



EDITOR'S
FILE COPY

RESEARCH NOTES

Issued by the

PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION

EDITOR'S
FILE COPY

No. 55

Portland, Oregon.

August 15, 1949

VOLUME TABLES FOR RED ALDER

By

Floyd A. Johnson - Pac. N. W. For. & Range Expt. Sta.
R. M. Kallander - Oregon State Board of Forestry^{1/}
Paul G. Lauterbach - Weyerhaeuser Timber Company

The increasing importance of red alder as a commercial species in the Pacific Northwest has prompted the three agencies listed above to pool their tree measurement data for the construction of standard regional red alder volume tables. The tables included here were based on trees from a variety of sites and form classes. Approximately one-quarter of the total number of tree measurements came from British Columbia.^{2/} The others came from the following counties of Oregon and Washington:

Oregon

Clatsop
Columbia
Tillamook
Clackamas
Coos
Yamhill

Washington

Cowlitz
Grays Harbor
Kitsap
King
Lewis

^{1/} Participation in this project by the staff of the State Forester of Oregon was made possible by funds derived through the Forest Research and Experimental Act of 1947.

^{2/} Cooperation of the British Columbia Forest Service in making available their alder tree measurements and in reviewing the tables in manuscript is gratefully acknowledged.

Table 1.--Red alder volume table

Scribner - Board Feet

Tree diameter (inches)	Number of 8' logs to merchantable top (8" minimum)										Basis No. of trees
	1	2	3	4	5	6	7	8	9	10	
10	18	35	53	71	89	107					54
11	21	42	63	85	106	127					
12	24	49	74	99	125	150	175	200			77
13	28	57	86	115	144	173	203	232			
14	33	66	99	132	165	199	232	266			96
15	37	75	112	150	188	226	264	302			
16	42	84	126	169	212	255	297	340	383		84
17	47	94	141	189	237	285	333	380	428		
18	52	104	157	210	263	316	370	423	476	530	57
19		115	174	232	291	350	408	467	526	585	
20		127	191	257	320	384	449	514	578	643	20
21		139	209	279	350	421	491	562	633	704	
22		151	228	304	381	458	535	613	690	767	16
23		164	247	330	414	497	581	665	749	833	
24		178	267	358	448	538	629	719	810	901	8
25			288	385	483	594	678	775	873	971	
26			310	414	519	624	729	834	939	1,040	1
27			332	444	557	669	782	894	1,007	1,120	2
28			355	475	595	716	836	956	1,077	1,198	
Basis No. of trees		14	26	54	82	98	70	45	22	4	415

Basis - 415 trees, block shows extent of basic data

Method - Multiple regression using an equation of the type:

$$\text{Log } V = a \text{Log } D + b \text{Log } H + c$$

Where V = Scribner bd. ft. volume of a tree - stump (as cut) to merchantable top (8" minimum)

D = Diameter at breast height

H = Number of 8' logs to a merchantable top

a, b, c = Constants

Regression Equation - $\text{Log } V = 1.8468 \text{Log } D + 1.0090 \text{Log } H - .6033$

Standard error of an individual tree volume = 10.3%

Table 2.--Red alder volume table

Volume by log position

Scribner - Board Feet

Tree diameter (inches)	No. of 8-foot logs	Log position										Tree total
		1	2	3	4	5	6	7	8	9	10	
10	1	18										18
	2	19	16									35
	3	22	17	14								53
	4	23	20	16	12							71
	5	25	21	18	14	11						89
	6	27	23	19	16	13	9					107
11	1	21										21
	2	23	19									42
	3	26	21	16								63
	4	28	24	19	14							85
	5	30	25	21	17	13						106
	6	32	28	23	19	15	10					127
12	1	24										24
	2	27	22									49
	3	31	24	19								74
	4	33	28	22	16							99
	5	35	30	25	20	15						125
	6	38	33	27	22	18	12					150
	7	39	35	30	24	21	16	10				175
	8	40	36	32	28	22	18	14	10			200
13	1	28										28
	2	31	26									57
	3	35	28	23								86
	4	38	32	25	21							115
	5	40	35	29	23	17						144
	6	43	38	31	26	21	14					173
	7	45	41	35	28	24	18	12				203
	8	46	42	37	32	26	21	16	12			232
14	1	33										33
	2	36	30									66
	3	40	33	26								99
	4	44	37	29	22							132
	5	46	40	33	26	20						165
	6	50	44	36	30	24	15					199
	7	51	46	39	33	28	21	14				232
	8	53	48	43	37	29	24	19	13			266

Table 2.--Continued

Tree diameter (inches)	No. of 8-foot logs	Log position										Tree total
		1	2	3	4	5	6	7	8	9	10	
15	1	37										37
	2	41	34									75
	3	46	37	29								112
	4	49	42	33	26							150
	5	53	45	38	30	22						188
	6	56	50	41	34	27	18					226
	7	58	53	45	37	31	24	16				264
	8	61	54	48	42	33	27	21	16			302
16	1	42										42
	2	46	38									84
	3	52	41	33								126
	4	56	47	37	29							169
	5	59	51	42	34	26						212
	6	64	56	46	38	31	20					255
	7	65	59	50	42	36	27	18				297
	8	68	61	54	48	37	31	24	17			340
	9	69	65	57	50	42	35	27	23	15		383
17	1	47										47
	2	52	42									94
	3	58	46	37								141
	4	62	53	42	32							189
	5	66	57	47	38	29						237
	6	71	63	51	43	34	23					285
	7	73	67	57	46	40	30	20				333
	8	76	68	61	53	42	34	27	19			380
	9	77	73	64	56	47	38	30	26	17		428
18	1	52										52
	2	57	47									104
	3	64	52	41								157
	4	69	59	46	36							210
	5	74	63	53	42	31						263
	6	79	70	57	47	38	25					316
	7	82	74	63	52	44	33	22				370
	8	85	76	68	59	47	38	29	21			423
	9	86	81	71	62	52	43	33	29	19		476
	10	90	85	74	64	53	48	42	32	26	16	530
19	2	63	52									115
	3	71	57	46								174
	4	77	65	51	39							232
	5	81	70	58	47	35						291
	6	88	77	63	52	42	28					350
	7	90	82	69	57	49	37	24				408
	8	94	84	75	65	51	42	33	23			467
	9	95	89	79	68	58	47	37	32	21		526
	10	99	94	82	70	59	53	47	35	29	17	585

Table 2.--Continued

Tree diameter (inches)	No. of 8-foot logs	Log position										Tree total
		1	2	3	4	5	6	7	8	9	10	
20	2	70	57									127
	3	78	63	50								191
	4	85	72	56	44							257
	5	89	77	64	51	39						320
	6	96	84	69	58	46	31					384
	7	99	90	76	63	54	40	27				449
	8	103	92	82	72	57	46	36	26			514
	9	104	98	87	75	64	52	40	35	23		578
	10	109	103	90	77	64	58	51	39	32	20	643
21	2	76	63									139
	3	86	69	54								209
	4	92	78	61	48							279
	5	98	84	70	56	42						350
	6	105	93	76	63	50	34					421
	7	108	98	83	69	59	44	30				491
	8	112	101	90	79	62	51	39	28			562
	9	114	108	95	82	70	57	44	38	25		633
	10	120	113	99	85	70	63	56	42	35	21	704
22	2	83	68									151
	3	93	75	60								228
	4	100	85	68	51							304
	5	107	91	76	61	46						381
	6	114	101	82	69	55	37					458
	7	118	107	91	75	64	48	32				535
	8	123	110	98	86	67	55	43	31			613
	9	124	117	104	90	76	62	48	41	28		690
	10	130	123	107	92	77	69	61	46	38	23	767
23	2	90	74									164
	3	101	82	64								247
	4	109	92	73	56							330
	5	116	99	83	66	50						414
	6	124	109	89	75	60	40					497
	7	128	116	99	81	70	52	35				581
	8	133	120	106	93	73	60	47	33			665
	9	135	127	112	97	82	67	53	45	31		749
	10	142	133	116	100	83	75	67	50	42	25	833
24	2	98	80									178
	3	110	88	69								267
	4	118	100	79	61							358
	5	125	107	90	72	54						448
	6	135	118	97	81	64	43					538
	7	138	126	107	88	75	57	38				629
	8	144	129	115	101	79	65	50	36			719
	9	146	138	121	105	89	73	57	49	32		810
	10	153	144	126	108	90	81	72	54	45	28	901

Table 2.--Continued

Tree diameter (inches)	No. of 8-foot logs	Log position										Tree total
		1	2	3	4	5	6	7	8	9	10	
25	3	118	95	75								288
	4	127	108	85	65							385
	5	135	116	97	77	58						483
	6	148	131	107	89	72	47					594
	7	149	136	115	95	81	61	41				678
	8	155	140	124	108	85	70	54	39			775
	9	157	148	131	114	96	79	61	52	35		873
	10	165	155	136	117	97	87	78	58	49	29	971
26	3	127	102	81								310
	4	137	116	91	70							414
	5	145	125	104	83	62						519
	6	156	137	112	94	75	50					624
	7	160	146	124	102	87	66	44				729
	8	167	150	133	117	92	75	58	42			834
	9	169	160	141	122	103	84	66	56	38		939
	10	177	166	146	125	104	94	83	62	52	31	1,040
27	3	136	110	86								332
	4	147	124	98	75							444
	5	156	134	111	89	67						557
	6	167	147	121	100	80	54					669
	7	172	156	133	109	94	70	47				782
	8	179	161	143	125	98	80	63	45			894
	9	181	171	151	131	111	91	71	60	40		1,007
	10	190	179	157	134	112	101	90	56	34		1,120
28	3	146	117	92								355
	4	157	133	104	81							475
	5	167	143	119	95	71						595
	6	179	158	129	107	86	57					716
	7	184	167	142	117	100	75	50				836
	8	191	172	153	134	105	86	67	48			956
	9	194	183	162	140	118	97	75	65	43		1,077
	10	204	191	168	143	120	108	96	72	60	36	1,198

Table 3.--Red alder volume table

International - Board Feet

Tree diameter (inches)	Number of 8' logs to merchantable top (8" minimum)									
	1	2	3	4	5	6	7	8	9	10
10	19	37	57	76	95	114				
11	22	44	67	90	112	134				
12	25	51	78	104	131	157	183	209		
13	29	59	90	119	150	180	211	241		
14	34	68	103	137	171	206	240	275		
15	38	77	116	155	194	233	272	311		
16	43	86	130	174	218	262	305	349	394	
17	48	96	145	195	243	292	341	389	439	
18	53	106	161	215	269	323	378	432	487	542
19		117	178	237	297	357	416	476	537	597
20		129	195	262	326	391	457	523	589	655
21		141	213	284	356	428	499	571	644	716
22		152	232	309	387	465	543	622	701	779
23		166	251	335	420	504	589	674	760	945
24		180	271	363	454	545	637	728	821	913
25			292	390	489	601	686	784	884	983
26			314	419	525	631	737	843	950	1,052
27			336	449	563	676	790	903	1,018	1,132
28			359	480	601	723	844	965	1,088	1,210

Method - Derived from the red alder volume table (Scribner)
Derivation based on relationship between the Scribner and
International $\frac{1}{4}$ -inch rules.

Table 4.--Red alder volume table

Cubic feet

Tree diameter (inches)	Total height (feet)									Basis No. of trees
	40	50	60	70	80	90	100	110	120	
6	3.5	4.4	5.2	6.1	7.0					0
7	4.7	5.9	7.0	8.1	9.2					
8	6.0	7.5	9.0	10.4	11.9	13.3	14.8			19
9	7.5	9.3	11.2	12.9	14.8	16.6	18.4			
10	9.1	11.4	13.6	15.8	18.0	20.2	22.4	24.5		50
11	10.9	13.6	16.2	18.9	21.5	24.1	26.7	29.3		
12	12.8	16.0	19.1	22.2	25.3	28.3	31.4	34.5		70
13	14.9	18.5	22.1	25.7	29.3	32.9	36.4	39.9	43.5	
14		21.2	25.4	29.5	33.6	37.7	41.8	45.9	48.8	81
15		24.2	28.9	33.6	38.3	42.9	47.6	52.2	56.8	
16		27.3	32.6	37.9	43.1	48.4	53.6	58.8	64.0	69
17		30.5	36.5	42.4	48.3	54.2	60.0	65.9	71.7	
18			40.6	47.2	53.7	60.2	66.8	73.3	79.8	48
19			44.9	52.2	59.4	66.6	73.9	81.1	88.2	
20			49.4	57.4	65.3	73.3	81.2	89.1	97.0	15
21			54.1	62.8	71.6	80.3	89.0	97.6	106.2	
22				68.5	78.0	87.5	97.7	106.5	115.9	11
23				74.4	84.8	95.0	105.3	115.6	125.8	
24				80.6	91.8	102.9	114.1	125.2	136.2	7
25				86.9	99.0	111.0	123.1	135.0	147.0	
26				93.5	106.5	119.4	132.4	145.3	158.1	1
27				100.3	114.3	128.1	142.0	155.9	169.7	
28				107.3	122.3	137.1	152.0	166.8	181.6	1
Basis No. of trees			9	25	129	123	69	16	1	372

Basis - 372 trees, block shows extent of basic data

Method - Multiple regression using an equation of the type:

$$\log V = a \log D + b \log H + c$$

Where V = Cubic volume of a tree - stump (as cut) to a 4" top

D = Diameter at breast height

H = Total height

a, b, c = Constants

Regression Equation - $\log V = 1.8618 \log D + .9751 \log H - 2.4628$

Standard error of a single tree volume = 9.7%

Table 5.--Red alder volume table

Scribner - Board Feet

Tree diameter (inches)	Total height (feet)									Basis No. of trees
	40	50	60	70	80	90	100	110	120	
10	35	44	54	63	72	81	90			50
11	45	56	68	80	91	103	115			
12	56	70	84	99	114	128	143			70
13	68	86	103	121	139	157	174			
14	82	103	124	145	167	188	210	231	253	81
15	97	122	148	173	198	224	248	275	301	
16	114	144	173	203	233	263	293	323	353	69
17		167	202	236	271	306	341	376	411	
18		193	233	273	313	353	393	434	474	48
19		221	266	312	358	404	450	496	543	
20		251	303	355	407	459	512	564	617	15
21			342	401	460	519	578	637	697	
22			384	450	516	583	649	716	783	11
23			429	503	577	651	725	800	875	
24			478	559	657	724	807	890	973	7
25				619	710	802	893	985	1,077	
26				683	784	885	986	1,087	1,189	0
27				751	861	972	1,083	1,195	1,306	
28				822	943	1,064	1,186	1,308	1,430	2
Basis No. of trees			7	24	117	119	69	16	1	353

Basis - 353 trees, block shows extent of basic data

Method - Multiple regression using an equation of the type:

$$\text{Log } V = a \text{Log } D + b \text{Log } H + c$$

Where V = Scribner board-foot volume of a tree - stump
as cut to merchantable top 8" (minimum)

D = Diameter at breast height

H = Total height

a, b, c = Constants

Regression Equation - $\text{Log } V = 2.4985 \text{ Log } D + 1.0270 \text{ Log } H - 2.5957$

Standard error of an individual tree volume = 20.6%

Table 6.--Aggregate differences by locality for tables 1, 4, and 5

Source of data	No. of trees	Aggregate differences ^{1/}		
		Table 1	Table 4	Table 5
Clatsop, Columbia, Tillamook and Yamhill Counties, Oregon (State data)	64	- 1%	+ 1%	+ 4%
Lewis County, Washington	23 24	- 1%	- 6%	- 10%
King County, Washington	19 21	- 4%	0%	+ 2%
Clackamas County, Oregon	4	- 2%	- 8%	- 17%
Tillamook County, Oregon	10	- 4%	0%	+ 4%
Kitsap County, Washington	66 68	+ 2%	0%	- 3%
Grays Harbor County, Washington	45	- 1%	No data	No data
Coos County, Oregon	26 13	+ 5%	+ 5%	+ 5%
Snoqualmie Falls, Washington	26	+ 3%	+ 10%	+ 10%
British Columbia	110 121	- 1%	- 5%	- 9%
Cowlitz County, Washington	22 21 18	+ 8%	+ 12%	+ 14%

^{1/} The difference between the sum of all the actual tree volumes and the sum of all the tree volumes as determined from the tables. A minus indicates the table is low for basic data collected from a certain source; a plus indicates the table is high for basic data collected from a certain source.