544	3,793	
34	348	467	607	755	907	1,063	1,223	1,389	1,560	1,737	1,921	2,112	2,311	2,518	2,734	2,959	3,194	3,439	3,694	3,961	4,240	
36	396	522	681	844	1,012	1,185	1,362	1,545	1,735	1,931	2,135	2,347	2,568	2,798	3,037	3,287	3,548	3,820	4,104	4,401	4,711	
38	446	588	759	939	1,124	1,313	1,509	1,710	1,919	2,136	2,361	2,595	2,838	3,092	3,356	3,632	3,920	4,221	4,536	4,864	5,207	
40	498	656	837	1,039	1,241	1,449	1,663	1,884	2,113	2,351	2,597	2,854	3,121	3,400	3,691	3,994	4,311	4,642	4,989	5,350	5,728	
42	552	726	927	1,143	1,364	1,590	1,824	2,066	2,316	2,576	2,845	3,126	3,418	3,723	4,041	4,374	4,721	5,084	5,463	5,859	6,273	
44	608	798	1,019	1,253	1,492	1,739	1,993	2,256	2,528	2,811	3,105	3,410	3,729	4,061	4,408	4,770	5,149	5,545	5,958	6,391	6,843	
46	666	876	1,117	1,367	1,627	1,894	2,170	2,455	2,750	3,056	3,375	3,707	4,053	4,413	4,790	5,188	5,615	6,060	6,526	6,946	7,438	
48	726	956	1,217	1,487	1,767	2,056	2,354	2,661	2,981	3,312	3,657	4,016	4,390	4,780	5,182	5,602	6,062	6,544	7,047	7,574	8,125	
50	788	1,038	1,329	1,612	1,914	2,224	2,545	2,877	3,221	3,578	3,950	4,337	4,740	5,162	5,602	6,032	6,527	7,046	7,588	8,155	8,749	
52	852	1,112	1,433	1,744	2,099	2,444	2,794	3,100	3,470	3,854	4,254	4,670	5,104	5,558	6,032	6,527	7,046	7,588	8,155	8,749	9,370	
54	918	1,198	1,549	1,900	2,281	2,681	3,081	3,432	3,729	4,140	4,569	5,016	5,482	5,969	6,477	7,009	7,566	8,148	8,758	9,396	10,064	
56	986	1,286	1,669	2,060	2,469	2,899	3,339	3,722	4,059	4,460	4,896	5,374	5,873	6,394	6,939	7,509	8,105	8,729	9,382	10,066	10,782	
58	1,056	1,396	1,819	2,240	2,681	3,141	3,581	4,021	4,424	4,744	5,234	5,744	6,277	6,834	7,416	8,025	8,662	9,329	10,028	10,759	11,524	
60	1,128	1,508	1,969	2,430	2,911	3,411	3,911	4,408	4,860	5,261	5,833	6,427	6,956	7,528	8,131	8,764	9,427	10,120	10,843	11,596	12,380	
62	1,202	1,612	2,103	2,603	3,124	3,664	4,224	4,794	5,364	5,888	6,541	7,219	7,922	8,650	9,403	10,181	10,984	11,812	12,665	13,544	14,448	
64	1,278	1,718	2,249	2,789	3,350	3,940	4,550	5,180	5,830	6,500	7,241	8,003	8,786	9,599	10,442	11,315	12,218	13,151	14,114	15,107	16,130	
66	1,356	1,826	2,397	2,977	3,587	4,237	4,917	5,627	6,367	7,137	7,947	8,799	9,682	10,595	11,538	12,511	13,514	14,547	15,610	16,703	17,826	
68	1,436	1,936	2,547	3,167	3,827	4,527	5,257	6,017	6,807	7,627	8,477	9,369	10,292	11,245	12,228	13,241	14,284	15,357	16,460	17,593	18,756	
70	1,518	2,048	2,709	3,369	4,069	4,809	5,589	6,409	7,269	8,159	9,089	10,059	11,069	12,109	13,179	14,279	15,409	16,569	17,769	18,999	20,259	
72	1,602	2,162	2,863	3,563	4,303	5,083	5,903	6,763	7,663	8,593	9,553	10,553	11,593	12,663	13,763	14,893	16,053	17,253	18,493	19,763	21,063	
74	1,688	2,288	3,029	3,769	4,549	5,369	6,229	7,129	8,069	9,049	10,069	11,129	12,229	13,369	14,549	15,769	17,029	18,329	19,669	21,049	22,469	
76	1,776	2,416	3,207	3,987	4,807	5,667	6,567	7,507	8,487	9,507	10,567	11,667	12,807	13,987	15,207	16,467	17,767	19,107	20,487	21,907	23,367	
78	1,866	2,546	3,387	4,207	5,067	5,967	6,907	7,887	8,907	9,967	11,067	12,207	13,387	14,607	15,867	17,167	18,507	19,887	21,307	22,767	24,267	
80	1,958	2,678	3,569	4,429	5,329	6,269	7,249	8,269	9,329	10,429	11,569	12,749	13,969	15,229	16,529	17,869	19,249	20,669	22,129	23,629	25,169	

^{1/2} Diameter classes are midpoint; e.g., 12-inch class includes 11.0-12.9.

NOTE.—Block indicates extent of data.

Table 3.—Board-foot volume of Douglas-fir by Scribner rule in 16-foot logs to a utilized top

Table 3.—Board-foot volume of Douglas-fir by section rule in 10-foot logs to a uniform top																							
Stump and top excluded		Total height--Feet																				Top diameter, variable Stump height, 1 foot	
Diameter breast height outside bark-- inches ^{1/2}		40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	
12	2 23	36	56	77	97	117	137	158	178	198	219	239	259										
14	23	49	77	104	132	159	187	215	242	270	298	325	353										
16	28	64	100	136	172	208	244	280	317	353	389	425	461										
18	35	81	127	172	218	264	309	355	401	446	492	538	583										
20	43	100	156	213	269	325	382	438	495	551	607	664	720	777	833	889							
22	53	121	189	257	326	394	462	530	599	667	735	803	872	940	1,008	1,076							
24	63	144	225	306	387	469	550	631	712	794	875	956	1,037	1,118	1,200	1,281							
26	73	169	264	359	455	550	645	741	836	931	1,027	1,122	1,217	1,313	1,408	1,503							
28	83	196	306	417	527	638	748	859	970	1,080	1,191	1,301	1,412	1,522	1,633	1,743							
30	93	225	352	478	605	732	859	986	1,113	1,240	1,367	1,494	1,621	1,748	1,874	2,001							
32	103	256	400	544	689	833	978	1,122	1,266	1,411	1,555	1,700	1,844	1,988	2,133	2,277							
34	113	286	452	615	778	941	1,104	1,267	1,430	1,593	1,756	1,919	2,082	2,245	2,408	2,571							
36	123	316	506	689	872	1,054	1,237	1,420	1,603	1,785	1,968	2,151	2,334	2,516	2,699	2,882							
38	133	346	566	768	971	1,175	1,379	1,582	1,786	1,989	2,193	2,397	2,600	2,804	3,007	3,211							
40	143	376	616	851	1,076	1,302	1,527	1,753	1,979	2,204	2,430	2,655	2,881	3,107	3,332	3,558							
42	153	406	676	938	1,187	1,435	1,684	1,933	2,181	2,430	2,679	2,928	3,176	3,425	3,674	3,923							
44	163	436	736	1,029	1,302	1,575	1,848	2,121	2,394	2,667	2,940	3,213	3,486	3,759	4,032	4,305							
46	173	466	806	1,125	1,423	1,722	2,020	2,318	2,617	2,915	3,213	3,512	3,810	4,109	4,407	4,705							
48	183	496	886	1,225	1,550	1,875	2,199	2,524	2,849	3,174	3,499	3,824	4,149	4,474	4,799	5,123							
50	193	526	956	1,329	1,682	2,034	2,387	2,739	3,092	3,444	3,797	4,149	4,502	4,854	5,207	5,559							
52	203	556	1,026	1,429	1,775	2,153	2,531	2,909	3,287	3,665	4,043	4,421	4,799	5,177	5,555	5,933							
54	213	586	1,096	1,500	1,875	2,281	2,709	3,137	3,565	3,993	4,421	4,849	5,277	5,705	6,133	6,561							
56	223	616	1,166	1,575	1,993	2,459	2,937	3,415	3,893	4,371	4,849	5,327	5,805	6,283	6,761	7,239							
58	233	646	1,236	1,650	2,118	2,596	3,124	3,652	4,180	4,708	5,236	5,764	6,292	6,820	7,348	7,876							
60	243	676	1,306	1,725	2,243	2,771	3,349	3,927	4,505	5,083	5,661	6,239	6,817	7,395	7,973	8,551							
62	253	706	1,376	1,800	2,318	2,896	3,524	4,152	4,780	5,408	6,036	6,664	7,292	7,920	8,548	9,176							
64	263	736	1,446	1,875	2,393	2,971	3,649	4,327	4,955	5,633	6,311	6,989	7,667	8,345	9,023	9,701							
66	273	766	1,516	1,950	2,518	3,146	3,824	4,502	5,180	5,858	6,536	7,214	7,892	8,570	9,248	9,926							
68	283	796	1,586	2,025	2,643	3,324	4,002	4,680	5,358	6,036	6,714	7,392	8,070	8,748	9,426	10,104							
70	293	826	1,656	2,100	2,718	3,448	4,176	4,854	5,532	6,210	6,888	7,566	8,244	8,922	9,600	10,278							
72	303	856	1,726	2,175	2,793	3,572	4,300	4,978	5,656	6,334	7,012	7,690	8,368	9,046	9,724	10,402							
74	313	886	1,796	2,250	2,868	3,696	4,424	5,102	5,780	6,458	7,136	7,814	8,492	9,170	9,848	10,526							
76	323	916	1,866	2,325	2,943	3,820	4,544	5,222	5,900	6,578	7,256	7,934	8,612	9,290	9,968	10,646							
78	333	946	1,936	2,400	3,018	3,944	4,668	5,346	6,024	6,702	7,380	8,058	8,736	9,414	10,092	10,770							
80	343	976	2,006	2,475	3,093	4,068	4,792	5,516	6,194	6,872	7,550	8,228	8,906	9,584	10,262	10,940							

^{1/} Diameter classes are midpoint; e.g. 12-inch class includes 11.0-12.9.

NOTE.--Block indicates extent of data.

^{2/} The volume of a tree with a minimum saw log 8 inches d.i.b. and 12 feet long is 23 board feet. Trees lacking this minimum saw log have no Scribner volume.

Table 4.—Cubic-foot volume of ponderosa and Jeffrey pine

Stump and top excluded		Total height--Feet																						Top diameter, 4 inches Stump height, 1 foot	
		Oiameter breast height outside bark-- Inches--	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240		
6	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17									
8	4	5	6	7	8	9	10	11	12	13	14	15	16	17											
10	7	9	10	12	14	15	17	19	20	22	24	26	27												
12	10	13	15	18	21	23	26	28	31	33	36	39	41												
14	14	18	22	25	29	32	36	40	43	47	51	54	58												
16	19	24	29	34	39	43	48	53	58	63	68	72	77												
18	25	31	37	44	50	56	62	68	75	81	87	93	100												
20	31	39	47	55	62	70	78	86	93	101	109	117	125	132	140	148									
22	38	48	57	67	76	86	95	105	114	124	133	143	153	162	172	181									
24	46	57	69	80	92	103	115	126	137	149	160	172	183	195	206	218									
26	54	68	81	95	108	122	135	149	163	176	190	203	217	230	244	257									
28		79	95	111	127	142	158	174	190	206	221	237	253	269	285	301									
30		91	110	128	146	164	183	201	219	237	256	274	292	310	329	347	365	384	402	420	438				
32		104	125	146	167	188	209	230	251	272	292	313	334	355	376	397	418	439	459	480	501				
34			142	166	189	213	237	260	284	308	332	355	379	403	426	450	474	497	521	545	568				
36			160	187	213	240	267	293	320	346	373	400	426	453	480	506	533	560	586	613	640				
38				209	238	268	298	328	358	387	417	447	477	507	536	566	596	626	656	685	715				
40				232	265	298	331	364	397	431	464	497	530	563	596	629	662	696	729	762	795				
42				256	293	330	366	403	439	476	513	549	586	623	659	696	732	769	806	842	879				
44				282	322	363	403	443	484	524	564	604	645	685	725	766	806	846	887	927	967				
46				309	353	397	441	486	530	574	618	662	706	750	795	839	883	927	971	1,015	1,059				
48				337	385	434	482	524	576	628	681	733	786	838	890	943	995	1,047	1,100	1,152	1,204	1,257			
50				367	419	471	524	576	624	681	738	794	851	908	965	1,021	1,078	1,135	1,192	1,248	1,305	1,362			
52						511	567	624	681	736	797	858	919	981	1,042	1,103	1,165	1,226	1,287	1,348	1,410	1,471			
54						552	613	674	736	792	858	924	990	1,056	1,122	1,188	1,254	1,320	1,386	1,452	1,518	1,585			
56						594	660	726	780	851	922	993	1,064	1,135	1,206	1,277	1,348	1,418	1,489	1,560	1,631	1,702			
58						638	709	780	836	912	988	1,064	1,140	1,216	1,292	1,368	1,444	1,520	1,596	1,672	1,748	1,824			
60						684	760	836		975	1,056	1,138	1,219	1,300	1,381	1,463	1,544	1,625	1,706	1,788	1,869	1,950			
62										1,040	1,127	1,214	1,300	1,387	1,474	1,560	1,647	1,734	1,820	1,907	1,994	2,080			
64										1,107	1,200	1,292	1,384	1,477	1,569	1,661	1,753	1,846	1,938	2,030	2,123	2,215			
66										1,177	1,275	1,373	1,471	1,569	1,667	1,765	1,863	1,961	2,059	2,157	2,255	2,354			
68										1,248	1,352	1,456	1,560	1,664	1,768	1,872	1,976	2,080	2,184	2,288	2,392	2,496			
70												1,542	1,652	1,762	1,873	1,983	2,093	2,203	2,313	2,423	2,533	2,644			
72												1,630	1,747	1,863	1,980	2,096	2,213	2,329	2,446	2,562	2,678	2,795			
74												1,721	1,844	1,967	2,090	2,213	2,336	2,459	2,582	2,705	2,827	2,950			
76												1,814	1,944	2,073	2,203	2,333	2,462	2,592	2,721	2,851	2,981	3,110			
78												1,910	2,046	2,183	2,319	2,456	2,592	2,728	2,865	3,001	3,138	3,274			
80																									

1/ Diameter classes are midpoint; e.g., 12-inch class includes 11.0-12.9.

NOTE.--Block indicates extent of data.

Table 5.—Board-foot volume of ponderosa and Jeffrey pine by International 1/4-inch rule

Top diameter, 6.5 inches
Stump height, 1 foot

Stump and top excluded

Diameter breast height outside bark-- inches 1/4		Total height--Feet																				
		40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240
10	20	25	31	37	43	49	56	62	69	76	84	92	99									
12	40	50	62	73	85	97	109	121	134	148	161	175	189									
14	65	83	101	119	137	157	176	196	217	237	259	280	303									
16	96	122	148	174	202	229	258	286	316	346	376	407	439									
18	133	168	203	240	277	315	353	392	432	473	514	556	599									
20	174	220	267	315	363	412	463	514	566	618	672	727	782	839	896	954						
22	222	280	339	399	460	523	586	651	716	783	850	919	989	1,060	1,132	1,204						
24	274	346	419	493	569	646	724	803	884	966	1,049	1,133	1,219	1,306	1,394	1,483						
26	332	419	507	597	688	781	875	971	1,068	1,167	1,267	1,369	1,472	1,577	1,683	1,790						
28	400	499	604	711	819	929	1,041	1,155	1,270	1,387	1,506	1,626	1,748	1,872	1,998	2,125						
30	486	586	709	834	961	1,090	1,221	1,354	1,489	1,626	1,765	1,906	2,048	2,193	2,340	2,489						
32	579	679	822	967	1,114	1,263	1,415	1,569	1,725	1,883	2,044	2,207	2,372	2,539	2,709	2,880	2,640	2,792	2,947	3,104	3,262	
34			943	1,109	1,278	1,449	1,623	1,799	1,978	2,159	2,343	2,529	2,718	2,910	3,104	3,300	3,054	3,231	3,409	3,590	3,773	
36			1,073	1,261	1,453	1,647	1,845	2,045	2,248	2,454	2,662	2,874	3,088	3,305	3,525	3,748	3,499	3,701	3,905	4,112	4,321	
38			1,423	1,639	1,858	2,082	2,311	2,583	2,839	3,099	3,361	3,628	3,898	4,171	4,448	4,729	4,479	4,736	4,996	5,260	5,526	
40			1,595	1,836	2,082	2,331	2,595	2,876	3,160	3,449	3,741	4,038	4,338	4,642	4,950	5,262	5,577	5,897	6,220	6,548	6,879	
42			1,776	2,045	2,318	2,595	2,876	3,160	3,449	3,741	4,038	4,338	4,642	4,950	5,262	5,577	5,897	6,220	6,548	6,879	7,210	
44			1,967	2,264	2,567	2,873	3,184	3,499	3,818	4,141	4,469	4,801	5,137	5,478	5,822	6,171	6,525	6,882	7,244	7,610	7,978	
46			2,167	2,495	2,828	3,165	3,507	3,854	4,206	4,562	4,922	5,288	5,658	6,032	6,412	6,795	7,184	7,577	7,975	8,378	8,782	
48			2,377	2,737	3,102	3,472	3,847	4,227	4,612	5,002	5,397	5,798	6,203	6,613	7,029	7,449	7,875	8,306	8,741	9,182	9,623	
50			2,597	2,990	3,388	3,792	4,201	4,616	5,037	5,463	5,894	6,331	6,773	7,221	7,674	8,133	8,597	9,067	9,543	10,023	10,503	
52					3,687	4,126	4,572	5,023	5,480	5,943	6,412	6,887	7,368	7,855	8,348	8,847	9,352	9,862	10,379	10,901	11,416	
54					3,999	4,475	4,958	5,447	5,942	6,444	6,953	7,467	7,988	8,516	9,050	9,590	10,137	10,690	11,250	11,816	12,387	
56					4,323	4,837	5,359	5,888	6,423	6,965	7,514	8,071	8,634	9,203	9,780	10,364	10,954	11,552	12,156	12,767	13,382	
58					4,659	5,214	5,776	6,346	6,922	7,507	8,098	8,697	9,304	9,917	10,538	11,167	11,803	12,446	13,097	13,755	14,418	
60					5,009	5,605	6,209	6,821	7,440	8,068	8,704	9,347	9,998	10,658	11,325	12,000	12,683	13,374	14,073	14,780	15,494	
62							7,313	7,977	8,650	9,331	10,020	10,718	11,425	12,140	12,863	13,595	14,335	15,084	15,841	16,606	17,379	
64							7,822	8,532	9,251	9,980	10,717	11,463	12,218	12,983	13,756	14,538	15,330	16,130	16,939	17,757	18,574	
66							8,348	9,106	9,873	10,650	11,437	12,233	13,039	13,854	14,679	15,513	16,357	17,211	18,074	18,946	19,818	
68							8,891	9,698	10,515	11,343	12,180	13,028	13,885	14,753	15,631	16,520	17,418	18,326	19,245	20,164	21,083	
70							9,452	10,309	11,178	12,057	12,947	13,847	14,759	15,681	16,614	17,558	18,512	19,477	20,453	21,429	22,405	
72									11,860	12,793	13,737	14,692	15,659	16,637	17,626	18,627	19,639	20,663	21,698	22,734	23,769	
74									12,563	13,550	14,550	15,561	16,585	17,621	18,668	19,728	20,800	21,884	22,980	24,076	25,172	
76									13,286	14,330	15,386	16,456	17,538	18,633	19,741	20,861	21,994	23,139	24,298	25,457	26,616	
78									14,029	15,131	16,246	17,375	18,518	19,673	20,843	22,025	23,221	24,430	25,653	26,876	28,099	
80									14,792	15,954	17,130	18,320	19,524	20,742	21,974	23,221	24,481	25,756	27,044	28,332	29,620	

1/ Diameter classes are midpoint; e.g., 12-inch class includes 11.0-12.9.
NOTE.--Block indicates extent of data.

Table 6.—Board-foot volume of ponderosa and Jeffrey pine in 16-foot logs to a utilized top

Stump and top excluded		Total height--Feet																				Top diameter, variable Stump height, 1 foot	
Diameter breast height outside bark-- inches 1/		40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	
12	2 23	27	33	40	51	62	73	84	95	106	117	129	140										
14	30	45	63	81	99	116	134	152	170	188	206	224	242										
16	53	79	106	132	158	184	210	236	262	288	314	340	367										
18	85	121	157	192	228	264	300	335	371	407	442	478	514										
20	123	170	216	263	310	357	403	450	497	544	590	637	684	730	777	824							
22	166	225	285	344	403	462	521	580	639	699	758	817	876	935	944	1,053							
24	215	288	361	434	507	580	653	726	799	872	945	1,018	1,091	1,164	1,237	1,310							
26	270	358	446	534	623	711	799	887	976	1,064	1,152	1,240	1,328	1,417	1,505	1,593							
28	435	540	645	749	854	959	1,064	1,169	1,274	1,379	1,484	1,588	1,693	1,798	1,903								
30	519	642	765	888	1,010	1,133	1,256	1,379	1,502	1,625	1,748	1,871	1,994	2,117	2,240	2,363	2,486	2,608	2,731	2,854			
32	610	752	895	1,037	1,179	1,322	1,464	1,606	1,749	1,891	2,034	2,176	2,318	2,461	2,603	2,746	2,888	3,030	3,173	3,315			
34	871	1,034	1,198	1,361	1,524	1,687	1,851	2,014	2,177	2,340	2,504	2,667	2,830	2,993	3,157	3,320	3,483	3,647	3,810				
36	998	1,184	1,369	1,555	1,741	1,926	2,112	2,297	2,483	2,668	2,854	3,039	3,225	3,411	3,596	3,782	3,967	4,153	4,338				
38	1,343	1,553	1,762	1,971	2,180	2,390	2,599	2,808	3,017	3,227	3,436	3,645	3,854	4,064	4,273	4,482	4,691	4,901					
40	1,513	1,747	1,981	2,216	2,450	2,684	2,919	3,153	3,388	3,622	3,856	4,091	4,325	4,559	4,794	5,028	5,262	5,495					
42	1,692	1,953	2,214	2,475	2,735	2,996	3,257	3,518	3,779	4,040	4,301	4,561	4,822	5,083	5,344	5,605	5,866	6,127					
44	1,881	2,170	2,459	2,747	3,036	3,325	3,614	3,902	4,191	4,480	4,769	5,058	5,346	5,635	5,924	6,213	6,502	6,790					
46	2,080	2,398	2,716	3,034	3,352	3,671	3,989	4,307	4,625	4,943	5,261	5,579	5,897	6,215	6,534	6,852	7,170	7,488					
48	2,289	2,638	2,986	3,335	3,684	4,033	4,382	4,731	5,080	5,428	5,777	6,126	6,475	6,824	7,173	7,522	7,870	8,219					
50	2,507	2,888	3,269	3,650	4,031	4,412	4,793	5,174	5,555	5,936	6,317	6,698	7,079	7,460	7,841	8,222	8,603	8,984					
52	3,565	3,980	4,394	4,809	5,223	5,638	6,052	6,467	6,882	7,296	7,711	8,125	8,540	8,954	9,369	9,784							
54	3,873	4,323	4,772	5,222	5,671	6,121	6,571	7,020	7,470	7,919	8,369	8,818	9,268	9,717	10,167	10,616							
56	4,194	4,680	5,166	5,652	6,138	6,624	7,110	7,596	8,082	8,568	9,053	9,539	10,025	10,511	10,997	11,483							
58	4,528	5,052	5,575	6,099	6,623	7,147	7,670	8,194	8,718	9,241	9,765	10,289	10,812	11,336	11,860	12,383							
60	4,874	5,437	6,000	6,563	7,126	7,689	8,252	8,815	9,378	9,940	10,503	11,066	11,629	12,192	12,755	13,318							
62	7,044	7,647	8,251	8,854	9,458	10,061	10,665	11,268	11,872	12,475	13,079	13,682	14,286										
64	7,542	8,187	8,833	9,478	10,124	10,769	11,415	12,060	12,706	13,351	13,997	14,642	15,288										
66	8,056	8,745	9,434	10,123	10,812	11,501	12,190	12,879	13,568	14,257	14,946	15,635	16,324										
68	8,588	9,322	10,055	10,789	11,523	12,257	12,991	13,724	14,458	15,192	15,926	16,659	17,393										
70	9,136	9,916	10,696	11,476	12,256	13,036	13,816	14,596	15,376	16,156	16,936	17,716	18,496										
72	11,357	12,185	13,012	13,840	14,668	15,495	16,323	17,151	17,978	18,806	19,634												
74	12,038	12,914	13,791	14,668	15,544	16,421	17,298	18,175	19,051	19,928	20,805												
76	12,738	13,665	14,592	15,519	16,446	17,374	18,301	19,228	20,155	21,082	22,010												
78	13,458	14,437	15,416	16,395	17,374	18,353	19,332	20,311	21,290	22,269	23,248												
80	14,197	15,230	16,262	17,294	18,327	19,359	20,391	21,424	22,456	23,488	24,521												

1/ Diameter classes are midpoint; e.g. 12-inch class includes 11.0-12.9.

NOTE.--Block indicates extent of data.

2/ The volume of a tree with a minimum saw log 8 inches d.i.b. and 12 feet long is 23 board feet. Trees lacking this minimum saw log have no Scribner volume.

Table 7.—Cubic-foot volume of sugar pine

Top diameter, 4 inches
Stump height, 1 foot

Stump and top excluded

Diameter breast height outside bark-- Inches--		Total height--Feet																					
		40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	
6	2		3	4	4	5	5	6	6	7	8	8	9	9									
8	4		5	6	7	8	9	10	12	13	14	15	16	17									
10	7		8	10	12	14	15	17	19	20	22	24	25	27									
12	10		12	15	17	20	22	25	27	30	32	35	37	40									
14	14		17	21	24	28	31	35	38	42	45	48	52	55									
16	18		23	27	32	37	41	46	50	55	60	64	69	73									
18	23		29	35	41	47	53	59	64	70	76	82	88	94									
20	29		36	44	51	58	66	73	80	87	95	102	109	117	124	131	139						
22	36		44	53	62	71	80	89	98	107	115	124	133	142	151	160	169						
24	43		53	64	74	85	96	106	117	128	138	149	159	170	181	191	202						
26	50		63	75	88	100	113	125	138	150	163	175	188	200	213	225	238						
28			73	88	102	117	131	146	160	175	190	204	219	233	248	263	277						
30			84	101	118	134	151	168	185	202	218	235	252	269	286	302	319	336	353	370	386	403	
32			96	115	134	153	173	192	211	230	249	268	288	307	326	345	364	383	403	422	441	460	
34				130	152	174	195	217	239	260	282	304	326	347	369	391	412	434	456	477	499	521	
36				146	171	195	219	244	268	293	317	341	366	390	415	439	463	488	512	536	561	585	
38					191	218	245	272	299	327	354	381	408	436	463	490	517	545	572	599	626	653	
40					212	242	272	302	332	363	393	423	453	484	514	544	574	604	635	665	695	725	
42					234	267	300	334	367	401	434	467	501	534	567	601	634	668	701	734	768	801	
44					257	294	330	367	404	440	477	514	550	587	624	660	697	734	770	807	844	881	
46					281	321	361	402	442	482	522	562	602	642	683	723	763	803	843	883	924	964	
48					306	350	394	438	482	525	569	613	657	700	744	788	832	876	919	963	1,007	1,051	
50					333	380	428	476	523	571	618	666	713	761	808	856	904	951	999	1,046	1,094	1,141	
52							463	515	566	618	669	721	772	824	875	927	978	1,030	1,081	1,133	1,184	1,236	
54							500	556	611	667	723	778	834	889	945	1,001	1,056	1,112	1,167	1,223	1,279	1,334	
56							539	598	658	718	778	838	898	957	1,017	1,077	1,137	1,197	1,257	1,316	1,376	1,436	
58							578	642	707	771	835	899	964	1,028	1,092	1,156	1,221	1,285	1,349	1,413	1,478	1,542	
60							619	688	757	826	894	963	1,032	1,101	1,170	1,238	1,307	1,376	1,445	1,514	1,582	1,651	
62										882	956	1,029	1,103	1,176	1,250	1,323	1,397	1,470	1,544	1,617	1,691	1,765	
64										941	1,019	1,098	1,176	1,254	1,333	1,411	1,490	1,568	1,646	1,725	1,803	1,882	
66										1,001	1,085	1,168	1,251	1,335	1,418	1,502	1,585	1,669	1,752	1,835	1,919	2,002	
68										1,063	1,152	1,241	1,329	1,418	1,506	1,595	1,684	1,772	1,861	1,950	2,038	2,127	
70										1,128	1,221	1,315	1,409	1,503	1,597	1,691	1,785	1,879	1,973	2,067	2,161	2,255	
72												1,392	1,492	1,591	1,691	1,790	1,890	1,989	2,089	2,188	2,287	2,387	
74												1,472	1,577	1,682	1,787	1,892	1,997	2,102	2,207	2,313	2,418	2,523	
76												1,553	1,664	1,775	1,886	1,997	2,108	2,219	2,330	2,440	2,551	2,662	
78												1,637	1,754	1,870	1,987	2,104	2,221	2,338	2,455	2,572	2,689	2,806	
80												1,722	1,845	1,968	2,091	2,214	2,338	2,461	2,584	2,707	2,830	2,953	

^{1/2} Diameter classes are midpoint; e.g., 12-inch class includes 11.0-12.9.
NOTE.—Block indicates extent of data.

Table 8.—Board-foot volume of sugar pine by International 1/4-inch rule

Top diameter, 6.5 inches
Stump height, 1 foot

Stump and top excluded

Diameter breast height outside bark-- inches 1/4	Total height--Feet																				Top diameter, 6.5 inches Stump height, 1 foot
	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240
10	21	27	34	40	48	55	64	73	83	94	106	119	133								
12	40	51	62	74	86	99	113	127	143	160	178	197	217								
14	64	80	98	115	134	153	174	195	218	241	266	293	321								
16	92	116	140	166	192	219	247	276	306	338	372	407	444								
18	125	158	191	224	259	295	332	370	410	451	494	539	586								
20	163	205	248	291	336	382	429	477	527	579	633	689	747	808	871	936					
22	206	259	312	367	422	479	538	598	660	723	789	857	928	1,001	1,077	1,156					
24	254	318	384	451	519	588	659	732	806	883	962	1,044	1,128	1,215	1,305	1,398					
26	306	384	463	543	625	707	792	879	967	1,058	1,152	1,248	1,347	1,449	1,555	1,663					
28		456	549	644	740	838	937	1,039	1,143	1,249	1,358	1,470	1,586	1,704	1,826	1,951					
30		533	643	753	865	979	1,095	1,213	1,333	1,456	1,582	1,711	1,843	1,979	2,119	2,262					
32		617	743	871	1,000	1,131	1,264	1,399	1,537	1,678	1,822	1,969	2,120	2,275	2,433	2,596					
34			851	997	1,144	1,293	1,445	1,599	1,756	1,916	2,079	2,246	2,416	2,591	2,770	2,953					
36			966	1,131	1,298	1,467	1,638	1,813	1,990	2,170	2,353	2,541	2,732	2,927	3,127	3,332					
38				1,274	1,462	1,652	1,844	2,039	2,237	2,439	2,644	2,853	3,067	3,284	3,507	3,735					
40				1,425	1,635	1,847	2,061	2,279	2,499	2,724	2,952	3,184	3,421	3,662	3,908	4,160					
42				1,585	1,818	2,053	2,291	2,532	2,776	3,024	3,276	3,533	3,794	4,060	4,331	4,608					
44				1,753	2,010	2,270	2,532	2,798	3,067	3,340	3,618	3,900	4,186	4,478	4,776	5,079					
46				1,930	2,212	2,498	2,786	3,077	3,373	3,672	3,976	4,285	4,598	4,917	5,242	5,573					
48				2,115	2,424	2,736	3,051	3,370	3,693	4,020	4,351	4,688	5,029	5,377	5,730	6,090					
50				2,308	2,646	2,986	3,329	3,676	4,027	4,383	4,743	5,109	5,480	5,857	6,240	6,629					
52					3,246	3,619	3,995	4,376	4,762	5,152	5,548	5,949	6,357	6,771	7,192	7,620					
54					3,517	3,920	4,328	4,739	5,156	5,578	6,005	6,438	6,878	7,324	7,777	8,238					
56					3,799	4,234	4,673	5,117	5,566	6,020	6,480	6,946	7,419	7,899	8,386	8,881					
58					4,092	4,560	5,032	5,509	5,992	6,479	6,973	7,473	7,979	8,495	9,017	9,547					
60					4,395	4,898	5,404	5,916	6,433	6,956	7,485	8,020	8,563	9,113	9,671	10,237					
62						6,337		6,337	6,337	6,890	7,449	8,014	8,586	9,165	9,752	10,348					
64								7,673	7,673	7,363	7,959	8,561	9,171	9,788	10,414	11,047					
66								7,223	7,223	7,851	8,485	9,127	9,775	10,432	11,097	11,770					
68								7,687	7,687	8,355	9,029	9,710	10,399	11,096	11,801	12,516					
70								8,166	8,166	8,874	9,590	10,312	11,042	11,780	12,527	13,284					
72										10,167	10,932	11,704	12,485	13,275	14,075	14,885					
74										10,761	11,569	12,386	13,211	14,045	14,889	15,744					
76										11,372	12,225	13,086	13,957	14,836	15,726	16,627					
78										12,000	12,899	13,806	14,723	15,649	16,586	17,534					
80										12,645	13,591	14,546	15,510	16,484	17,469	18,465					

1/ Diameter classes are midpoint; e.g., 12-inch class includes 11.0-12.9.

NOTE.--Block indicates extent of data.

Table 9.—Board-foot volume of sugar pine in 16-foot logs to a utilized top

Oiameter breast height outside bark-- Inches		Total height--Feet																						Top diameter, variable Stump height, 1 foot	
		40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240			
12	25	31	37	43	49	55	61	67	74	80	86	92	98												
14	46	58	69	81	92	104	116	127	139	150	162	173	185												
16	73	91	109	128	146	164	182	201	219	237	255	274	292												
18	105	131	157	183	210	236	262	288	314	341	367	393	419												
20	142	177	212	248	283	319	354	389	425	460	496	531	566	602	637	673									
22	183	229	275	321	367	413	459	505	550	596	642	688	734	780	826	872									
24	230	288	346	403	461	518	576	634	691	749	806	864	922	979	1,037	1,094									
26	282	353	424	494	565	635	706	777	847	918	988	1,059	1,129	1,200	1,271	1,341									
28	424	509	594	679	764	848	933	1,018	1,103	1,188	1,273	1,357	1,442	1,527	1,612										
30	502	602	702	803	903	1,003	1,104	1,204	1,305	1,405	1,505	1,606	1,706	1,806	1,907										
32	586	703	820	937	1,054	1,171	1,288	1,405	1,522	1,640	1,757	1,874	1,991	2,108	2,225										
34		811	946	1,081	1,216	1,351	1,487	1,622	1,757	1,892	2,027	2,162	2,297	2,433	2,568										
36		927	1,081	1,235	1,390	1,544	1,699	1,853	2,008	2,162	2,316	2,471	2,625	2,780	2,934										
38			1,225	1,400	1,575	1,750	1,925	2,100	2,275	2,450	2,625	2,800	2,975	3,150	3,325										
40			1,377	1,574	1,771	1,968	2,165	2,361	2,558	2,755	2,952	3,149	3,345	3,542	3,739										
42			1,539	1,759	1,979	2,198	2,418	2,638	2,858	3,078	3,298	3,518	3,737	3,957	4,177										
44			1,709	1,953	2,198	2,442	2,686	2,930	3,174	3,418	3,663	3,907	4,151	4,395	4,639										
46			1,888	2,158	2,428	2,698	2,967	3,237	3,507	3,777	4,046	4,316	4,586	4,856	5,125										
48			2,076	2,373	2,669	2,966	3,263	3,559	3,856	4,152	4,449	4,746	5,042	5,339	5,636										
50			2,273	2,598	2,922	3,247	3,572	3,897	4,221	4,546	4,871	5,195	5,520	5,845	6,170										
52				3,187	3,541	3,895	4,249	4,603	4,957	5,311	5,665	6,019	6,373	6,727	7,082										
54				3,462	3,847	4,232	4,616	5,001	5,386	5,770	6,155	6,540	6,925	7,309	7,694										
56				3,749	4,166	4,582	4,999	5,416	5,832	6,249	6,665	7,082	7,499	7,915	8,332										
58				4,048	4,497	4,947	5,397	5,846	6,296	6,746	7,196	7,645	8,095	8,545	8,995										
60				4,357	4,841	5,325	5,810	6,294	6,778	7,262	7,746	8,230	8,714	9,199	9,683										
62					6,238	6,757	7,277	7,797	8,317	8,837	9,356	9,876	10,396	10,916	11,435										
64					6,681	7,237	7,794	8,351	8,907	9,464	10,021	10,578	11,134	11,691	12,248										
66					7,139	7,734	8,329	8,924	9,518	10,113	10,708	11,303	11,898	12,493	13,088										
68					7,612	8,246	8,881	9,515	10,149	10,784	11,418	12,053	12,687	13,321	13,956										
70					8,101	8,776	9,451	10,126	10,801	11,476	12,151	12,826	13,501	14,176	14,851										
72						10,038	10,755	11,472	12,189	12,906	13,623	14,340	15,057	15,774	16,491										
74						10,643	11,403	12,164	12,924	13,684	14,444	15,205	15,965	16,725	17,485										
76						11,266	12,071	12,875	13,680	14,485	15,290	16,094	16,899	17,704	18,508										
78						11,906	12,757	13,607	14,458	15,308	16,159	17,009	17,859	18,710	19,560										
80						12,564	13,462	14,359	15,257	16,154	17,052	17,949	18,847	19,744	20,641										

1/ Diameter classes are midpoint; e.g., 12-inch class includes 11.0-12.9.
NOTE.--Block indicates extent of data.

Table 10.—Cubic-foot volume of lodgepole pine

Stump and top excluded

Top diameter, 4 inches
Stump height, 1 foot

Diameter breast height outside bark-- inches ^{1/}	Total height--Feet												
	40	50	60	70	80	90	100	110	120	130	140	150	160
6	3	4	5	5	6	6	6						
8	6	7	8	9	10	11	12						
10	9	11	13	15	17	18	20	21	22	23	23	25	26
12	13	16	19	22	25	27	29	31	33	34	35	36	38
14	17	21	26	30	34	37	41	43	46	48	50	52	53
16	22	28	34	39	44	49	54	58	62	65	68	71	73
18	28	35	42	49	57	63	69	74	79	84	88	92	95
20	35	44	52	61	70	78	86	93	99	105	111	116	120
22	42	53	63	74	84	95	104	113	121	129	136	143	148
24	50	63	75	88	101	113	125	135	146	155	164	172	180
26	59	74	88	103	118	133	147	160	172	184	194	204	214
28		86	103	120	137	154	171	186	201	214	227	240	251
30		98	118	137	157	177	196	215	232	248	263	277	291
32		112	134	156	179	201	223	245	265	283	301	318	334
34			151	177	202	227	252	277	300	322	342	361	380
36			170	198	226	254	283	311	338	362	385	408	429
38				221	252	284	315	347	378	405	431	457	481
40				244	279	314	349	384	419	450	480	508	536
42				269	308	346	385	423	462	498	531	563	593
44				296	338	380	422	465	507	548	585	620	654
46				323	369	415	462	508	554	600	641	680	718
48				352	402	452	503	553	603	653	700	743	784
50				382	436	491	545	600	654	709	761	808	854

^{1/} Diameter classes are midpoint; e.g., 12-inch class includes 11.0-12.9.
NOTE.--Block indicates extent of data.

Table 11.—Board-foot volume of lodgepole pine by International 1/4-inch rule

Stump and top excluded		Top diameter, 6.5 inches Stump height, 1 foot													
Diameter breast height outside bark-- inches ^{1/}	Total height--Feet														
	40	50	60	70	80	90	100	110	120	130	140	150	160		
10	23	39	55	70	86	101	117								
12	43	66	88	110	133	155	178	200	223	245	268	290	313		
14	68	98	129	159	190	221	251	282	312	343	374	404	435		
16	97	137	177	217	257	297	337	377	417	457	497	537	577		
18	132	183	233	284	334	385	436	486	537	587	638	688	739		
20	172	234	297	359	421	484	546	609	671	734	796	859	921		
22	216	292	367	443	519	594	670	745	821	896	972	1,048	1,123		
24	266	356	446	536	626	716	805	895	985	1,075	1,165	1,255	1,345		
26	321	426	532	637	743	848	954	1,059	1,165	1,270	1,376	1,482	1,587		
28		503	625	747	870	992	1,115	1,237	1,359	1,482	1,604	1,727	1,849		
30		585	726	866	1,007	1,147	1,288	1,428	1,569	1,709	1,850	1,990	2,131		
32		674	834	994	1,154	1,314	1,474	1,634	1,793	1,953	2,113	2,273	2,433		
34			950	1,131	1,311	1,491	1,672	1,852	2,033	2,213	2,394	2,574	2,755		
36			1,073	1,276	1,478	1,680	1,883	2,085	2,287	2,490	2,692	2,894	3,097		
38				1,430	1,655	1,881	2,106	2,331	2,557	2,782	3,008	3,233	3,459		
40				1,592	1,842	2,092	2,342	2,592	2,841	3,091	3,341	3,591	3,841		
42				1,764	2,039	2,315	2,590	2,865	3,141	3,416	3,692	3,967	4,242		
44				1,944	2,246	2,548	2,851	3,153	3,455	3,757	4,060	4,362	4,664		
46				2,133	2,463	2,794	3,124	3,454	3,785	4,115	4,445	4,776	5,106		
48				2,330	2,690	3,050	3,410	3,769	4,129	4,489	4,848	5,208	5,568		
50				2,537	2,927	3,317	3,708	4,098	4,488	4,879	5,269	5,659	6,050		

^{1/} Diameter classes are midpoint; e.g., 12-inch class includes 11.0-12.9.
NOTE.--Block indicates extent of data.

Table 12.—Board-foot volume of lodgepole pine by Scribner rule in 16-foot logs to a utilized top

Stump and top excluded		Top diameter, variable Stump height, 1 foot											
Diameter breast height outside bark-- Inches ^{1/}	Total height--Feet												
	40	50	60	70	80	90	100	110	120	130	140	150	160
12	27	48	68	89	110	130	151	172	192	213	234	254	275
14	48	76	104	132	160	188	216	244	272	301	329	357	385
16	73	109	146	183	220	256	293	330	367	403	440	477	513
18	102	149	195	242	288	335	381	428	474	521	567	614	660
20	137	194	252	309	366	424	481	538	596	653	711	768	825
22	176	245	315	384	453	523	592	662	731	801	870	940	1,009
24	219	302	384	467	550	632	715	798	880	963	1,046	1,128	1,211
26	267	364	461	558	655	752	849	946	1,043	1,140	1,237	1,334	1,431
28		432	545	657	770	882	995	1,107	1,220	1,332	1,445	1,557	1,670
30		506	636	765	894	1,023	1,152	1,281	1,410	1,539	1,669	1,798	1,927
32		586	733	880	1,027	1,174	1,321	1,468	1,615	1,761	1,908	2,055	2,202
34			837	1,003	1,169	1,335	1,501	1,667	1,832	1,998	2,164	2,330	2,496
36			949	1,135	1,320	1,506	1,692	1,878	2,064	2,250	2,436	2,622	2,808
38				1,274	1,481	1,688	1,895	2,103	2,310	2,517	2,724	2,931	3,138
40				1,421	1,651	1,880	2,110	2,340	2,569	2,799	3,028	3,258	3,487
42				1,577	1,830	2,083	2,336	2,589	2,842	3,095	3,348	3,601	3,854
44				1,740	2,018	2,296	2,573	2,851	3,129	3,407	3,684	3,962	4,240
46				1,912	2,215	2,519	2,822	3,126	3,430	3,733	4,037	4,340	4,644
48				2,091	2,422	2,752	3,083	3,413	3,744	4,075	4,405	4,736	5,066
50				2,279	2,637	2,996	3,355	3,713	4,072	4,431	4,789	5,148	5,507

^{1/} Diameter classes are midpoint; e.g., 12-inch class includes 11.0-12.9.
NOTE.--Block indicates extent of data.

Table 13.—Cubic-foot volume of white fir

Top diameter, 4 inches
Stump height, 1 foot

Stump and top excluded

Diameter breast height outside bark-- inches	Total height--Feet																				Top diameter, 4 inches Stump height, 1 foot
	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240
6	3	3	4	5	5	6	7	7	8	9	9	10	10								
8	5	6	7	8	10	11	12	13	14	15	16	17	19								
10	8	9	11	13	15	17	18	20	22	24	26	27	29								
12	11	14	16	19	21	24	27	29	32	34	37	39	42								
14	15	18	22	26	29	33	36	40	43	47	50	54	57								
16	19	24	29	33	38	43	47	52	56	61	65	70	74								
18	24	30	36	42	48	54	60	66	71	77	83	89	94								
20	30	38	45	52	60	67	74	81	88	95	102	109	116								
22	36	45	54	63	72	81	90	98	107	115	124	132	141	123	130						
24	43	54	65	75	86	96	107	117	127	137	147	157	167	177	187	197					
26	51	63	76	88	101	113	125	137	149	161	173	185	196	208	220	231					
28	61	74	88	102	117	131	145	159	173	187	200	214	228	241	255	268					
30	74	88	101	118	134	150	166	183	198	214	230	246	261	277	292	308	323	338	353	368	382
32	96	115	134	152	171	189	208	226	244	262	280	297	315	333	350	367	384	401	418	435	
34	130	151	172	193	214	234	255	275	296	316	336	356	375	395	415	434	453	472	491		
36	146	169	193	216	240	263	286	309	331	354	376	399	421	443	465	486	508	529	551		
38	189	215	241	267	293	318	344	369	394	419	444	469	493	518	542	566	590	614			
40	209	238	267	296	324	353	381	409	437	465	493	520	547	574	601	627	654	680			
42	230	263	294	326	358	389	420	451	482	512	543	573	603	633	662	691	721	750			
44	253	288	323	358	393	427	461	495	529	562	596	629	662	694	727	759	791	823			
46	276	315	353	391	429	467	504	541	578	615	651	687	723	759	794	829	864	899			
48	301	343	385	426	467	508	549	589	629	669	709	748	787	826	865	903	941	979			
50	327	372	417	462	507	551	596	639	683	726	769	812	854	896	938	980	1,021	1,062			
52	451	500	548	596	644	692	739	785	832	878	924	970	1,015	1,060	1,105	1,149	1,191	1,239			
54	487	539	591	643	695	747	802	857	911	965	1,018	1,072	1,125	1,177	1,229	1,281	1,332	1,382			
56	524	580	636	692	747	801	860	919	977	1,035	1,092	1,150	1,206	1,263	1,319	1,374	1,429				
58	562	622	682	742	801	858	921	983	1,046	1,108	1,169	1,230	1,291	1,351	1,411	1,471	1,530				
60	601	666	730	794	858	916	983	1,050	1,117	1,183	1,248	1,314	1,378	1,443	1,507	1,570	1,633				
62																					
64																					
66																					
68																					
70																					
72																					
74																					
76																					
78																					
80																					

1/ Diameter classes are midpoint; e.g., 12-inch class includes 11.0-12.9.
NOTE.--Block indicates extent of data.

Table 14.—Board-foot volume of white fir by International 1/4-inch rule

Stump and top excluded		Total height--Feet																			Top diameter, 6.5 inches Stump height, 1 foot	
Diameter breast height outside bark-- Inches.	Diameter breast height outside bark-- Inches.	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240
		33	38	42	45	50	57	68	84	107	137	177	226	288								
10	56	66	75	83	92	103	119	140	169	207	255	316	390									
12	84	102	116	130	144	161	182	210	245	291	349	420	507									
14	118	144	166	186	207	230	258	292	335	389	457	539	639									
16	157	193	224	253	281	311	346	388	439	502	579	673	785									
18	201	249	290	328	365	404	446	496	556	628	716	821	947									
20	251	312	365	413	460	508	559	618	687	769	867	984	1,123	1,271	1,475	1,702						
22	306	382	448	508	566	623	685	753	832	924	1,033	1,162	1,314	1,493	1,702	1,944	2,200					
24	367	459	539	612	682	751	823	901	990	1,093	1,214	1,355	1,520	1,741	1,950	2,192	2,471					
26	432	532	612	682	751	823	901	990	1,093	1,214	1,355	1,520	1,741	1,950	2,192	2,471						
28	502	612	702	772	842	912	982	1,052	1,122	1,192	1,262	1,332	1,402	1,472	1,542	1,612	1,682					
30	582	702	802	882	952	1,022	1,092	1,162	1,232	1,302	1,372	1,442	1,512	1,582	1,652	1,722	1,792					
32	672	802	902	982	1,052	1,122	1,192	1,262	1,332	1,402	1,472	1,542	1,612	1,682	1,752	1,822	1,892					
34	782	902	1,002	1,082	1,152	1,222	1,292	1,362	1,432	1,502	1,572	1,642	1,712	1,782	1,852	1,922	1,992					
36	912	1,032	1,132	1,212	1,282	1,352	1,422	1,492	1,562	1,632	1,702	1,772	1,842	1,912	1,982	2,052	2,122					
38	1,052	1,172	1,272	1,352	1,422	1,492	1,562	1,632	1,702	1,772	1,842	1,912	1,982	2,052	2,122	2,192	2,262					
40	1,202	1,322	1,422	1,502	1,572	1,642	1,712	1,782	1,852	1,922	1,992	2,062	2,132	2,202	2,272	2,342	2,412					
42	1,362	1,482	1,582	1,662	1,732	1,802	1,872	1,942	2,012	2,082	2,152	2,222	2,292	2,362	2,432	2,502	2,572					
44	1,532	1,652	1,752	1,832	1,902	1,972	2,042	2,112	2,182	2,252	2,322	2,392	2,462	2,532	2,602	2,672	2,742					
46	1,712	1,832	1,932	2,012	2,082	2,152	2,222	2,292	2,362	2,432	2,502	2,572	2,642	2,712	2,782	2,852	2,922					
48	1,902	2,022	2,122	2,202	2,272	2,342	2,412	2,482	2,552	2,622	2,692	2,762	2,832	2,902	2,972	3,042	3,112					
50	2,102	2,222	2,322	2,402	2,472	2,542	2,612	2,682	2,752	2,822	2,892	2,962	3,032	3,102	3,172	3,242	3,312					
52	2,312	2,432	2,532	2,612	2,682	2,752	2,822	2,892	2,962	3,032	3,102	3,172	3,242	3,312	3,382	3,452	3,522					
54	2,532	2,652	2,752	2,832	2,902	2,972	3,042	3,112	3,182	3,252	3,322	3,392	3,462	3,532	3,602	3,672	3,742					
56	2,762	2,882	2,982	3,062	3,132	3,202	3,272	3,342	3,412	3,482	3,552	3,622	3,692	3,762	3,832	3,902	3,972					
58	3,002	3,122	3,222	3,302	3,372	3,442	3,512	3,582	3,652	3,722	3,792	3,862	3,932	4,002	4,072	4,142	4,212					
60	3,252	3,372	3,472	3,552	3,622	3,692	3,762	3,832	3,902	3,972	4,042	4,112	4,182	4,252	4,322	4,392	4,462					
62	3,512	3,632	3,732	3,812	3,882	3,952	4,022	4,092	4,162	4,232	4,302	4,372	4,442	4,512	4,582	4,652	4,722					
64	3,782	3,902	4,002	4,082	4,152	4,222	4,292	4,362	4,432	4,502	4,572	4,642	4,712	4,782	4,852	4,922	4,992					
66	4,062	4,182	4,282	4,362	4,432	4,502	4,572	4,642	4,712	4,782	4,852	4,922	4,992	5,062	5,132	5,202	5,272					
68	4,352	4,472	4,572	4,652	4,722	4,792	4,862	4,932	5,002	5,072	5,142	5,212	5,282	5,352	5,422	5,492	5,562					
70	4,652	4,772	4,872	4,952	5,022	5,092	5,162	5,232	5,302	5,372	5,442	5,512	5,582	5,652	5,722	5,792	5,862					
72	4,962	5,082	5,182	5,262	5,332	5,402	5,472	5,542	5,612	5,682	5,752	5,822	5,892	5,962	6,032	6,102	6,172					
74	5,282	5,402	5,502	5,582	5,652	5,722	5,792	5,862	5,932	6,002	6,072	6,142	6,212	6,282	6,352	6,422	6,492					
76	5,612	5,732	5,832	5,912	5,982	6,052	6,122	6,192	6,262	6,332	6,402	6,472	6,542	6,612	6,682	6,752	6,822					
78	5,952	6,072	6,172	6,252	6,322	6,392	6,462	6,532	6,602	6,672	6,742	6,812	6,882	6,952	7,022	7,092	7,162					
80	6,302	6,422	6,522	6,602	6,672	6,742	6,812	6,882	6,952	7,022	7,092	7,162	7,232	7,302	7,372	7,442	7,512					

1/ Diameter classes are midpoint; e.g., 12-inch class includes 11.0-12.9.

NOTE.--Block indicates extent of data.

Table 15.—Board-foot volume of white fir by Scribner rule in 16-foot logs to a utilized top

Top diameter, variable
Stump height, 1 foot

Stump and top excluded

Diameter breast height outside bark-- inches		Total height--feet																							
		40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240			
12	50	53	55	58	62	68	79	96	119	151	192	243	307												
14	77	85	92	99	108	119	135	158	187	226	275	336	411												
16	109	124	137	150	164	181	203	232	269	315	373	444	530												
18	147	170	190	209	230	255	284	320	364	419	486	567	664												
20	190	222	250	278	307	339	376	420	473	537	614	705	813	939	1,086	1,255									
22	239	281	319	356	394	435	481	534	596	669	756	857	976	1,115	1,275	1,458									
24	293	346	395	443	491	542	598	661	733	816	913	1,025	1,155	1,306	1,478	1,675									
26	352	418	480	539	599	660	727	800	883	977	1,084	1,208	1,349	1,512	1,696	1,906									
28	497	572	644	716	790	868	953	1,047	1,152	1,271	1,405	1,559	1,732	1,929	2,152										
30	583	672	759	844	931	1,022	1,119	1,224	1,341	1,472	1,618	1,783	1,968	2,177	2,411	2,673	2,966	3,292	3,600	3,973	4,384				
32	675	781	882	982	1,083	1,187	1,297	1,416	1,545	1,687	1,845	2,022	2,219	2,439	2,685	2,959	3,257	3,572	3,920	4,303	4,725				
34		897	1,015	1,130	1,246	1,365	1,489	1,621	1,763	1,918	2,088	2,276	2,484	2,716	2,972	3,257	3,569	3,894	4,251	4,643	5,074				
36		1,021	1,156	1,289	1,421	1,555	1,694	1,840	1,995	2,163	2,345	2,545	2,765	3,007	3,274	3,590	3,932	4,303	4,709	5,147					
38		1,307	1,458	1,607	1,757	1,911	2,072	2,242	2,423	2,618	2,829	3,060	3,313	3,590	3,894	4,227	4,593	5,000	5,430						
40		1,467	1,637	1,804	1,972	2,142	2,318	2,502	2,697	2,905	3,129	3,371	3,634	3,920	4,233	4,574	4,946	5,352	5,795	6,267	6,767				
42		1,636	1,826	2,012	2,198	2,386	2,578	2,777	2,986	3,207	3,443	3,696	3,969	4,264	4,584	4,932	5,303	5,686	6,099	6,547					
44		1,814	2,025	2,232	2,437	2,643	2,852	3,067	3,290	3,525	3,772	4,036	4,319	4,622	4,950	5,303	5,686	6,099	6,547						
46		2,001	2,235	2,463	2,688	2,913	3,139	3,371	3,609	3,857	4,117	4,391	4,683	4,995	5,328	5,687	6,072	6,488	6,935						
48		2,198	2,455	2,705	2,951	3,195	3,440	3,688	3,942	4,204	4,476	4,761	5,062	5,381	5,720	6,082	6,470	6,885	7,331						
50		2,403	2,685	2,959	3,227	3,491	3,755	4,021	4,290	4,566	4,851	5,146	5,456	5,782	6,126	6,491	6,879	7,293	7,735						
52			3,223	3,514	3,800	4,084	4,367	4,653	4,943	5,240	5,546	5,864	6,196	6,544	6,911	7,299	7,710	8,146							
54			3,499	3,814	4,122	4,426	4,728	5,030	5,335	5,645	5,961	6,287	6,625	6,976	7,344	7,730	8,136	8,566							
56			3,786	4,126	4,457	4,782	5,103	5,422	5,742	6,064	6,391	6,725	7,068	7,422	7,789	8,172	8,573	8,993							
58			4,085	4,450	4,805	5,152	5,492	5,829	6,164	6,499	6,836	7,177	7,525	7,881	8,247	8,625	9,019	9,428							
60			4,394	4,786	5,166	5,535	5,896	6,251	6,601	6,948	7,296	7,644	7,996	8,353	8,717	9,090	9,474	9,872							
62				5,332	5,714	6,084	6,454	6,824	7,193	7,562	7,931	8,300	8,669	9,038	9,407	9,776	10,145	10,514	10,883						
64				6,343	6,746	7,138	7,520	7,893	8,266	8,639	9,012	9,385	9,758	10,131	10,504	10,877	11,250	11,623	12,000						
66				6,768	7,193	7,603	8,001	8,388	8,764	9,139	9,514	9,889	10,264	10,639	11,014	11,389	11,764	12,139							
68				7,206	7,654	8,084	8,498	8,897	9,284	9,658	10,033	10,407	10,782	11,157	11,532	11,907	12,282	12,657	13,032						
70				7,658	8,129	8,579	9,010	9,422	9,818	10,198	10,562	10,914	11,252	11,580	11,897	12,205	12,503	12,801	13,099						
72					9,089	9,536	9,962	10,367	10,752	11,118	11,466	11,797	12,111	12,410	12,695	12,969	13,243	13,517	13,791						
74					9,613	10,078	10,517	10,931	11,321	11,688	12,032	12,353	12,654	12,933	13,193	13,443	13,693	13,943	14,193						
76					10,152	10,634	11,087	11,510	11,905	12,272	12,611	12,922	13,207	13,466	13,699	13,923	14,147	14,371	14,595						
78					10,706	11,206	11,672	12,104	12,504	12,870	13,203	13,504	13,772	14,009	14,213	14,407	14,591	14,765	14,939						
80					11,274	11,792	12,272	12,713	13,117	13,482	13,809	14,097	14,348	14,561	14,735										

^{1/} Diameter classes are midpoint; e.g., 12-inch class includes 11.0-12.9.
NOTE.—Block indicates extent of data.

Table 16.—Cubic-foot volume of California red fir

Top diameter, 4 inches
Stump height, 1 foot

Stump and top excluded

Diameter breast height outside bark-- Inches ^{1/}	Total height--Feet																
	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200
6	3	4	5	5	6	7	8	9	9	10	11	12	13				
8	5	7	8	10	11	13	14	15	17	18	20	21	22				
10	8	10	13	15	17	20	22	24	26	28	31	33	35				
12	10	14	18	22	25	28	31	35	38	41	44	47	50				
14	13	18	23	28	34	38	43	47	51	56	60	64	68				
16	17	22	28	35	42	49	56	61	67	73	78	84	89				
18	21	27	34	42	50	59	69	78	85	92	99	106	113				
20	26	33	41	50	60	70	81	93	105	113	122	131	140	148	157	166	
22	32	40	49	59	70	82	95	108	122	136	148	158	169	180	190	201	
24	38	47	57	69	82	95	110	125	140	157	174	188	201	214	226	239	
26	44	55	66	79	94	109	125	142	160	178	198	218	236	251	265	280	
28		64	77	90	107	124	142	161	181	201	223	245	268	291	308	325	
30		74	88	103	120	140	160	181	203	225	249	274	300	326	353	373	393
32		84	101	117	135	156	178	202	226	251	277	304	333	362	392	423	447
34			113	132	151	174	198	224	250	278	307	336	367	399	432	466	501
36			127	148	170	192	219	247	276	306	337	370	403	438	473	510	548
38				165	189	213	241	271	303	335	369	405	441	478	517	557	598
40				183	209	236	263	296	331	366	403	441	480	521	562	605	649
42				202	231	260	289	323	360	398	438	479	521	565	610	656	703
44				222	253	285	317	350	390	432	474	518	564	611	659	708	759
46				242	277	312	346	381	422	466	512	559	608	658	709	762	817
48				264	302	339	377	415	455	502	551	602	654	707	762	818	876
50				286	327	368	409	450	491	540	592	646	701	758	816	876	938
52						398	442	487	531	578	634	691	750	811	873	936	1,002
54						429	477	525	573	620	678	738	801	865	931	998	1,067
56						462	513	564	616	667	722	787	853	921	991	1,062	1,135
58						495	550	605	661	716	771	837	907	979	1,052	1,128	1,205
60						530	589	648	707	766	825	889	962	1,038	1,116	1,196	1,277
62									755	818	881	943	1,020	1,100	1,181	1,265	1,351
64									804	871	938	1,005	1,078	1,162	1,249	1,337	1,427
66									855	927	998	1,069	1,140	1,227	1,318	1,410	1,504
68									908	984	1,059	1,135	1,211	1,293	1,388	1,485	1,584
70									962	1,042	1,122	1,203	1,283	1,363	1,461	1,563	1,666
72										1,188	1,272	1,357	1,442	1,535	1,642	1,750	
74										1,254	1,344	1,434	1,523	1,613	1,723	1,836	
76										1,323	1,418	1,512	1,607	1,701	1,806	1,924	
78										1,394	1,493	1,593	1,692	1,792	1,891	2,014	
80										1,466	1,571	1,676	1,780	1,885	1,990	2,106	

^{1/} Diameter classes are midpoint; e.g., 12-inch class includes 11.0-12.9.

NOTE.--Block indicates extent of data.

Table 17.—Board-foot volume of California red fir by International 1/4-inch rule

Top diameter, 6.5 inches
Stump height, 1 foot

Stump and top excluded

Diameter breast height outside bark-- inches ^{1/}	Total height--Feet																	
	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	
10	38	51	66	84	105	129	157	189	227	269	318	372	433					
12	54	72	92	115	142	173	209	250	296	349	409	477	552					
14	73	95	121	150	184	223	267	317	374	438	511	591	681					
16	94	122	154	191	232	279	332	392	460	536	621	716	822					
18	117	153	192	236	285	341	404	474	554	642	741	851	973					
20	144	187	233	286	344	409	482	564	656	758	871	996	1,135	1,288	1,455	1,638		
22	173	224	279	340	408	483	568	661	766	881	1,010	1,152	1,308	1,479	1,667	1,872		
24	205	264	329	399	477	564	660	766	884	1,014	1,158	1,317	1,491	1,683	1,892	2,119		
26	240	308	382	463	552	650	758	878	1,010	1,155	1,316	1,492	1,686	1,897	2,128	2,379		
28		355	440	532	632	742	864	997	1,144	1,306	1,483	1,678	1,891	2,123	2,376	2,652		
30		406	502	605	718	841	976	1,124	1,286	1,465	1,660	1,873	2,107	2,361	2,637	2,937	3,262	
32		460	567	683	809	946	1,095	1,258	1,437	1,632	1,846	2,079	2,333	2,610	2,910	3,235	3,587	
34			637	766	905	1,056	1,220	1,400	1,595	1,809	2,041	2,295	2,571	2,870	3,195	3,546	3,926	
36			711	853	1,007	1,173	1,353	1,549	1,762	1,994	2,246	2,521	2,819	3,142	3,492	3,870	4,278	
38				946	1,114	1,296	1,492	1,705	1,936	2,188	2,461	2,757	3,078	3,425	3,801	4,207	4,644	
40				1,043	1,226	1,424	1,638	1,869	2,119	2,390	2,684	3,003	3,347	3,720	4,122	4,556	5,023	
42				1,144	1,344	1,559	1,790	2,040	2,310	2,602	2,918	3,259	3,628	4,026	4,456	4,918	5,415	
44				1,251	1,468	1,700	1,950	2,219	2,509	2,822	3,160	3,525	3,919	4,344	4,801	5,293	5,821	
46				1,362	1,596	1,847	2,116	2,405	2,716	3,051	3,412	3,802	4,221	4,673	5,159	5,681	6,241	
48				1,477	1,730	2,000	2,289	2,598	2,931	3,289	3,674	4,088	4,534	5,013	5,528	6,081	6,674	
50				1,598	1,870	2,159	2,468	2,799	3,154	3,535	3,945	4,385	4,858	5,365	5,910	6,494	7,120	
52					2,324	2,654	3,007	3,385	3,790	4,225	4,691	5,192	5,729	6,304	6,921	7,580		
54					2,495	2,847	3,223	3,624	4,054	4,515	5,008	5,537	6,104	6,710	7,359	8,053		
56					2,673	3,047	3,446	3,872	4,327	4,814	5,335	5,893	6,490	7,129	7,811	8,540		
58					2,856	3,254	3,677	4,127	4,608	5,123	5,672	6,260	6,888	7,559	8,276	9,041		
60					3,045	3,467	3,914	4,391	4,899	5,441	6,019	6,637	7,297	8,001	8,753	9,554		
62						4,662	5,198	5,768	6,376	7,025	7,718	8,456	9,243	10,081				
64						4,942	5,505	6,105	6,744	7,424	8,150	8,923	9,746	10,622				
66						5,230	5,822	6,451	7,121	7,834	8,593	9,401	10,261	11,176				
68						5,526	6,147	6,807	7,509	8,255	9,048	9,892	10,790	11,744				
70						5,830	6,481	7,172	7,906	8,686	9,515	10,395	11,331	12,325				
72							7,547	8,314	9,128	9,993	10,911	11,885	12,920					
74							7,931	8,732	9,581	10,482	11,438	12,452	13,528					
76							8,324	9,160	10,045	10,983	11,977	13,032	14,149					
78							8,727	9,598	10,519	11,495	12,529	13,624	14,784					
80								9,139	10,046	11,004	12,019	13,093	14,229	15,432				

^{1/} Diameter classes are midpoint; e.g., 12-inch class includes 11.0-12.9.
NOTE.—Block indicates extent of data.

Table 18.—Board-foot volume of California red fir by Scribner rule in 16-foot logs to a utilized top

Top diameter, variable
Stump height, 1 foot

Stump and top excluded

Diameter breast height outside bark-- inches	Total height--Feet																		
	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200		
12	24	41	60	81	105	133	164	199	239	284	334	390	452						
14	38	60	84	112	142	177	215	259	308	363	424	491	566						
16	54	82	113	147	185	227	274	327	385	451	523	603	692						
18	74	108	146	187	233	284	340	402	471	548	633	726	828						
20	96	138	183	232	287	346	412	485	565	654	752	859	976	1,105	1,245	1,398			
22	121	171	224	283	346	416	492	576	668	769	880	1,002	1,135	1,280	1,438	1,610			
24	149	207	270	337	411	491	578	674	779	894	1,019	1,156	1,305	1,468	1,644	1,836			
26	179	247	320	397	481	573	672	780	898	1,027	1,167	1,320	1,487	1,667	1,863	2,075			
28		290	373	462	557	661	772	894	1,026	1,169	1,325	1,495	1,679	1,878	2,094	2,327			
30		337	431	532	639	755	880	1,015	1,162	1,321	1,493	1,680	1,882	2,101	2,338	2,593	2,867		
32		388	494	606	726	855	994	1,144	1,306	1,481	1,671	1,876	2,097	2,336	2,594	2,871	3,170		
34			560	685	819	962	1,115	1,281	1,459	1,651	1,858	2,082	2,323	2,583	2,863	3,163	3,487		
36			631	770	917	1,075	1,244	1,425	1,620	1,829	2,055	2,298	2,560	2,841	3,144	3,469	3,817		
38				859	1,021	1,194	1,379	1,577	1,789	2,017	2,262	2,525	2,808	3,112	3,438	3,787	4,161		
40				953	1,131	1,320	1,521	1,737	1,967	2,214	2,479	2,763	3,067	3,394	3,744	4,119	4,520		
42				1,051	1,246	1,452	1,671	1,904	2,153	2,420	2,705	3,010	3,338	3,688	4,063	4,464	4,892		
44				1,155	1,366	1,590	1,827	2,079	2,348	2,634	2,941	3,269	3,619	3,994	4,394	4,822	5,278		
46				1,264	1,493	1,734	1,990	2,261	2,550	2,858	3,187	3,537	3,912	4,312	4,738	5,193	5,678		
48				1,377	1,624	1,885	2,160	2,452	2,762	3,091	3,442	3,817	4,216	4,641	5,095	5,578	6,093		
50				1,496	1,762	2,042	2,337	2,650	2,981	3,333	3,708	4,106	4,531	4,983	5,464	5,976	6,521		
52					2,205	2,521	2,855	3,209	3,584	3,983	4,406	4,857	5,336	5,845	6,387	6,963			
54					2,374	2,712	3,069	3,445	3,844	4,268	4,717	5,194	5,701	6,239	6,811	7,418			
56						2,550	2,910	3,289	3,690	4,114	4,562	5,038	5,543	6,078	6,646	7,249	7,888		
58							2,732	3,115	3,518	3,943	4,392	4,867	5,369	5,902	6,467	7,065	7,700	8,372	
60							2,920	3,327	3,754	4,204	4,679	5,181	5,711	6,273	6,867	7,497	8,164	8,870	
62									4,474	4,976	5,505	6,064	6,655	7,280	7,941	8,641	9,381		
64									4,752	5,281	5,838	6,427	7,048	7,704	8,398	9,132	9,907		
66									5,039	5,595	6,182	6,800	7,452	8,140	8,867	9,635	10,446		
68									5,333	5,919	6,535	7,184	7,867	8,588	9,349	10,152	11,000		
70									5,637	6,252	6,898	7,578	8,294	9,048	9,844	10,683	11,567		
72										7,270	7,982	8,731	9,520	10,351	11,226	12,149			
74											7,653	8,397	9,180	10,004	10,870	11,783	12,744		
76												8,045	8,823	9,640	10,499	11,402	12,353	13,353	
78													8,447	9,259	10,111	11,006	11,947	12,936	13,976
80														8,859	9,705	10,593	11,525	12,504	13,532

1/ Diameter classes are midpoint; e.g., 12-inch class includes 11.0-12.9.
NOTE.--Block indicates extent of data.

Table 19.—Cubic-foot volume of incense-cedar

Stump and top excluded

Top diameter, 4 inches
Stump height, 1 foot

Diameter breast height outside bark-- inches ^{1/}	Total height--Feet														
	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
6	3	3	4	4	4	5	5	6	6	7	7	8	8		
8	5	5	6	7	8	9	9	10	11	12	13	14	15		
10	7	9	10	11	12	14	15	16	18	19	21	22	24		
12	11	12	14	16	18	19	21	23	25	28	30	32	34		
14	14	17	19	22	24	26	29	32	35	38	40	43	46		
16	19	22	25	28	31	35	38	41	45	49	53	57	60		
18	24	28	32	36	40	44	48	52	57	62	67	72	76		
20	29	34	39	44	49	54	59	65	71	77	82	88	94	100	106
22	36	42	47	53	59	65	71	78	86	93	100	107	114	121	128
24	42	49	57	64	71	78	85	93	102	110	119	127	136	144	153
26	50	58	66	75	83	91	100	110	119	129	139	149	159	169	179
28		67	77	87	96	106	116	127	139	150	162	173	185	196	208
30		77	88	99	110	122	133	146	159	172	186	199	212	225	239
32		88	100	113	126	138	151	166	181	196	211	226	241	256	271
34			113	128	142	156	170	187	204	221	238	255	272	289	306
36			127	143	159	175	191	210	229	248	267	286	305	324	344
38				159	177	195	213	234	255	276	298	319	340	361	383
40				177	196	216	236	259	283	306	330	353	377	401	424
42				195	217	238	260	286	312	338	364	390	416	442	468
44				214	238	261	285	314	342	371	399	428	456	485	513
46				234	260	286	312	343	374	405	436	467	499	530	561
48				254	283	311	340	373	407	441	475	509	543	577	611
50				276	307	338	368	405	442	479	515	552	589	626	663
52						365	399	438	478	518	557	597	637	677	717
54						394	430	472	515	558	601	644	687	730	773
56						424	462	508	554	600	647	693	739	785	831
58						454	496	545	594	644	694	743	793	842	892
60						486	531	583	636	689	742	795	848	901	954
62						519	567	623	679	736	793	849	906	962	1,019
64						553	604	664	724	784	844	905	965	1,025	1,086
66						588	642	706	770	834	898	962	1,026	1,091	1,155
68								817	885	953	1,021	1,090	1,158	1,226	
70								866	938	1,010	1,082	1,155	1,227	1,299	
72										1,069	1,145	1,221	1,298	1,374	
74										1,129	1,210	1,290	1,371	1,452	
76										1,191	1,276	1,361	1,446	1,531	
78										1,254	1,344	1,434	1,523	1,613	
80										1,319	1,414	1,508	1,602	1,696	

^{1/} Diameter classes are midpoint; e.g., 12-inch class includes 11.0-12.9.
NOTE.--Block indicates extent of data.

Table 20.—Board-foot volume of incense-cedar by International 1/4-inch rule

Top diameter, 6.5 inches
Stump height, 1 foot

Stump and top excluded

Diameter breast height outside bark-- inches--	Total height--Feet															
	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	
10	31	40	49	58	68	79	90	102	116	130	145	162	180			
12	45	57	70	84	98	113	130	147	166	187	209	233	259			
14	61	78	95	114	133	154	177	201	227	255	285	317	352			
16	80	102	125	149	174	201	231	262	296	332	372	414	460			
18	101	129	158	188	220	255	292	332	375	421	470	524	582			
20	125	159	195	232	272	315	360	410	462	519	581	647	718	795	877	
22	151	192	235	281	329	381	436	496	560	629	703	783	869	962	1,061	
24	180	229	280	334	392	453	519	590	666	748	836	932	1,034	1,144	1,263	
26	212	269	329	392	460	532	609	692	782	878	982	1,093	1,214	1,343	1,483	
28		312	381	455	533	617	707	803	906	1,018	1,138	1,268	1,408	1,558	1,719	
30		358	438	522	612	708	811	922	1,041	1,169	1,307	1,456	1,616	1,788	1,974	
32		407	498	594	696	806	923	1,049	1,184	1,330	1,487	1,656	1,838	2,035	2,246	
34			562	671	786	910	1,042	1,184	1,337	1,501	1,678	1,870	2,075	2,297	2,535	
36			630	752	882	1,020	1,168	1,327	1,498	1,683	1,882	2,096	2,327	2,575	2,842	
38				838	982	1,136	1,301	1,479	1,670	1,875	2,097	2,335	2,592	2,869	3,167	
40				928	1,088	1,259	1,442	1,638	1,850	2,078	2,323	2,588	2,873	3,179	3,509	
42				1,024	1,200	1,388	1,590	1,806	2,040	2,291	2,561	2,853	3,167	3,505	3,869	
44				1,123	1,317	1,523	1,745	1,983	2,238	2,514	2,811	3,131	3,476	3,847	4,246	
46				1,228	1,439	1,665	1,907	2,167	2,447	2,748	3,072	3,422	3,799	4,204	4,641	
48				1,337	1,567	1,813	2,076	2,359	2,664	2,992	3,345	3,726	4,136	4,578	5,053	
50				1,451	1,700	1,967	2,253	2,560	2,890	3,246	3,630	4,043	4,488	4,967	5,483	
52					2,128	2,437	2,769	3,126	3,511	3,926	4,373	4,855	5,373	5,930		
54					2,294	2,628	2,986	3,371	3,787	4,234	4,716	5,235	5,794	6,395		
56					2,468	2,826	3,211	3,626	4,072	4,553	5,072	5,630	6,231	6,877		
58					2,647	3,032	3,445	3,889	4,368	4,884	5,441	6,039	6,684	7,377		
60					2,833	3,244	3,686	4,162	4,675	5,227	5,822	6,463	7,153	7,895		
62					3,025	3,464	3,936	4,444	4,992	5,581	6,217	6,901	7,638	8,430		
64					3,223	3,691	4,194	4,736	5,319	5,947	6,624	7,354	8,139	8,983		
66					3,428	3,926	4,461	5,036	5,657	6,325	7,045	7,820	8,655	9,553		
68								5,346	6,005	6,714	7,478	8,302	9,188	10,141		
70								5,665	6,363	7,115	7,925	8,797	9,736	10,746		
72										7,527	8,384	9,307	10,300	11,369		
74										7,951	8,856	9,831	10,881	12,009		
76										8,387	9,341	10,370	11,477	12,667		
78										8,834	9,840	10,923	12,089	13,343		
80										9,293	10,351	11,490	12,717	14,036		

1/ Diameter classes are midpoint; e.g., 12-inch class includes 11.0-12.9.
NOTE.--Block indicates extent of data.

Table 21.—Board-foot volume of incense-cedar by Scribner rule in 16-foot logs to a utilized top

Diameter breast height outside bark-- inches ^{1/}	Total height--Feet														
	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
12	27	33	40	46	53	60	66	73	80	86	93	99	106		
14	42	53	63	74	84	95	105	116	126	137	147	158	168		
16	61	76	91	106	122	137	152	167	182	198	213	228	243		
18	83	103	124	145	165	186	207	227	248	269	289	310	331		
20	108	135	162	189	216	242	269	296	323	350	377	404	431	458	485
22	136	170	204	238	272	306	340	374	408	442	476	510	544	578	612
24	167	209	251	293	335	377	419	460	502	544	586	628	670	712	754
26	202	253	303	354	404	455	505	556	606	657	707	758	808	859	909
28		300	360	420	480	540	600	660	720	780	839	899	959	1,019	1,079
30		351	421	491	562	632	702	772	842	913	983	1,053	1,123	1,193	1,264
32		406	487	569	650	731	812	894	975	1,056	1,137	1,219	1,300	1,381	1,462
34			558	651	745	838	931	1,024	1,117	1,210	1,303	1,396	1,489	1,582	1,675
36			634	740	846	951	1,057	1,163	1,268	1,374	1,480	1,585	1,691	1,797	1,903
38				834	953	1,072	1,191	1,310	1,429	1,548	1,668	1,787	1,906	2,025	2,144
40				933	1,067	1,200	1,333	1,467	1,600	1,733	1,867	2,000	2,133	2,267	2,400
42				1,038	1,187	1,335	1,483	1,632	1,780	1,928	2,077	2,225	2,373	2,522	2,670
44				1,149	1,313	1,477	1,641	1,806	1,970	2,134	2,298	2,462	2,626	2,790	2,955
46				1,265	1,446	1,627	1,807	1,988	2,169	2,350	2,530	2,711	2,892	3,073	3,253
48				1,387	1,585	1,783	1,981	2,179	2,378	2,576	2,774	2,972	3,170	3,368	3,566
50				1,514	1,731	1,947	2,163	2,379	2,596	2,812	3,028	3,245	3,461	3,677	3,894
52						2,118	2,353	2,588	2,824	3,059	3,294	3,529	3,765	4,000	4,235
54						2,296	2,551	2,806	3,061	3,316	3,571	3,826	4,081	4,336	4,591
56						2,481	2,756	3,032	3,308	3,583	3,859	4,135	4,410	4,686	4,962
58						2,673	2,970	3,267	3,564	3,861	4,158	4,455	4,752	5,049	5,346
60						2,872	3,192	3,511	3,830	4,149	4,468	4,787	5,107	5,426	5,745
62						3,079	3,421	3,763	4,105	4,448	4,790	5,132	5,474	5,816	6,158
64						3,293	3,659	4,025	4,390	4,756	5,122	5,488	5,854	6,220	6,586
66						3,514	3,904	4,294	4,685	5,075	5,466	5,856	6,247	6,637	7,027
68								4,989	5,405	5,820	6,236	6,652	7,068	7,483	7,898
70								5,303	5,744	6,186	6,628	7,070	7,512	7,954	8,396
72										6,563	7,032	7,501	7,970	8,438	8,906
74										6,951	7,448	7,944	8,441	8,937	9,434
76										7,351	7,876	8,401	8,926	9,451	9,976
78										7,761	8,315	8,870	9,424	9,978	10,532
80										8,182	8,767	9,351	9,936	10,520	

^{1/} Diameter classes are midpoint; e.g., 12-inch class includes 11.0-12.9.
NOTE.--Block indicates extent of data.

Table 22—Root mean squared errors of form factor equations

Species	Root mean squared error					
	Cubic		International 1/4-Inch		Scribner	
	Ratio	Percent	Ratio	Percent	Ratio	Percent
Douglas-fir	0.04	11.7	0.31	14.8	0.32	17.3
Ponderosa and Jeffrey pine	.05	13.4	.40	17.6	.41	20.9
Sugar pine	.05	15.5	.44	19.3	.45	21.7
Lodgepole pine	.04	10.9	.32	13.6	.33	16.6
White fir	.04	13.2	.37	17.0	.36	18.9
California red fir	.04	13.5	.38	18.0	.38	20.3
Incense-cedar	.04	14.6	.31	19.0	.29	21.6

Table 23—Results of a test of study equations and the old local volume tables against 441 trees of known volume from the Stanislaus National Forest

Species and log rule	Mean volume per tree	Root mean squared error ^{1/}		Aggregate difference	
		Study equations	Old local volume tables	Study equations	Old local volume tables
----- Percent -----					
Douglas-fir (15 trees):					
Cubic	114.6	19.2	27.7	10.1	-0.5
International 1/4-inch	780.6	24.9	51.0	9.1	-8.3
Scribner	677.1	31.1	48.1	10.7	-1.2
Ponderosa and Jeffrey pine (146 trees):					
Cubic	158.9	20.2	31.7	4.6	-8.5
International 1/4-inch	1,120.1	26.9	56.7	2.0	-17.0
Scribner	1,009.2	29.5	49.5	3.4	-13.3
Sugar pine (34 trees):					
Cubic	214.5	13.0	20.8	-5.2	-6.7
International 1/4-inch	1,546.5	17.6	32.1	-10.3	-13.9
Scribner	1,417.6	43.0	38.0	-9.9	-10.9
Lodgepole pine (60 trees):					
Cubic	79.0	15.8	50.5	3.8	35.0
International 1/4-inch	457.2	25.4	60.0	7.9	36.2
Scribner	411.6	30.0	77.4	4.7	41.0
White fir (86 trees):					
Cubic	168.3	15.7	22.4	-6.2	-10.8
International 1/4-inch	1,197.6	21.4	31.2	-9.7	-15.0
Scribner	1,096.7	38.1	52.4	-9.8	-12.5
California red fir (42 trees):					
Cubic	284.9	17.2	28.3	-2.6	-.1
International 1/4-inch	2,044.0	24.8	33.4	-10.2	-5.2
Scribner	1,892.6	28.1	27.4	-10.7	-2.5
Incense-cedar (58 trees):					
Cubic	117.3	20.5	39.2	-.6	-20.7
International 1/4-inch	769.9	28.1	52.8	-2.5	-23.1
Scribner	679.4	51.7	65.7	-5.0	-17.9
Combined (441 trees):					
Cubic	159.2	17.9	32.9	-.3	-5.4
International 1/4-inch	1,108.1	24.9	47.5	-3.8	-11.6
Scribner	1,005.9	34.8	43.8	-3.9	-8.1

^{1/} Logarithmic transformation was used to equalize variance.

Table 24—Comparative reliability of diameter-height and diameter-height-form class volume equations in estimating Stanislaus National Forest sample tree volumes
(In percent)

Equation	Cubic		International 1/4-inch		Scribner	
	Root mean squared error ^{1/}	Aggregate difference	Root mean squared error ^{1/}	Aggregate difference	Root mean squared error ^{1/}	Aggregate difference
Without form class	16.2	-0.6	20.1	-4.5	23.3	-4.4
With actual form class	12.0	5.4	13.0	1.7	16.3	1.7
With average form class	16.2	-1.8	20.5	-5.7	23.7	-5.5

^{1/} In order to equalize variance, root mean squared errors were calculated for four factors instead of volume.

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