

TECHNICAL NOTES

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BIOMASS MEASUREMENTS FOR WESTERN CONIFERS

A great deal of research and operational studies call for biomass data. In the last few years, considerable data have been gathered to predict biomass measurements of trees on an individual and per acre basis. A recent publication by the Intermountain Forest and Range Experiment Station has provided the opportunity for assessing biomass of western conifers. It employs weight of tops of various diameters by species. The top diameters will match upper bole wood diameters of these same species. For example, a ponderosa pine cubic foot volume table to a 4-inch top is available (Attachment 1) and will match the 4-inch top listed. Pounds per cubic foot for all commercial species can be obtained from Table W-122, Woodland Pocket Handbook. The weight of a bole plus a top weight will approximate total tree weight, minus bark of the bole and stump. If the tree of average diameter and height is known (from field measurements or yield tables), a biomass estimate per acre can be made by multiplying the individual tree weight times the number of trees per acre. If a yearly biomass estimate is needed, stand age can be divided into total biomass to obtain annual yield.

A typical example might be as follows:

Suppose a stand of ponderosa pine is inventoried using the zigzag system, and the tree of average diameter is measured for height and age. This gives a stand 124 years old, 90 feet in height, with a diameter of 14 inches. The bole wood volume in cubic feet of the average tree is determined from a volume table for a 4-inch top. Multiply the volume times the dry weight per cubic foot. This gives bole weight. For the limbs and top, look at the attached table and get the limb and top weight. Add these two weights to get total tree weight.

Multiply that times the number of trees per acre and get total biomass of wood per acre. If annual production is desired, divide by 124.

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In the example, it would look like this:

PP 124, 90', 14", 143 trees. Top and branch weight, from Attachment 2, 367 lbs.

Bole wood 34 cubic feet, from PP volume table, Attachment 1, x 28 lbs/cu ft = 952 lbs.

Total weight per tree = 1219 lbs x 143 trees = 174,317 lbs/acre
÷ 124 years = 1406 lbs/year.

Attachment 1 is from "Volume Tables for Pacific Northwest Trees," Ag. Handbook No. 92, USDA Forest Service 1955.

Attachment 2 is from "Handbook for Predicting Slash Weight of Western Conifers," Brown, et. al., USDA Forest Service, General Technical Report INT-37, 1977. Intermountain Forest and Range Experiment Station, Ogden, Utah, 84401.

Attachment 1

TABLE 29

Species..... PREDATORIA PINE (Pinus predatoris), young-growth
 Unit of measure..... Cubic-foot
 Variables..... D.b.h. and total height
 Stump height..... Equivalent to d.b.h. with a 24-inch maximum
 Top d.i.b..... 4 inches
 Method..... Adjustment of volume in table 22 U. S. Dept. Agr. Tech. Bul. 630
 Number of trees..... 2,947 for base table
 Location of trees..... All sites in Oregon, California, Colorado, Montana, New Mexico, and Arizona
 Accuracy..... Aggregate deviation for base table 0.26 percent high
 Author..... F. L. Hartweg, Pacific Northwest Forest and Range Expt. Sta.
 Source..... File report
 Year..... 1948

D.b.h. (Inches)	Cubic-foot volume when total height of tree in feet is—														
	20	30	40	50	60	70	80	90	100	110	120	130	140	150	
6	1.3	1.5	1.8	2.4	2.8	3.2	3.9	4.4	10.4	20.4	33	36	54	73	
8		2.9	4.0	4.9	5.9	7.0	8.2	9.4	18.5	30	46	50	69	73	
10		4.9	6.8	8.7	10.3	11.2	14.1	16.0	38	42	60	65	89	94	
12			6.0		11.1				49	55	77	83	110	117	
14				12	15	18	21	24	79	87	95	103	110		
16				13	17	26	30	34	94	104	114	124	132	140	
18				18	21	33	39	45	112	123	134	144	155	164	
20				23	29	43	50	57	131	144	156	166	178	191	
				28	37	54	62	70	151	166	180	194	207	220	
22				44	55	65	75	85	172	188	204	220	234	249	
24				64	76	89	100	117	192	210	227	245	260	276	
26				89	104	121	135	155	211	231	252	271	287	303	
28				102	120	138	155	172	235	256	275	296	313	329	
30									280	303	323	346	366	386	
32					114	134	155	176	292	316	337	371	392	413	
34					127	149	173	195	324	349	371	396	418	440	
36						167	191	215	347	372	395	421	444	468	
38						184	211	236	368	393	419	446	470	495	
40						202	230	256	389	418	445	471	496	522	
42							249	276	402	436	467	492	517	542	
44							268	295	424	459	491	517	542	567	
46							288	316	446	481	513	540	566	591	
48							308	336	468	503	535	562	588	613	
50							328	356	490	525	557	584	610	635	

Attachment 2

TABLE 2.--Weight per tree by d.b.h. of all material for crowns and unmerchantable bole tips to a 4-inch top

4-INCH TOP

D.b.h. (inches)	Species							
	PP	LP	WL-WP	DF	GF	AF	WC-WH	ES
	----- Pounds -----							
5	67	55	60	70	77	62	61	68
6	82	62	63	81	92	74	70	82
7	101	72	69	94	111	90	83	99
8	126	86	77	110	132	110	98	118
9	154	103	87	128	157	134	115	140
10	188	122	98	148	185	162	134	165
11	226	142	109	170	217	195	155	192
12	268	164	122	194	252	233	177	222
13	315	187	136	220	290	276	202	253
14	367	213	151	248	333	325	229	288
15	424	240	166	277	379	381	257	325
16	485	269	183	309	430	444	288	364
17	552	299	200	342	486	495	320	406
18	623	332	218	388	546	552	354	451
19	699	366	237	437	595	613	390	498
20	780	401	257	489	645	677	428	549
21	867	439	277	544	696	744	469	602
22	959	478	298	603	749	814	511	658
23	1,060	518	320	666	803	888	555	718
24	1,160	561	342	732	859	965	602	781
25	1,270	605	366	802	916	1,050	650	847
26	1,380	650	390	875	975	1,130	701	917
27	1,500	697	414	952	1,040	1,220	754	990
28	1,620	746	440	1,030	1,100	1,310	810	1,070
29	1,760	796	466	1,120	1,160	1,400	868	1,150
30	1,890	848	493	1,210	1,220	1,500	928	1,230
31	2,030		520	1,300	1,290		990	1,320
32	2,180		549	1,400	1,360		1,060	1,420
33	2,340		578	1,500	1,420		1,120	1,510
34	2,500		607	1,600	1,490		1,190	1,620
35	2,660		637	1,710	1,560		1,270	1,720
36	2,840		668	1,830	1,640		1,340	1,840
37	3,020		700	1,950	1,710		1,420	1,950
38	3,200		732	2,070	1,780		1,500	2,080
39	3,390		766	2,200	1,860		1,580	2,200
40	3,590		799	2,330	1,940		1,670	2,340