



# STATE FOREST NOTES

1416 Ninth Street  
Sacramento, CA 95814  
Phone 916-445-5571

No. 77

September 1979

A GROSS VOLUME TABLE FOR CALIFORNIA WHITE OAK  
IN MONTEREY AND SAN LUIS OBISPO COUNTIES



The largest oak species in our state, California white oak (Quercus lobata Nee), is currently an unmanaged, though valuable, resource. Reliable estimates of volume do not exist for this species, and therefore, an effective management program cannot be established. A volume table is a necessary component needed for the inventory of white oak woodlands and their subsequent management.

---

Thomas J. Harrington, Forest Technician, El Dorado National Forest, Graduate of the Department of Natural Resources Management, California Polytechnic State University, San Luis Obispo.

Norman H. Pillsbury, Associate Professor of Forestry and Watershed Management, Department of Natural Resources Management, California Polytechnic State University, San Luis Obispo.

Brian Barrette, Forester III, Service Forestry Program Supervisor, California Department of Forestry, Sacramento.

TABLE 1  
 CALIFORNIA WHITE OAK GROSS VOLUME IN CUBIC FEET  
 (Smalian's Formula)

DBH inches	HEIGHT IN FEET										
	5	10	15	20	25	30	35	40	45	50	55
4	0.1	0.3	0.4	0.6	0.7	0.9					
6	0.3	0.7	1.1	1.5	1.9	2.4	2.8	3.3	3.8		
8	0.6	1.3	2.1	2.9	3.8	4.6	5.5	6.4	7.3	8.3	9.2
10		2.3	3.6	4.9	6.4	7.8	9.3	10.8	12.4	13.9	15.5
12		3.5	5.5	7.6	9.7	12.0	14.3	16.6	18.9	21.3	23.7
14		5.0	7.8	10.9	14.0	17.2	20.4	23.8	27.1	30.6	34.0
16			10.7	14.8	19.1	23.4	27.9	32.4	37.1	41.7	46.5
18			14.1	19.5	25.1	30.9	36.7	42.7	48.8	55.0	61.2
20			18.0	25.0	32.1	39.5	47.0	54.6	62.4	70.3	78.3
22				31.2	40.1	49.3	58.7	68.2	77.9	87.8	97.8
24				38.2	49.2	60.4	71.9	83.6	95.5	107.6	119.8
26				46.1	59.3	72.8	86.7	100.8	115.1	129.7	144.4
28				54.8	70.5	86.6	103.0	119.8	136.9	154.2	171.7
30					82.8	101.7	121.0	140.8	160.8	181.1	201.7
32					96.2	118.2	140.7	163.7	186.9	210.6	234.5
34					110.9	136.2	162.1	188.5	215.4	242.6	270.2
36					126.7	155.7	185.3	215.5	246.1	277.2	308.8
38						176.6	210.2	244.4	279.2	314.5	350.3
40						199.1	237.0	275.5	314.8	354.5	394.9
42						223.1	265.5	308.8	352.7	397.3	442.5
44						248.7	296.0	344.2	393.2	442.9	493.3
46						275.9	328.4	381.9	436.2	491.3	547.2
48								421.7	481.8	542.7	604.4
50								463.9	530.0	596.9	664.8
52								508.4	580.8	654.2	728.6
54								555.2	634.3	714.5	795.7
56										777.8	866.2
58										844.2	940.2
60										913.7	1017.6

Note: Solid line represents the basic range of sample data.

TABLE 1 (cont.)  
 CALIFORNIA WHITE OAK GROSS VOLUME IN CUBIC FEET  
 (Smalian's Formula)

DBH	HEIGHT IN FEET											
	40	45	50	55	60	65	70	75	80	85	90	
4												
6												
8	10.2	11.1										
10	17.1	18.7	20.4									
12	26.2	28.7	31.2									
14	37.6	41.1	44.7									
16	51.3	56.1	61.1	66.0	71.0	76.0	81.1					
18	67.5	73.9	80.4	86.9	93.5	100.1	106.8					
20	86.4	94.5	102.8	111.1	119.5	128.0	136.5					
22	107.9	118.1	128.4	138.8	149.3	159.9	170.6	181.3	192.1	203.0	214.0	
24	132.2	144.7	157.3	170.1	183.0	195.9	209.0	222.2	235.4	248.8	262.2	
26	159.3	174.4	189.7	205.0	220.5	236.2	251.9	267.8	283.8	299.9	316.1	
28	189.4	207.4	225.5	243.8	262.2	280.8	299.5	318.4	337.4	356.5	375.8	
30	222.6	243.6	264.9	286.4	308.0	329.9	351.9	374.0	396.4	418.8	441.4	
32	258.7	283.2	308.0	332.9	358.1	383.5	409.1	434.9	460.8	486.9	513.2	
34	298.1	326.3	354.8	383.6	412.6	441.8	471.3	501.0	530.9	561.0	591.2	
36	340.6	372.9	405.5	438.3	471.5	504.9	538.6	572.5	606.7	641.1	675.7	
38	386.5	423.1	460.0	497.3	534.9	572.8	611.1	649.6	688.3	727.3	766.6	
40	435.7	476.9	518.5	560.6	603.0	645.7	688.8	732.2	775.9	819.8	864.1	
42	488.2	534.4	581.1	628.2	675.7	723.6	771.9	820.5	869.5	918.8	968.3	
44	544.2	595.7	647.8	700.3	753.3	806.7	860.5	914.7	969.2	1024.2	1079.4	
46	603.7	660.9	718.6	776.9	835.6	894.9	954.6	1014.7	1075.2	1136.2	1197.5	
48	666.8	729.9	793.7	858.0	922.9	988.4	1054.3	1120.7	1187.6	1254.9	1322.6	
50	733.5	802.9	873.0	943.8	1015.2	1087.2	1159.7	1232.8	1306.3	1380.4	1454.9	
52	803.8	879.9	956.8	1034.3	1112.6	1191.5	1270.9	1351.0	1431.6	1512.7	1594.4	
54	877.9	961.0	1044.9	1129.6	1215.1	1301.2	1388.0	1475.4	1563.5	1652.1	1741.2	
56	955.7	1046.1	1137.5	1229.7	1322.7	1416.5	1511.0	1606.2	1702.0	1798.5	1895.5	
58	1037.3	1135.5	1234.6	1334.7	1435.7	1537.5	1640.0	1743.3	1847.3	1952.0	2057.4	
60	1122.7	1229.0	1336.3	1444.6	1553.9	1664.1	1775.1	1886.9	1999.5	2112.8	2226.8	

Note: Solid line represents the basic range of sample data.

During the summers of 1977 and 1978, a total of 20 sample trees were measured in detail in Monterey and San Luis Obispo Counties. The trees measured were considered to be representative of the trees growing in the area. Sample tree diameters ranged from 6.5 inches to 54.8 inches and heights from 26.6 feet to 74.1 feet. They occurred both as individuals and in mixed stands.

Diameter at breast height was measured in inches by a diameter tape, and total height was measured in feet by a relaskop. Volume was determined by measuring the upper and lower diameter of each tree segment and that segment's length. This was done with a relaskop to a minimum diameter of 4 inches. When a segment grew at an angle from the horizontal plane, the angle was estimated to the nearest 5 degrees and its length determined by the sine function. Horizontal segments were measured by projecting the segment's length onto the ground and measuring it with a cloth tape. Terminal branches having a large end diameter of 4 inches were found to average 6 feet in length.\*

Smalian's formula\*\* was used to compute the volume in cubic feet of all segments. Terminal branch volumes were computed as a cone. The sum of terminal branch and segment volumes gives an estimate of the gross volume for each standing tree. This estimate was further refined by using an equation developed by Pillsbury and Stephens (1978) which correlates standing tree volume for central coast hardwoods determined by the above method to cut tree volume.

$$\text{Vol-cut (ft}^3\text{)} = 1.18824 \text{ Vol-standing (ft}^3\text{)}^{0.9947} \quad (1)$$

A multiple regression (logarithm transformation) was used to obtain the tree volume equation for California white oak.

$$\text{Vol (ft}^3\text{)} = 0.0007757 \text{ D(in)}^{2.334753} \text{ H(ft)}^{1.129842} \quad (2)$$

A very strong relationship ( $R^2 = 0.989$ ) occurred between the dependent variable--volume, and the independent variables--DBH and total height. The volume table based on equation (2) is shown in the table.

The central coast ranges of California contain a valuable and mostly unused wood fiber resource. Management of this resource cannot be done effectively without an accurate inventory of the woodlands. It is recommended that anyone interested in the inventory of California white oaks use this table for trees located in Monterey and San Luis Obispo Counties.

---

\*Pillsbury, Norman H. and Jeffrey A. Stephens. 1978. Hardwood volume and weight tables for California's central coast. State of California, Resources Agency, Department of Forestry, Sacramento.

\*\*

$$\text{Volume (ft}^3\text{)} = \sum \left[ (h/2)(A_o + A_u) \right]$$

Where  $A_o$  is the cross-sectional area at the large end of each segment,  $A_u$  is the cross-sectional area at the small end of each segment, and h is the segment length.