



Purdue University
Forestry and Natural Resources

Timber Processing

Log and Tree Scaling Techniques

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Buying and selling logs and standing trees based on an estimate of the number of board feet they contain is an everyday practice in the lumber industry. However, it can also be a very confusing practice. There are a number of issues addressed in this publication. In addition, remember that log and tree scaling are just estimates of the final board footage expected and that different individuals will likely obtain somewhat different estimates.

Tables and formulas to estimate the board-foot volume of logs and trees by three of the most commonly used log rules are provided. Background information concerning the various rules as well as scaling techniques is also provided.

Log Rules

In the United States and Canada there are over 95 log scaling rules bearing about 185 names (Freese, no date) that have been developed and used, at least to some degree, over time. However, only three, Doyle, Scribner, and International, are widely recognized and in current use. The Doyle and International Rules are termed formula rules. That is, the values are obtained by formula. The Scribner Rule is called a diagram rule because the original numbers were derived by fitting boards into perfect circles representing the ends of logs.

The **Doyle Rule** (Table 1) is the most widely used rule, especially on private timber in the east and south. The formula is simple and easy to remember.

$$\text{Board Feet Doyle} = (D-4)^2 \times (L/16)$$

D = Diameter inside bark at the small end in inches

L = Log length in feet

This formula says to subtract four inches from the diameter for slabs and edgings, square the result, and

adjust for log length. Log taper is ignored. The edgings and slab allowance are too large for small logs and too small for large logs. As a result, the rule seriously under scales small logs and over scales large logs.

The earliest version of this rule existing is a second edition titled "The Improved Pocket Rechner for Timber, Plant, Boards, Sawlogs, Wages, Board, and Interest" by Edward Doyle published in 1837 in Rochester, New York. No copies of the first edition published in 1825, remain. However, it is very likely that the rule dates to 1825.

The **Scribner Rule** was first published in 1846 by J. M. Scribner. This diagram rule is for 1-inch lumber in widths of 4, 6, and 8 inches with 1/4 inch kerf allowance. Log taper is again ignored. Volumes increase only when log diameter increases in such a way that board width increases or additional boards can be added. This version of the rule is not commonly found or used, but a portion is reproduced in Table 2A for the readers information and convenience.

Because of the diagramming process for the Scribner Rule (Table 2), irregular increases in board foot values from one diameter class to the next result. Furthermore, Scribner Decimal C, the most prevalent form of the rule, rounds the predicted volume to the nearest 10 board feet (anonymous, 1985). Because of these factors, Scribner volumes change erratically as a step function with log diameter and length. For example, a 10-inch diameter log, for all lengths from 8 feet through 12 feet, contains 30 board feet. Several variations of the rule have been published by Bruce and Schumacher (1950).

Because of the irregularities of the rule, the following formula to correct the deficiencies was proposed (Bruce and Schumacher, 1950).

$$\text{Board Feet Scribner} = (.79D^2 - 2D - 4)L/16$$

D = Diameter inside bark small end in inches

L = Log length in feet

The rule is fairly consistent on 16 foot or shorter logs under 28 inches in diameter.

The Scribner Rule was widely used especially by the Forest Service in the Lake States and the western United States. Recently, it has been replaced by a cubic volume measurement system. The Spauling or Columbia Pine Log Rule closely approximates the value of the Scribner Rule. In the west, east-side and west-side (Cascades), Scribner Rules are also in use.

The **International Rule** (Table 3) was developed by Judson F. Clark in 1900 while working for the Province of Ontario. It is probably the most accurate of the current rules but has found little use. It is based on a very carefully researched analysis of the losses occurring during the conversion of sawlogs to lumber and is one of the few rules incorporating a basis for dealing with log taper. Based on studies of northeastern tree species, Clark made a conservative taper assumption of 1/2-inch change in diameter for every 4 feet of log length. The initial rule was based on a kerf of 1/8-inch and is called the International 1/8-inch Kerf Rule. The basic formula for a 4 foot log is as follows:

$$\text{Board Foot International (4 foot log)} = (0.22D^2 - 0.71D)$$

D = Diameter inside bark small end in inches

The formula is expanded for longer lengths up to 20 feet by adding 1/2-inch in diameter for every 4 foot section and applying the basic formula.

Since many mills could not recover the volumes estimated by the International 1/8-inch Kerf Rule, Clark in 1917 modified the rule to allow for a 1/4-inch kerf. The resulting rule is as follows for log lengths of 4 to 20 feet:

$$\text{BF (for 4-foot lengths)} = 0.199D^2 - 0.642D$$

$$\text{BF (for 8-foot lengths)} = 0.398D^2 - 1.086D - 0.271$$

$$\text{BF (for 12-foot lengths)} = 0.597D^2 - 1.330D - 0.715$$

$$\text{BF (for 16-foot lengths)} = 0.796D^2 - 1.375D - 1.230$$

$$\text{BF (for 20-foot lengths)} = 0.995D^2 - 1.221D - 1.719$$

All values are rounded to the nearest multiple of 5 board feet and lengths over 20 feet are to be scaled as two or more logs.

Finally, Grosenbaugh (1952) published an integrated formula for the International Rule.

$$\begin{aligned} \text{Board Feet International} = & 0.04976191LD^2 + 0.006 \\ & 220239L^2D - 0.1854762LD + 0.0002591767L^3 - \\ & 0.01159226L^2 + 0.0422222L \end{aligned}$$

D = Diameter inside bark small end in inches

L = Log length in feet

Application of Log Rules

There is no simple answer as to the best log rule to use. Local tradition will most likely predict which rule will be used in buying and selling cut logs. The rules are fair as long as everyone uses the same rule. Most experienced operators know how much overrun to expect for a particular set of logs and mill conditions. Overrun is a common term in the sawmill industry that refers to the number of board feet produced by the mill beyond what the log scale indicated.

$$\text{Overrun in percent} = \left[\frac{\text{Lumber Tally}}{\text{Log Scale}} - 1 \right] 100$$

Underruns can also occur.

There are a large number of factors which can affect over or underrun. Some of these include the log rule used, scaling practices, overall roughness of the logs, log taper, log diameter and length, species, slab thickness and edging practices, board thickness, random width lumber vs. specified widths, length of shortest piece saved, sawing variation, kerf thickness, over sizing, sawyer experience, grade sawing vs. volume sawing, and finally, the presence of various devices that assist the sawyer such as laser lights, computer controls, and scanning equipment. Obviously, these conditions vary with available timber, from one mill to the next, and even in the same mill, depending on the day. Nevertheless, most experienced mills have good data on the amount of overrun they can expect. This information is factored into the price that can be paid for logs.

If the objective of scaling is to estimate as closely as possible the volume of lumber to be produced from a given set of logs, the International Scale would be preferred – along with some adjustment for overrun or underrun.

Log Rule Comparison

Figure 1 shows the comparison of the three rules assuming that the International Rule provides a correct estimate of the content of a 16-foot log by diameter. On small logs the Doyle Rule estimates only a fraction of the board foot content. The accuracy of the rule increases as log diameter increases. The Scribner Decimal C Rule provides a closer estimate and like the Doyle Rule, it generally improves in accuracy as log diameter increases. However, the results are erratic.

Log Scaling Techniques

The actual scaling of logs and the recording of the data should be done as carefully as possible. The author has seen a group of 14 knowledgeable timbermen scale 11 logs and come up with 14 different answers. The average scale was 1544 board feet Doyle with a range from 1434 to 1795 board feet, or a spread of 361 board feet. After the contest, where each log was carefully examined, the agreed upon volume was 1589 board feet.

Besides just plain carelessness, there are several other factors that can affect the results of log scaling. First, log lengths need to be determined with a tape measure. Some logs may have several inches of trim allowance, and others may be just short of a full foot measure. Being just short of a full foot measure in the log will result in the lumber being tallied at the next lower foot length in hardwoods and the next even foot length in softwoods. Thus, correct length cannot be eyeballed consistently. Next, the diameter of the log on the small end should be measured in two directions taken at 90° angles to each other inside the bark. Logs are seldom perfectly round. Thus, the small and large diameters need to be averaged. A decision needs to be made on how to round fractions of an inch. Consistently rounding down obviously results in less log scale but it could also result in the next batch of logs going to a competitor. Next, does the scaling diameter truly represent the milling diameter of the log? Some logs are purposely bucked close to or through branch stubs or other swollen areas likely to contain defects. The result is a "necking down effect" of the log diameter. The purpose of bucking through major defects is to increase the grade yield of the log, but it is also easy to increase the scaling diameter by an inch or more.

There are also rules for scaling out defective areas such as rot, splits, and sweep. These rules are based on general geometry and are somewhat time consuming to apply. As a result, mills usually insist that defective or crooked logs are not acceptable. When they do occur, they are usually scaled back by reducing the length.

Weight Scaling

In some sections of the country and particularly on small diameter low valued logs, weight is used as a measurement system. Unlike stick scaling, as discussed above, weight scaling is quick and easy. However, each mill usually develops its own set of tables for its own specific conditions.

Determining Volume of Standing Trees

When purchasing stumpage (standing trees), the buyer must estimate the value of the usable product which he is attempting to buy. In high-valued hardwoods, or where a limited number of trees are involved, buyers often measure the diameter breast high, termed DBH, which is the diameter at 4-1/2 feet above the ground, and deduct a certain amount for taper and bark thickness to estimate the scaling diameter at the top of the first log. The volume is then determined from a log scale table (a "Log Rule"). Ocular estimates combined with local experience on taper and bark thickness are then used to determine the diameter and length of each additional log and hence the volume in the tree.

A second method commonly used by trained foresters requires the use of volume tables. These tables predict the gross volume of the tree, using any one of the three common log rules, based on the DBH, "merchantable height" in 16-foot logs, and sometimes for added refinement, a form factor. One commonly used form factor is the Girard form class, defined as the percentage ratio between the diameter inside bark, at the top of the first 16-foot log and the DBH (outside bark). For example, a tree with a first-log scaling diameter of 16.0 inches and a DBH of 20.0 inches has a form class of $(16 \div 20 \times 100)$ or 80 percent. Form class can vary for a given species, age, diameter, and height. For the most accurate estimates, a separate form class should be determined for each diameter class and species tallied.

Merchantable height includes that portion of a tree from stump height to a point on the stem at which merchantability for saw timber is limited by branches, deformity, or minimum diameter. For smooth stems, this minimum diameter is usually not less than 60 percent of the tree DBH; which is the case for the smallest sawlog trees, usually 10 inches in diameter. It decreases to 40 percent for large trees that are 30 to 40 inches in diameter. This definition of merchantability or usable log length must be carefully followed.

A complete set of volume tables for the Doyle, International and Scribner Rules based on different form classes is given by Mesavage and Girard (1956). Tables 4, 5, and 6 report values for form class 78 or the most commonly used class. A rule of thumb calls for a 3 percent increase in volume for each unit increase or decrease in form class. That is, a form class of 79 will have approximately 3 percent more volume than that of a form class 78.

Wiant (1986) has formulated the Mesavage and Girard Form Class 78 table for each of the three log rules discussed here. Formulas for the Doyle log rules, Scribner and International 1/4 inch predicted 90 to 98 percent of table values within two percent. The equations are presented below.

$$\begin{aligned} \text{Doyle Vol.} &= (0.55743L^2 + 41.51275L - 29.37337) \\ &+ (2.78043 - 0.04516L^2 - 8.77272L)D \\ &+ (0.04177 - 0.01578L^2 + 0.59042L)D^2 \end{aligned}$$

$$\begin{aligned} \text{Scribner Vol.} &= (17.53508L - 0.59242L^2 - 22.50365) \\ &+ (3.02988 - 0.02302L^2 - 4.34381L)D \\ &+ (0.51593L - 0.02035L^2 - 0.01969)D^2 \end{aligned}$$

$$\begin{aligned} \text{International 1/4 inch Vol.} &= (1.52968L^2 \\ &+ 9.58615L - 13.35212) \\ &+ (1.79620 - 0.27465L^2 - 2.59995L)D \\ &+ (0.04482 - 0.00961L^2 + 0.45997L)D^2 \end{aligned}$$

L = Number of 16 foot logs

D = DBH

Numerous other volume tables have also been developed. These tables are often preferred since they take local timber conditions into account. Tables 7, 8, and 9 are presented as an example for Indiana (Beers, 1973). These tables are particularly useful because they are in 12 foot and half log increments. Twelve-foot lengths are common in Indiana and probably other regions of the central states. Sixteen-foot lengths are common in the south and Lake States.

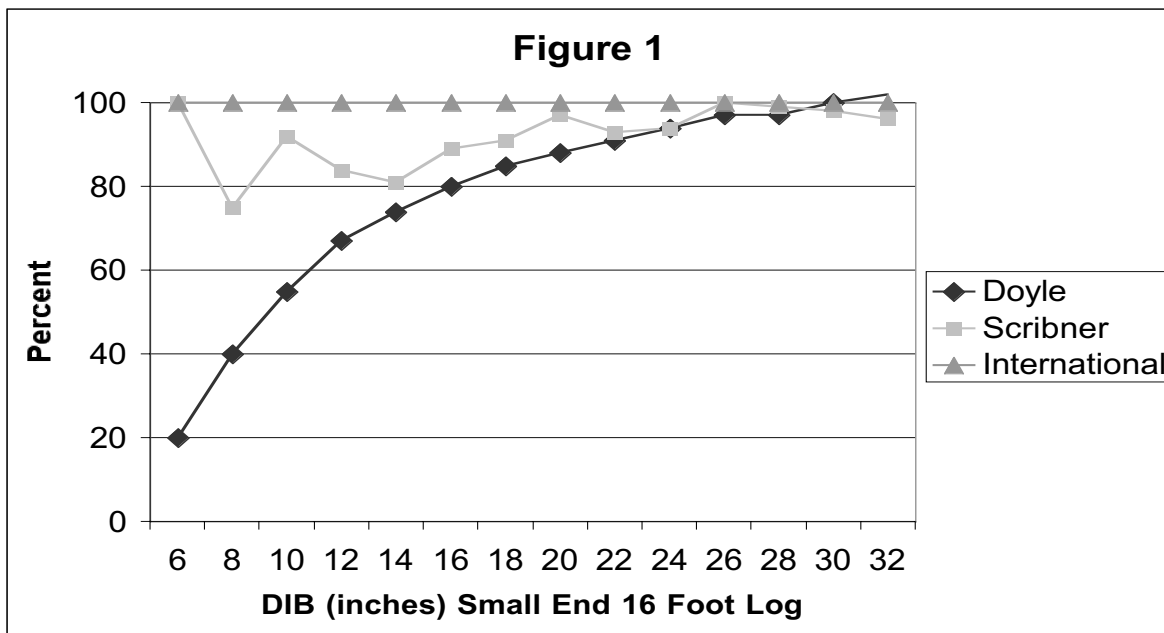


Figure 1. Comparison of log volumes assuming that the International 1/4 inch rule provides a 100 percent estimate of the correct volume.

Table 1. Doyle Log Rule, Board Feet.

Diameter of log, small end, inside bark (in)	Length of log in feet												
	6	7	8	9	10	11	12	13	14	15	16	17	18
	Contents of log in board feet												
6	1	2	2	2	2	3	3	3	4	4	4	4	4
7	3	4	4	5	5	6	7	7	8	8	9	10	10
8	6	7	8	9	10	11	12	13	14	15	16	17	18
9	9	11	12	14	16	17	19	20	22	23	25	27	28
10	13	16	18	20	22	25	27	29	31	34	36	38	40
11	18	21	24	28	31	34	37	40	43	46	49	52	55
12	24	28	32	36	40	44	48	52	56	60	64	68	72
13	30	35	40	46	51	56	61	66	71	76	81	86	91
14	37	44	50	56	62	69	75	81	87	94	100	106	112
15	45	53	60	68	76	83	91	98	106	113	121	129	136
16	54	63	72	81	90	99	108	117	126	135	144	153	162
17	63	74	84	95	106	116	127	137	148	158	169	180	190
18	73	86	98	110	122	135	147	159	171	184	196	208	220
19	84	98	112	127	141	155	169	183	197	211	225	239	253
20	96	112	128	144	160	176	192	208	224	240	256	272	288
21	108	126	144	163	181	199	217	235	253	271	289	307	325
22	121	142	162	182	202	223	243	263	283	304	324	344	364
23	135	158	180	203	226	248	271	293	316	338	361	384	406
24	150	175	200	225	250	275	300	325	350	375	400	425	450
25	165	193	220	248	276	303	331	358	386	413	441	469	496
26	181	212	242	272	302	333	363	393	423	454	484	514	544
27	198	231	264	298	331	364	397	430	463	496	529	562	595
28	216	252	288	324	360	396	432	468	504	540	576	612	648
29	234	273	312	352	391	430	469	508	547	586	625	664	702
30	253	296	338	380	422	465	507	549	591	634	676	718	760
31	273	319	364	410	456	501	547	592	638	683	729	775	820
32	294	343	392	441	490	539	588	637	686	735	784	833	882
33	315	368	420	473	526	578	631	683	736	788	841	894	946
34	337	394	450	506	562	610	675	731	787	844	900	956	1012
35	360	420	480	541	601	661	721	781	841	901	961	1021	1081
36	384	448	512	576	640	704	768	832	896	960	1024	1088	1152
37	408	476	544	613	681	749	817	885	953	1021	1089	1157	1225
38	433	506	578	650	722	795	867	939	1011	1084	1156	1228	1300
39	459	536	612	689	766	842	919	995	1072	1148	1225	1302	1378
40	486	567	648	729	810	891	972	1052	1134	1215	1296	1377	1458

$$\text{Formula} = (D-4)^2 \times (L/16)$$

Table 2. Scribner Decimal C Log Rule, Board Feet.

Diameter of log, small end, inside bark (in)	(Board foot volumes in tens 0's omitted – no taper considered)													
	Length of Log in Feet													
	6	7	8	9	10	11	12	13	14	15	16	17	18	20
	Contents of log in board feet													
6	0.5	0.5	0.5	0.5	1	1	1	1	1	1	2	2	2	2
7	.5	1	1	1	1	2	2	2	2	2	3	3	3	3
8	1	1	1	1	2	2	2	2	2	2	3	3	3	3
9	1	2	2	2	3	3	3	3	3	3	4	4	4	4
10	2	2	3	3	3	3	3	4	4	5	6	6	6	7
11	2	2	3	3	4	4	4	5	5	6	7	7	8	8
12	3	3	4	4	5	5	6	6	7	7	8	8	9	10
13	4	4	5	5	6	7	7	8	8	9	10	10	11	12
14	4	5	6	6	7	8	9	9	10	11	11	12	13	14
15	5	6	7	8	9	10	11	12	12	13	14	15	16	18
16	6	7	8	9	10	11	12	13	14	15	16	17	18	20
17	7	8	9	10	12	13	14	15	16	17	18	20	21	23
18	8	9	11	12	13	15	16	17	19	20	21	23	24	27
19	9	10	12	13	15	16	18	19	21	22	24	25	27	30
20	11	12	14	16	17	19	21	23	24	26	28	30	31	35
21	12	13	15	17	19	21	23	25	27	28	30	32	34	38
22	13	15	17	19	21	23	25	27	29	31	33	35	38	42
23	14	16	19	21	23	26	28	31	33	35	38	40	42	47
24	15	18	21	23	25	28	30	33	35	38	40	43	45	50
25	17	20	23	26	29	31	34	37	40	43	46	49	52	57
26	19	22	25	28	31	34	37	41	44	47	50	53	56	62
27	21	24	27	31	34	38	41	44	48	51	55	58	62	68
28	22	25	29	33	36	40	44	47	51	54	58	62	65	73
29	23	27	31	35	38	42	46	49	53	57	61	65	68	76
30	25	29	33	37	41	45	49	53	57	62	66	70	74	82
31	27	31	36	40	44	49	53	58	62	67	71	75	80	89
32	28	32	37	41	46	51	55	60	64	69	74	78	83	92
33	29	34	39	44	49	54	59	64	69	73	78	83	88	98
34	30	35	40	45	50	55	60	65	70	75	80	85	90	100
35	33	38	44	49	55	60	66	71	77	82	88	93	98	109
36	35	40	46	52	58	63	69	75	81	86	92	98	104	115
37	39	45	51	58	64	71	77	84	90	96	103	109	116	129
38	40	47	54	60	67	73	80	87	93	100	107	113	120	133
39														
40	45	53	60	68	75	83	90	98	105	113	120	128	135	150

Table 2A. Scribner Log Rule, Board Feet

Diameter of log, small end, inside bark (in)	Length of log in feet				
	12	14	16	18	20
	Contents of log in board feet				
6	12	14	18	22	24
7	18	24	28	32	34
8	24	28	32	40	44
9	30	35	40	45	50
10	40	45	50	55	65
11	50	55	65	70	80
12	59	69	79	88	98
13	73	85	97	109	122
14	86	100	114	129	143
15	107	125	142	160	178
16	119	139	159	178	198
17	139	162	185	208	232
18	160	187	213	240	267
19	180	210	240	270	300
20	210	245	280	315	350
21	228	266	304	342	380
22	251	292	334	376	418
23	283	330	377	424	470
24	303	353	404	454	505
25	344	401	459	516	573
26	375	439	500	562	625
.27	411	479	548	616	684
28	436	509	582	654	728
29	457	539	609	685	761
30	493	575	657	739	821
31	532	622	710	799	888
32	552	644	736	828	920
33	588	686	784	882	980
34	600	700	800	900	1000
35	657	766	876	985	1095
36	692	807	923	1038	1152
37	772	901	1029	1158	1287
38	801	934	1068	1201	1335
39	840	980	1120	1260	1400
40	903	1053	1204	1354	1505

Table 3. International 1/4 inch Log Rule, Board Feet.

Diameter of log, small end, inside bark (in)	Length of log in feet						
	8	10	12	14	16	18	20
Contents of log in board feet							
6	10	10	15	15	20	25	25
7	10	15	20	25	30	35	40
8	15	20	25	35	40	45	50
9	20	30	35	45	50	60	70
10	30	35	45	55	65	75	85
11	35	45	55	70	80	95	105
12	45	55	70	85	95	110	125
13	55	70	85	100	115	135	150
14	65	80	100	115	135	155	175
15	75	95	115	135	160	180	205
16	85	110	130	155	180	205	235
17	95	125	150	180	205	235	265
18	110	140	170	200	230	265	300
19	125	155	190	225	260	300	335
20	135	175	210	250	290	330	370
21	155	195	235	280	320	365	410
22	170	215	260	305	355	405	455
23	185	235	285	335	390	445	495
24	205	255	310	370	425	485	545
25	220	280	340	400	460	525	590
26	240	305	370	435	500	570	640
27	260	330	400	470	540	615	690
28	280	355	430	510	585	665	745
29	305	385	465	545	630	715	800
30	325	410	495	585	675	765	860
31	350	440	530	625	720	820	915
32	375	470	570	670	770	875	980
33	400	500	605	715	820	930	1045
34	425	535	645	760	875	990	1110
35	450	565	685	805	925	1050	1175
36	475	600	725	855	980	1115	1245
37	505	635	770	905	1040	1175	1315
38	535	670	810	955	1095	1245	1390
39	565	710	855	1100	1155	1310	1465
40	595	750	900	1060	1220	1380	1540

Table 4. Gross Volume of Trees, Doyle Log Scale Form Class 78.

DBH	Merchantable height in number of 16-foot logs										
	1	1-1/2	2	2-1/2	3	3-1/2	4	4-1/2	5	5-1/2	6
In.	Volume in board feet										
10	14	17	20	21	22	-	-	-	-	-	-
11	22	27	32	35	38	-	-	-	-	-	-
12	29	36	43	48	53	54	56	-	-	-	-
13	38	48	59	66	73	76	80	-	-	-	-
14	48	62	75	84	93	98	103	-	-	-	-
15	60	78	96	108	121	128	136	-	-	-	-
16	72	94	116	132	149	160	170	-	-	-	-
17	86	113	140	161	182	196	209	-	-	-	-
18	100	132	164	190	215	232	248	-	-	-	-
19	118	156	195	225	256	276	297	-	-	-	-
20	135	180	225	261	297	322	346	364	383	-	-
21	154	207	260	302	344	374	404	428	452	-	-
22	174	234	295	344	392	427	462	492	521	-	-
23	195	264	332	388	444	483	522	558	594	-	-
24	216	293	370	433	496	539	582	625	668	-	-
25	241	328	414	486	558	609	660	709	758	-	-
26	266	362	459	539	619	678	737	793	849	-	-
27	292	398	505	594	684	749	814	877	940	-	-
28	317	434	551	651	750	820	890	961	1032	1096	1161
29	346	475	604	714	824	902	980	1061	1142	1218	1294
30	376	517	658	778	898	984	1069	1160	1251	1339	1427
31	408	562	717	850	983	1080	1176	1273	1370	1470	1570
32	441	608	776	922	1068	1176	1283	1386	1488	1600	1712
33	474	654	835	994	1152	1268	1385	1497	1609	1734	1858
34	506	700	894	1064	1235	1361	1487	1608	1730	1866	2003
35	544	754	964	1149	1334	1472	1610	1743	1876	2020	2163
36	581	808	1035	1234	1434	1583	1732	1878	2023	2173	2323
37	618	860	1102	1318	1534	1694	1854	2013	2172	2332	2492
38	655	912	1170	1402	1635	1805	1975	2148	2322	2491	2660
39	698	974	1250	1498	1746	1932	2118	2298	2479	2662	2844
40	740	1035	1330	1594	1858	2059	2260	2448	2636	2832	3027

Table 5. Gross Volume of Trees, Scribner Log Scale Form Class 78.

DBH	Merchantable height in number of 16-foot logs										
	1	1-1/2	2	2-1/2	3	3-1/2	4	4-1/2	5	5-1/2	6
In.	Volume in board feet										
10	28	36	44	48	52	-	-	-	-	-	-
11	38	49	60	67	74	-	-	-	-	-	-
12	47	61	75	85	95	100	106	-	-	-	-
13	58	76	94	107	120	128	136	-	-	-	-
14	69	92	114	130	146	156	166	-	-	-	-
15	82	109	136	157	178	192	206	-	-	-	-
16	95	127	159	185	211	229	247	-	-	-	-
17	109	146	184	215	246	268	289	-	-	-	-
18	123	166	209	244	280	306	331	-	-	-	-
19	140	190	240	281	322	352	382	-	-	-	-
20	157	214	270	317	364	298	432	459	486	-	-
21	176	240	304	358	411	450	490	523	556	-	-
22	194	266	338	398	458	504	549	588	626	-	-
23	214	294	374	441	508	558	607	652	698	-	-
24	234	322	409	484	558	611	665	718	770	-	-
25	258	355	452	534	617	678	740	799	858	-	-
26	281	388	494	585	676	745	814	880	945	-	-
27	304	420	536	636	736	811	886	959	1032	-	-
28	327	452	578	686	795	877	959	1040	1120	1190	1261
29	354	491	628	746	864	953	1042	1132	1222	1306	1389
30	382	530	678	806	933	1028	1124	1224	1325	1421	1517
31	411	571	731	871	1011	1117	1223	1328	1434	1541	1648
32	440	612	784	936	1089	1206	1322	1432	1543	1661	1779
33	469	654	838	1001	1164	1280	1414	1534	1654	1783	1912
34	487	695	892	1066	1239	1373	1507	1636	1766	1906	2046
35	530	742	954	1141	1328	1473	1618	1757	1896	2044	2192
36	563	789	1015	1216	1416	1572	1728	1877	2026	2182	2338
37	596	836	1075	1290	1506	1670	1835	1998	2160	2324	2488
38	629	882	1135	1366	1596	1769	1942	2118	2295	2466	2637
39	666	935	1204	1449	1694	1881	2068	2251	2434	2616	2799
40	703	988	1274	1532	1791	1993	2195	2384	2574	2768	2961

Table 6. Gross Volume of Trees, International 1/4 inch Log Scale Form Class 78.

DBH	Merchantable height in number of 16-foot logs										
	1	1-1/2	2	2-1/2	3	3-1/2	4	4-1/2	5	5-1/2	6
In.	Volume in board feet										
10	36	48	59	66	73	-	-	-	-	-	-
11	46	61	76	86	96	-	-	-	-	-	-
12	56	74	92	106	120	128	137	-	-	-	-
13	67	90	112	130	147	158	168	-	-	-	-
14	78	105	132	153	174	187	200	-	-	-	-
15	92	124	156	182	208	225	242	-	-	-	-
16	106	143	180	210	241	263	285	-	-	-	-
17	121	164	206	242	278	304	330	-	-	-	-
18	136	184	233	274	314	344	374	-	-	-	-
19	154	209	264	311	358	392	427	-	-	-	-
20	171	234	296	348	401	440	480	511	542	-	-
21	191	626	332	391	450	496	542	579	616	-	-
22	211	289	357	434	599	552	593	546	581	-	-
23	231	317	494	467	552	608	663	714	766	-	-
24	251	345	441	523	605	664	723	782	840	-	-
25	275	380	484	574	665	732	800	865	930	-	-
26	299	414	528	626	725	801	877	949	1021	-	-
27	323	448	572	680	788	870	952	1032	1111	-	-
28	347	482	616	733	850	938	1027	1114	1201	1280	1358
29	375	521	667	794	920	1016	1112	1210	1308	1398	1488
30	403	560	718	854	991	1094	1198	1306	1415	1517	1619
31	432	602	772	921	1070	1184	1299	1412	1526	1640	1754
32	462	644	826	988	1149	1274	1400	1518	1637	1762	1888
33	492	686	880	1053	1226	1360	1495	1622	1750	1888	2026
34	521	728	934	1119	1304	1447	1590	1727	1864	2014	2163
35	555	776	998	1196	1394	1548	1702	1851	2000	2156	2312
36	589	826	1063	1274	1485	1650	1814	1974	2135	2298	2461
37	622	873	1124	1351	1578	1752	1926	2099	2272	2444	2616
38	656	921	1186	1428	1670	1854	2038	2224	2410	2590	2771
39	694	976	1258	1514	1769	1968	2166	2359	2552	2744	2937
40	731	1030	1329	1598	1868	2081	2294	2494	2693	2898	3103

Table 7. Tree Volume Table for Indiana Hardwoods, Doyle Log Rule Form Class 78 by 12-foot Lengths (Beers, 1973).

DBH	Board feet (Doyle) by merchantable height in number of 12-foot logs											
	-	1	1-1/2	2	2-1/2	3	3-1/2	4	4-1/2	5	5-1/2	6
10	3	8	11	14	-	-	-	-	-	-	-	-
11	6	15	21	25	-	-	-	-	-	-	-	-
12	10	23	32	39	45	50	-	-	-	-	-	-
13	14	32	44	55	64	71	-	-	-	-	-	-
14	19	41	57	72	84	94	103	112	-	-	-	-
15	24	51	71	90	105	119	131	143	-	-	-	-
16	30	61	86	110	129	146	161	176	188	206	-	-
17	36	72	203	130	153	175	194	212	229	252	-	-
18	44	84	119	150	180	207	229	251	273	300	-	-
19	52	97	137	174	208	241	267	294	322	351	-	-
20	61	111	156	199	238	277	308	341	373	406	-	-
21	70	129	176	225	270	316	353	393	428	466	-	-
22	81	149	198	255	305	359	401	449	488	530	578	625
23	93	168	228	289	344	405	455	508	552	598	650	701
24	105	190	257	324	386	454	511	570	620	671	728	786
25	118	212	286	360	430	505	569	635	692	747	808	869
26	133	236	318	399	479	558	630	702	765	826	896	968
27	148	261	348	435	527	613	693	771	842	909	986	1062
28	163	285	382	478	579	670	758	843	922	996	1084	1172
29	181	314	418	523	630	729	825	918	1005	1087	1184	1280
30	200	340	456	571	685	791	895	997	1092	1182	1290	1398
31	220	372	497	622	740	857	968	1080	1182	1281	1402	1522
32	243	402	539	676	799	927	1044	1167	1277	1387	1518	1649
33	267	435	584	732	866	1001	1126	1258	1377	1496	1635	1774
34	295	470	632	793	936	1078	1211	1353	1471	1609	1762	1914
35	325	507	682	856	1007	1158	1299	1451	1588	1727	1888	2050
36	357	547	735	923	1082	1240	1390	1552	1700	1844	2020	2196
37	391	590	792	993	1158	1324	1484	1655	1813	1968	2156	2345
38	426	635	850	1065	1238	1410	1581	1760	1931	2095	2300	2507
39	465	681	910	1139	1318	1497	1680	1868	2050	2224	2437	2650
40	506	732	974	1215	1400	1585	1782	1979	2171	2355	2582	2808

Table 8. Tree Volume Table for Indiana Hardwoods, Scribner Log Rule Form Class 78 by 12-foot Lengths (Beers, 1973).

DBH	Board feet (Scribner) by merchantable height in number of 12-foot logs											
	-	1	1-1/2	2	2-1/2	3	3-1/2	4	4-1/2	5	5-1/2	6
10	10	17	23	27	-	-	-	-	-	-	-	-
11	14	25	36	45	-	-	-	-	-	-	-	-
12	19	35	50	64	74	83	-	-	-	-	-	-
13	24	46	64	83	97	111	-	-	-	-	-	-
14	30	57	80	102	122	139	154	164	-	-	-	-
15	35	69	96	123	145	167	188	200	-	-	-	-
16	41	81	113	144	169	198	221	236	261	278	-	-
17	49	93	130	167	197	226	256	275	302	327	-	-
18	55	106	149	190	224	259	291	316	350	375	-	-
19	64	123	170	215	253	293	331	361	399	430	-	-
20	71	138	190	239	285	327	373	410	448	486	-	-
21	80	155	212	267	320	368	417	460	501	546	-	-
22	90	170	235	291	356	408	464	512	560	605	660	711
23	99	190	259	325	395	450	511	566	620	667	725	787
24	109	209	284	355	435	498	562	623	685	734	795	867
25	120	229	312	389	477	547	615	682	752	803	868	951
26	131	250	342	424	520	597	671	745	818	877	949	1036
27	142	273	371	462	563	647	729	809	887	955	1033	1134
28	155	296	403	502	609	698	790	877	958	1038	1125	1220
29	168	321	438	545	658	753	852	942	1037	1125	1211	1318
30	182	347	474	588	709	808	920	1014	1118	1210	1300	1425
31	196	374	511	631	760	870	989	1093	1198	1300	1398	1533
32	210	400	550	677	815	930	1065	1170	1286	1395	1500	1655
33	226	428	589	726	874	995	1140	1253	1375	1495	1606	1763
34	243	456	629	776	934	1063	1216	1335	1465	1595	1720	1890
35	260	484	672	830	995	1135	1297	1418	1560	1700	1830	2010
36	277	514	715	886	1059	1205	1373	1510	1655	1805	1946	2140
37	297	541	757	944	1125	1281	1454	1605	1754	1911	2060	2280
38	317	569	802	1002	1185	1360	1537	1695	1858	2019	2180	2425
39	337	598	848	1062	1251	1437	1625	1792	1960	2130	2310	2565
40	358	625	895	1123	1315	1514	1716	1885	2064	2250	2428	2715

Table 9. Tree Volume Table for Indiana Hardwoods, International Log Rule Form Class 78 by 12-foot Lengths (Beers, 1973).

DBH	Board feet (International) by merchantable height in number of 12-foot logs											
	-	1	1-1/2	2	2-1/2	3	3-1/2	4	4-1/2	5	5-1/2	6
10	11	20	26	32	-	-	-	-	-	-	-	-
11	16	30	41	51	-	-	-	-	-	-	-	-
12	21	39	56	70	81	93	-	-	-	-	-	-
13	26	50	73	90	105	122	-	-	-	-	-	-
14	33	62	89	112	132	150	165	180	-	-	-	-
15	38	73	105	132	158	180	200	220	-	-	-	-
16	45	86	123	155	184	212	235	255	279	296	-	-
17	52	98	141	176	211	243	272	296	323	347	-	-
18	60	112	160	202	240	275	311	336	372	396	-	-
19	68	127	180	225	270	312	351	382	423	455	-	-
20	76	142	200	252	302	350	393	428	475	510	-	-
21	85	160	223	280	338	390	440	481	531	571	-	-
22	95	178	247	306	374	431	487	538	588	636	695	744
23	107	196	271	338	414	475	536	592	648	698	764	816
24	117	218	297	368	451	520	590	653	712	768	834	895
25	128	238	324	404	494	568	645	715	778	839	907	978
26	140	260	352	440	538	619	701	778	848	915	990	1074
27	152	284	381	479	581	670	758	842	917	994	1074	1160
28	165	308	412	520	626	723	820	908	993	1077	1165	1268
29	178	331	445	562	675	780	882	977	1070	1161	1259	1367
30	193	357	477	605	726	833	949	1050	1150	1249	1355	1477
31	208	382	509	650	781	900	1019	1126	1234	1342	1451	1590
32	223	408	544	697	837	964	1094	1204	1320	1435	1550	1709
33	238	435	581	745	896	1032	1165	1283	1412	1535	1646	1825
34	254	465	624	797	958	1100	1240	1365	1510	1638	1752	1949
35	271	492	666	850	1024	1174	1317	1450	1610	1745	1862	2065
36	290	523	715	903	1089	1245	1398	1542	1710	1850	1977	2200
37	310	556	766	960	1155	1320	1480	1640	1815	1960	2100	2342
38	330	590	830	1021	1220	1392	1567	1735	1916	2066	2215	2480
39	354	626	897	1080	1286	1472	1657	1840	2025	2179	2345	2627
40	376	667	975	1150	1355	1545	1750	1936	2135	2305	2472	2780

References

- Anonymous. May 1985. *National Forest Log Scaling Handbook*. Forest Service USDA, Washington, DC. 184 pp.
- Beers, Thomas W. 1973. *Revised Composite Tree Volume Tables for Indiana Hardwoods*. Research Progress Report 417, Agr. Exp. Sta., Purdue University, W. Lafayette, IN 47907
- Bruce, Donald and Francis X. Schumacher. 1950. *Forest Mensuration 3rd ed.* McGraw-Hill Book Company, Inc. New York. 483 pp.
- Freese, Frank, No Date. *A Collection of Log Rules*. USDA Forest Service General Technical Report FPL 1. 65 pp.
- Grosenbaugh, L. R. 1952. *Short Cuts for Cruisers and Scalers*. 24 pp. Occasional Pap. 126, S. Forest Exp. Sta., Forest Service, New Orleans, LA.
- Mesavage, Clement and James W. Girard. 1956. *Tables for Estimating Board-Foot Volume of Timber*. USDA Forest Service, Washington, DC. 94 pp.
- Wiant, H. V. 1986. Formulas for Mesavage and Girard's volume tables. *Northern Journal of Applied Forestry*. 3:124.



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