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A GUIDE TO SELLING AND SCALING SAWLOGS

Introduction

On occasion forestland owners find it appropriate to sell timber. Even nonindustrial private woodland owners including farmers and nonfarm rural landowners may decide to harvest their woods. Reasons for logging a woodland include benefits from additional income and, if properly planned and conducted, silvicultural improvement of forest stands.

When harvesting one's own woods, in contrast to selling standing timber (stumpage) to a logging or sawmill business, marketing the products becomes the landowner's responsibility. Selling harvested hardwood sawlogs will be either at roadside adjacent to a woodland or delivered to a sawmill. It is advisable before harvesting begins to have secured appropriate markets for the different products, including pulpwood, firewood, and logs.

Marketing hardwood sawlogs profitably requires a knowledge of: (1) buyers, (2) log specifications established by different sawmills, and (3) values of different tree species for such products as veneer, baseball bats, pulpwood, utility poles, fence posts, furniture grade lumber, and construction or pallet lumber. In addition, an understanding of log grading, log scaling, and log rules is important.

Log value factors

The value of logs sold to a sawmill is determined by the following factors:

1. end-use products which are obtained from logs,
2. local supply and demand situation relative to logs,
3. quality of a log which determines value of final products, and
4. volume of a log which determines yield of wood products.

Tree species

Values of different species of logs of the same quality and volume may vary due to relative differences in prices for end-use products. For instance, beech is of lower value as a species than white ash or black cherry. The more valuable species of logs, in recent years, have been red oak, white oak, black cherry, sugar maple, white ash, and yellow birch. However, it should be noted that the higher prices paid for these species do not apply to low quality logs. And, although there may be exceptions, relatively low priced species of logs include red spruce, American beech, aspen (popple) and hemlock.

Log length

Log lengths affect lumber value, logging and sawmilling costs, and therefore log values. Short logs of 8 feet normally are not sought except for specialty products; but 10-foot

and 12-foot logs may be preferred over 14-foot and 16-foot logs depending on the sawmill and its markets. Log lengths typically are specified in even-foot units from 8 to 16 feet, with about 4 inches of trim allowance required in addition to the specified log length. Thus, an 8-foot log should be cut 8 feet 4 inches in length and a 16-foot log will measure 16 feet 4 inches to meet requirements of sawmills. Many sawmills purchase logs in even lenghts of 8 ft., 10 ft., 12 ft., 14 ft., and 16 ft.; and they will determine volume of a log to the nearest even foot which is less than actual log length. For example, logs measuring 13 feet 4 inches and 13 feet 11 inches would be scaled for volume as 12 foot logs. Sometimes, however, sawmills will purchase logs in odd-foot lengths, but the seller should determine the log-length scaling procedures before cutting (bucking) logs to length for the marketplace.

It is easy to lose value by miscutting logs. Logs which are too short are reduced in scale. Logs which are too long waste timber because the purchase price for logs is based on standard lengths specified by the purchaser. Logs are normally cut from tree butt to top, and if logs are bucked over-length, the last log may be shorter than necessary or possibly not even long enough to meet the minimum length of 8 feet 4 inches required for a sawlog. Additionally, the scaling diameter for an excessively long log as well as for the logs which occur above it in a tree is reduced due to the natural taper of a tree from stump to top.

Log diameter

Log diameters also affect log values. Normally, small diameter logs are more costly to harvest, truck, and saw into lumber than large diameter logs. For logs between 9 and 18 inches in diameter, measured inside the bark (d.i.b.) on the small end, it is usual for logging and sawmilling costs to increase as log diameters decrease. In addition, the more valuable lumber grades are usually yielded by logs of at least 13 inches in scaling diameter (measured d.i.b. on the small end of the log).

Log grades

Hardwood log grades are used to predict value of lumber recovery from sawmilling and to separate logs of one species into different purchase price categories based on factors such as the following:

log length
log diameter
knots or branch stubs
bumps which indicate internal wood irregularities or overgrown knots
seams with ingrown bark
frost cracks
splits
ring shake or separation of growth rings on end of log
bird peck
worm holes
rot or decay
gum spots (in black cherry)
sweep which is a continuous deviation of a log's length from a straight line
crook which is an abrubt deviation of a segment of a log's length from a straight line

The highest grade of hardwood log is normally a veneer log for slicing. And the highest priced veneer logs are commonly exported to Europe. High grade veneer logs for rotary turning are valuable, but container or construction grade veneer logs are of less value. The highest grade of sawlog is commonly called "prime" although sometimes individual sawmills specify the highest grades as "veneer," "select," or "#1." After these grades the next

lower grades in succession from best to poorest are frequently identified as #2, #3, and cull.

The mill-delivered prices for logs graded as #3 may be so low that they are not profitable to produce. It is common for cull logs to be priced at less than the cost of logging and trucking because sawmill businesses do not want to be bothered with processing them due to high production costs and unprofitable value of lumber recovered.

Log prices

Prices for logs are quoted per thousand board feet (MBF) of logs delivered to a mill or sold at roadside next to a woodlot. Sometimes a "woods run" price is given for all logs removed from a woodland with a requirement that no logs be sold to other buyers. However, in most cases prices are quoted according to log grades which vary with each individual sawmill. It is common for the price range per thousand board feet of sawlogs to vary as much as $100 to $200 for valuable species such as black cherry, white ash, sugar maple, red oak, and white oak based on different log grades.

Since different log rules give significantly different board-foot volumes for the same log size, one must ensure that price comparisons are based on the same log rule. Also, one must ensure that scaling techniques and log grades are similar when comparing prices quoted by different sawmills.

Log rules

In New York State a number of different log rules may be used to measure the volume of board feet in logs. Since different log rules give significantly different volumes for logs of the same diameter and length, one must know what log rule is being used when prices are quoted and logs are measured in board-foot units. For example a 12-foot long, 14-inch (d.i.b.) log contains 100 board feet on the International 1/4-inch Log Rule, 90 board feet by the Scribner Decimal C rule and only 75 board feet on the Doyle Log Rule.

According to the USDA Forest Service there are over 95 recognized log rules bearing about 185 names which have been developed in the United States and Canada. However, in New York only three log rules are commonly used. These are the International 1/4-inch, Doyle, and Scribner Decimal C. In addition, the Vermont, Roy, and Ontario log rules may be used on occasion.

The International 1/4-inch Log Rule is based on a mathematical formula ($V = 0.199D^2 - 0.642D$; where V=volume in board feet for 4-foot section and D=d.i.b. on small end of a 4-foot length). The formula is changed for log lengths of 8, 10, 12, 14, and 16 feet in order to account for log taper. This log rule is quite accurate but may result in less lumber being sawn than predicted by log scale so an underrun of 5 percent in actual lumber recovery compared to log scale may occur.

The Doyle Log Rule is based on a mathematical formula [$V = (d-4)^2 L/16$; where V = volume in board feet, d = scaling diameter in inches inside the bark on small end of log, and L = length of log in feet] which is especially inaccurate on small logs because of its excessive allowance of 4 inches for slabs and edgings. The Doyle log rule under scales log volumes for small diameter logs; and for these logs it provides an overrun of lumber sawn in comparison to volume of logs scaled. This tends to compensate the sawmill business for the inefficiencies of handling small logs; and in some cases motivates loggers and woodland owners to leave relatively small sawtimber trees to grow. From a forest management standpoint, the Doyle log rule some-

times is considered a disincentive to harvesting small diameter, immature trees.

For example, the volume of an 8-inch (d.i.b.), 10-foot log on the Doyle log rule is 10 board feet, only 50 percent of the 20-board-foot volume yielded by the International 1/4-inch log rule for the same size sawlog. In general, the under scaling of logs by the Doyle log rule increases as log diameters decrease from 23 inches (d.i.b.) to 8 inches. Also, for the same diameter logs between 8 inches and 23 inches, 16-foot logs are under scaled about 5 to 15 percent more than 8-foot logs when comparisons are made with the International 1/4-inch log rule. Therefore it is advantageous to sell 8-foot long logs rather than 16-foot logs when the Doyle Rule is used, if the buyer permits it.

The Scribner Log Rule is based on log diagrams indicating sawing patterns for logs of exact inch diameters (measured on the small end of logs) with no allowance made for log taper. The Scribner Decimal C Log Rule, which is commonly employed, is a modification of the Scribner log rule where board-foot volumes are rounded off to the nearest 10 feet and the cipher is dropped. Therefore 2 on the Scribner Decimal C log rule represents 20 board feet and 16 represents 160 board feet. The Scribner log rule commonly gives log volumes which are less than the International 1/4-inch log rule and more than the Doyle log rule for logs between 8 and 21 inches in diameter (d.i.b.).

The Vermont Log Rule is a formula rule reportedly used by approximately two-thirds of the sawmills in Vermont. The mathematical formula (BF = D x D/2; where BF = board feet in 12-foot logs, and D = scaling diameter in inches inside bark on small end of log) is reported to be quite accurate for hardwood logs over 14 inches in diameter. For smaller hardwood logs it has been estimated that the Vermont rule under scales logs so about 5 percent less lumber is sawn at Vermont mills than estimated by log scale. When comparisons are made with the International 1/4-inch rule it can be seen that volumes are quite similar. Volumes for logs other than 12 feet in length are determined by adjusting the formula to reflect the proportional increase or decrease in log volume due to length (2/3 volume for 8-foot log, 5/6 volume for 10-foot log, 1-1/6 volume for 14-foot log, and 1-1/3 volume for 16-foot log). For a 12-foot log the Vermont log rule volume is just the diameter times one half the diameter of the log.

The Roy Log Rule is a mathematical formula rule used in the Province of Quebec, Canada, which is quite accurate for 14-foot and 16-foot logs but slightly high in volume for shorter logs. The formula is $BF = (d-1)^2 L/20$; where BF = board feet, d = scaling diameter in inches inside the bark on the small end of the log, and L = log length in feet.

The Ontario Log Rule is a formula rule which is used by mills in the Province of Ontario, Canada, where it was adopted as the official rule in 1952. The mathematical formula [$BF = (0.55D^2 - 1.2D) L/12$; where BF = board feet, D = scaling diameter in inches inside the bark on the small end of the log, and L = log length in feet] applies to logs 4 to 40 inches in top diameter (d.i.b. small end) and 8 to 18 feet long. Log volumes by the Ontario rule tend to be somewhat less than by the International 1/4-inch log rule.

Determining Log Volume

To determine the gross board-foot volume of a log, measure the average diameter inside the bark to the nearest inch on the small end of a log and measure the log length in feet. Remember, log lengths typical-

ly are measured in even-foot lengths of 8, 10, 12, 14, and 16 feet with the aforementioned trim allowance of about 4 additional inches required for each log length.

Gross log volume in board feet is determined by using volumes estimated by any of the recognized log rules. The volume tables for different log rules are provided in tables appended to this publication for gross volume determination. A log scaling stick may be used if you prefer. Scaling sticks which are used to measure logs read directly in board-foot volumes for logs of different diameters and lengths.

To determine the actual or net board-foot content of a log, deductions are made from the gross volume for scaling defects which reduce the amount of lumber that can be sawn from a log. The scaling defects which must be subtracted from gross log scale account for losses in lumber yield due to holes, decay, splits, spiral seams, crook, and sweep in logs.

Common scaling practices involve rules of thumb to obtain a log's net volume by reducing gross log scale for scaling defects. Reducing the scaling diameter of a log or reducing the length of a log are typical methods of accounting for scaling defects. However, the recommended procedures for determining scaling deductions to account for holes, splits, sweep, crook, and decay are depicted in Figure 1.

Also, it should be noted that actual log scaling practices of sawmills vary, especially with the Doyle log rule. Because of competition in the log-buying market and due to under scaling of actual log volumes by the Doyle rule, some sawmills scale logs outside the bark so both bark thicknesses are included in the log diameter used to determine log volume in board feet. Other scaling practices include measuring the large end of small diameter logs and including one bark thickness but not the other when measuring the small end of a log. Of course there is only one prescribed method of measuring a log's diameter, and this is to determine the average diameter inside the bark on the small end of the log. But due to the variety of log scaling practices, a seller of logs should know and understand the scaling methods of log buyers because these practices affect log volume which with log grade (and associated price) determines log value.

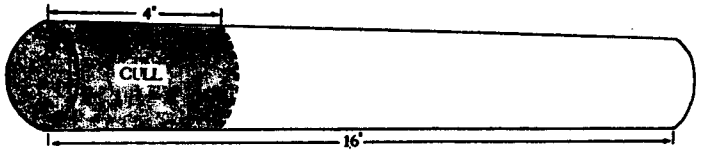
Determining Log Grade

Since every sawmill in New York State uses its own log grading specifications based on a combination of quality of logs available, particular needs of the sawmill, and competition or custom in the area, it is important to evaluate the potential for markets before producing and marketing logs. In general, the higher log grades are free from or have fewer scaling and grading defects because sweep, crook, knots, surface bumps, and decay in the quality zone (all of which are grading defects) reduce the grade of lumber sawn and therefore lumber value. Holes and decay in the low quality heart center (Figure 2) of a log are scaling defects which reduce log volume but not log grade according to the U.S.D.A. Forest Service's hardwood log grading procedures.

A hardwood sawlog's "quality zone", as defined by the U.S.D.A. Forest Service, is measured inside the bark from the circumference of a log on the small end toward the log's center with a radius equalling 30 percent of the log's scaling diameter (Figure 2). This quality zone contains higher grades of lumber than the heart center which is defined on the small end of a log as the area measured from the center of the log to a radius of 20 percent of the log's scaling diameter.

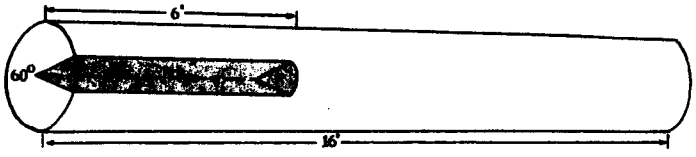
Figure 1. Methods of determining scaling deductions.*

(Examples based on a 16-foot log with 20-inch scaling diameter)



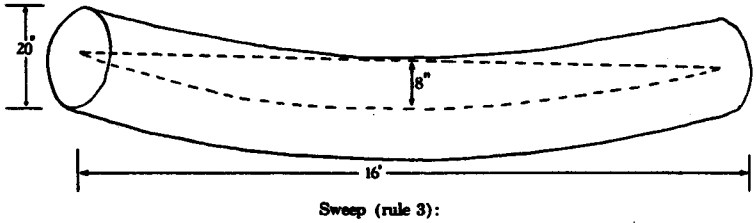
Defect section (rule 1):

Percent deduction $= \frac{4}{16} = 25\%$



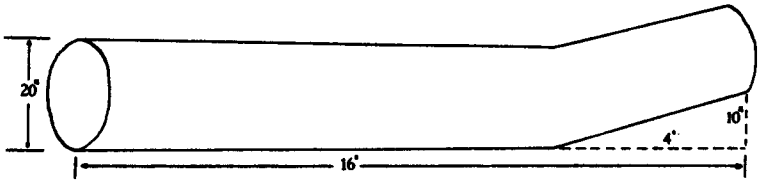
Defect section (rule 2):

Percent deduction $= \left(\frac{6}{16}\right)\left(\frac{60}{360}\right) =$ 6-1/4%



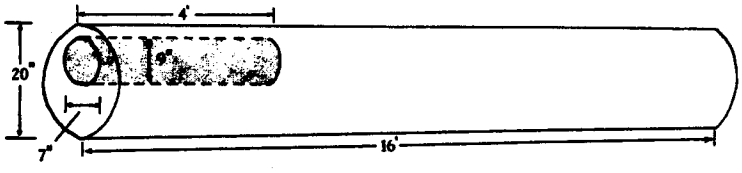
Sweep (rule 3):

Percent deduction $= \frac{8-2}{20} =$ 30%



Crook (rule 4):

Percent deduction $= \left(\frac{10}{20}\right)\left(\frac{4}{16}\right) =$ 12-1/2%



Interior defect (rule 5):

Percent deduction $= \frac{(8)\ (10)}{(20-1)^2} \times \frac{4}{16} =$ 5-5/9%

In practice each ellipse axis can be divided by $(20-1)$ and rounded to nearest tenth if desired.

Thus $\frac{8}{19} = .4$, $\frac{10}{19} = .5$, and $(.4)\ (.5)\left(\frac{4}{16}\right) =$ 5%

*Source: "A guide to Hardwood Log Grading," U.S.D.A. Forest Service, General Technical Report NE-1, 1973, by Everette D. Rast, David L. Sonderman, and Glenn L. Gammon.

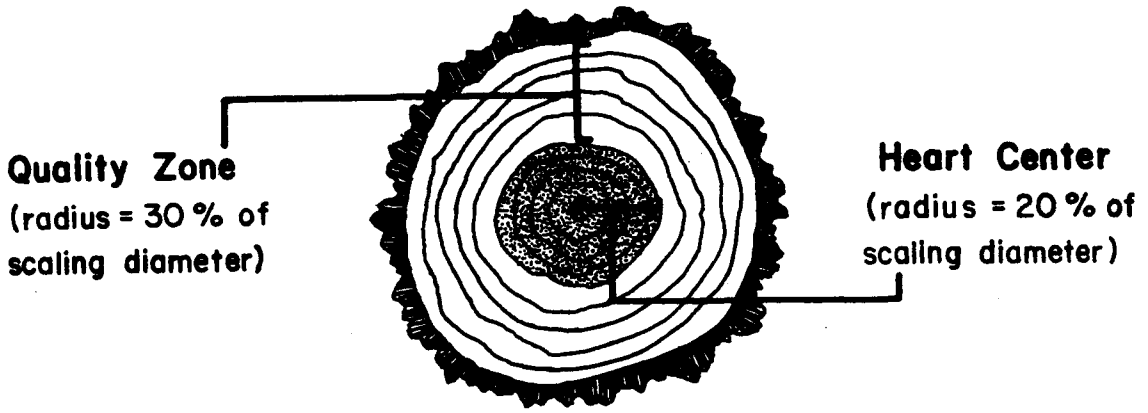


Figure 2. Heart center and quality zone of sawlogs.

Although sawmills may not use the term "quality zone" in defining their log grades, the higher grades of hardwood lumber are produced from this region of a log. Therefore, decay or a hole in the heart center does not significantly reduce the production of high grade lumber from a log; but, of course, it does reduce volume of lumber sawn.

Industry commonly defines high grade hardwood logs as those free of surface defects such as knots, bumps, splits, and spiral seams on the outside of a log. Also, some sawmills require high grade logs to be sound (free of decay and holes) even in the heart center. Of course veneer logs for rotary turning must be sound in the heart center so veneer lathe chucks can be used.

A helpful reference for those interested in log grading to predict lumber grade yields is "A Guide to Hardwood Log Grading," U.S.D.A. Forest Service, General Technical Report NE-1, dated 1973.

Forest Management

Log grades and values are influenced by forest management practices. Species composition of a woodland, volume of stocking, rate of tree growth, and quality of trees are determined by the practice of silviculture and careful logging. As a foundation for forest management, silviculture is concerned with the establishment, cultivation, and reproduction of forest stands.

Logging can be employed solely for immediate economic benefit, possibly destroying or reducing future timber values. Perhaps a more sound approach is to integrate timber harvesting with silviculture to provide both immediate income and improved forest growth, thereby maximizing timber production.

Managing forest stands includes harvesting timber and establishing tree reproduction as well as protecting soil from erosion in skid trails and roads, and favoring some high vigor, dominant, codominant, and what appear to be genetically superior trees for future growth.

Only a small percentage of all hardwood logs produced in New York State are of high grade. They are obtained from the very small percentage of all trees which are of highest quality. And most high grade logs

are the first (butt) log of a tree. However, proper forest management and good timber harvesting practices will increase the quantity and quality of valuable trees. Improvement cuttings for firewood and commercial timber harvesting for pulpwood and sawlogs can be silvicultural practices providing increased future returns from forests while meeting present needs for income.

Before a decision is made to harvest and sell hardwood sawlogs, or to cut cabin logs, firewood, fence posts, pulpwood, or poles, it may be appropriate to consider additional sources of assistance and information. Here are just a few.

1. CFM (Cooperating Cooperative Forest Management) program of the New York State Department of Environmental Conservation (DEC), Division of Lands and Forests, Bureau of Forest Resource Management which provides advisory services to woodland owners.

2. Consultant foresters who provide numerous services to woodland owners relative to determining timber value, identifying property boundaries, marketing, and recommending silvicultural practices (forest management) -- A "Directory of Cooperating Consultant Foresters Offering Services in New York State" is available free of charge from NYS DEC, Bureau of Forest Resource Management, 50 Wolf Road, Albany, NY 12233 (Telephone 518/457-7370).

3. "Directory of Primary Wood-Using Plants in New York State" and "Stumpage Price Report," published by the NYS DEC, Bureau of Forest Marketing and Economic Development of the Division of Lands and Forests, 50 Wolf Road, Albany, NY 12233 (Telephone 518/457-7431).

4. "Extension Publications for Woodland Owners," a list of "Conservation Circulars" published by the Department of Natural Resources, Fernow Hall, Cornell University, Ithaca, NY 14853 (Telephone 607/256-2114).

5. "Timber Harvesting Guidelines for New York" available from foresters and public/educational forestry organizations.

6. "Marketing Bulletin" published for the forest industry in conjunction with the NYS DEC Forest Marketing and Economic Development Section by the Wood Utilization Service, SUNY College of Environmental Science and Forestry, Syracuse, NY 13210 (Telephone 315/ 470-6562).

7. "The Empire State Timber Harvester," a monthly newsletter dedicated to professional loggers and pulpwood cutters, available from David W. Taber, Cooperative Extension Specialist, Wood Utilization Service (jointly sponsored by Cornell University and the State University of New York College of Environmental Science and Forestry), SUNY College of ESF, Syracuse, NY 13210 (Telephone 315/470-6739).

-- David W. Taber
Cooperative Extension Specialist
Wood Utilization Service

LOG VOLUMES IN BOARD FEET by DOYLE LOG RULE*

Diameter (D) in inches	Log length in feet (L)								
	8'	9'	10'	11'	12'	13'	14'	15'	16'
8"	8	9	10	11	12	13	14	15	16
9"	13	14	16	17	19	20	22	23	25
10"	18	20	23	25	27	29	32	34	36
11"	25	27	31	34	37	40	43	46	49
12"	32	36	40	44	48	52	56	60	64
13"	41	45	51	55	61	66	71	76	81
14"	50	56	63	68	75	81	88	94	100
15"	61	67	76	83	91	99	106	113	121
16"	72	81	90	99	108	117	126	135	144
17"	85	95	106	117	127	137	148	158	169
18"	98	110	123	134	147	159	172	183	196
19"	113	126	141	154	169	183	197	211	225
20"	128	144	160	176	192	208	224	240	256
21"	145	162	181	198	217	235	253	271	289
22"	162	182	203	223	243	263	284	303	324
23"	181	203	226	248	271	293	316	336	361
24"	200	225	250	275	300	325	350	375	400
25"	221	248	276	302	331	358	386	412	441
26"	242	272	303	333	363	393	424	453	484
27"	265	298	331	363	397	430	463	496	529
28"	288	328	360	396	432	468	504	540	576
29"	313	351	391	430	469	508	547	586	625
30"	338	380	423	465	507	549	592	633	676

*The Doyle Log Rule is based on the formula: Bd. Ft. = $(D-4)^2$ L/16 and it is used by many mills throughout New York State although it is not commonly used in the Eastern Adirondacks or East of the Hudson River (D = diameter small end of log measured inside the bark in inches; and L = log length measured in feet).

LOG VOLUMES IN BOARD FEET
by
INTERNATIONAL 1/4-INCH LOG RULE*

Diameter (D) in inches	Log length in feet (L)				
	8'	10'	12'	14'	16'
8"	15	20	25	35	40
9"	20	30	35	45	50
10"	30	35	45	55	65
11"	35	45	55	70	80
12"	45	55	70	85	95
13"	55	70	85	100	115
14"	65	80	100	115	135
15"	75	95	115	135	160
16"	85	110	130	155	180
17"	95	125	150	180	205
18"	110	140	170	200	230
19"	125	155	190	225	260
20"	135	175	210	250	290
21"	155	195	235	280	320
22"	170	215	260	305	355
23"	185	235	285	335	390
24"	205	255	310	370	425
25"	220	280	340	400	460
26"	240	305	370	435	500
27"	260	330	400	470	540
28"	280	335	430	510	585
29"	305	385	465	545	630
30"	325	410	495	585	675

*The International 1/4-Inch Log Rule is based on the formula Bd. Ft. = $0.199D^2 - 0.642D$ for a 4-foot log of scaling diameter D; and values are rounded off to the nearest multiple of 5 board feet. Each 4-foot section is assumed to have an increase in diameter of 1/2-inch.

LOG VOLUMES IN BOARD FEET
by
SCRIBNER DECIMAL C LOG RULE*

Diameter (D) in inches	Log length in feet (L)				
	8'	10'	12'	14'	16'
8"	1	2	2	2	3
9"	2	3	3	3	4
10"	3	3	3	4	6
11"	3	4	4	5	7
12"	4	5	6	7	8
13"	5	6	7	8	10
14"	6	7	9	10	11
15"	7	9	11	12	14
16"	8	10	12	14	16
17"	9	12	14	16	18
18"	11	13	16	19	21
19"	12	15	18	21	24
20"	14	17	21	24	28
21"	15	19	23	27	30
22"	17	21	25	29	33
23"	19	23	28	33	38
24"	21	25	30	35	40
25"	23	29	34	40	46
26"	25	31	37	44	50
27"	27	34	41	48	55
28"	29	36	44	51	58
29"	31	38	46	53	61
30"	33	41	49	57	66

*The Scribner Decimal C Log Rule is based on a diagram for cutting 1-inch wide lumber with a 1/4-inch allowance for saw kerf. Board-foot values are rounded off to the nearest 10 feet and the cipher is dropped. Therefore 2 equals 20 board feet and 12 equals 120 board feet. The scaling diameter "D" is measured on the small end of the log.

LOG VOLUMES IN BOARD FEET
by
VERMONT LOG RULE*

Diameter (D) in inches	Log length in feet (L)						
	8'	9'	10'	11'	12'	14'	16'
8"	21	24	27	29	32	37	43
9"	27	30	34	37	40	47	54
10"	34	38	42	46	50	58	67
11"	40	45	50	56	60	70	81
12"	48	54	60	66	72	84	96
13"	57	63	70	78	84	98	113
14"	66	74	81	90	98	114	131
15"	75	84	93	104	112	131	150
16"	86	96	106	118	128	149	171
17"	97	108	120	133	144	168	193
18"	108	122	134	149	162	189	216
19"	121	135	150	166	180	210	241
20"	134	150	166	184	200	233	267
21"	148	165	183	203	220	257	294
22"	162	182	201	223	242	282	323
23"	177	198	219	243	264	308	353
24"	193	216	239	265	288	336	384
25"	209	234	259	288	312	364	417
26"	226	254	280	311	338	394	451
27"	244	273	302	335	364	425	486
28"	263	294	325	361	392	457	522
29"	282	315	349	387	420	490	560
30"	302	338	374	414	450	525	600

*The Vermont Log Rule is based on the formula: Bd. Ft. = D x D/2 x L/12 and it is used by some mills in Vermont (D = diameter small end of log measured inside the bark in inches; and L = log length measured in feet).

LOG VOLUMES IN BOARD FEET by ROY LOG RULE*

Diameter (D) in inches	Log length in feet (L)						
	8'	9'	10'	11'	12'	14'	16'
8"	20	22	25	27	29	34	39
9"	26	29	32	35	38	45	51
10"	32	36	41	45	49	57	65
11"	40	45	50	55	60	70	80
12"	48	54	61	67	73	85	97
13"	58	65	72	79	86	101	115
14"	68	76	85	93	101	118	135
15"	78	88	98	108	118	137	157
16"	90	101	113	124	135	158	180
17"	102	115	128	141	154	179	205
18"	116	130	145	159	173	202	231
19"	130	146	162	178	194	227	259
20"	144	162	181	199	217	253	289
21"	160	180	200	220	240	280	320
22"	176	198	221	243	265	309	353
23"	194	218	242	266	290	339	387
24"	212	238	265	291	317	370	423
25"	230	259	288	317	346	403	461
26"	250	281	313	344	375	438	500
27"	270	304	338	372	406	473	541
28"	292	328	365	401	437	510	583
29"	314	353	392	431	470	549	627
30"	336	378	421	463	505	589	673

*The Roy Log Rule is based on the formula: Bd. Ft. = $(D-1)^2$ L/20 and it is used by mills in the Province of Quebec, Canada (D = diameter small end of log measured inside the bark in inches; and L = log length measured in feet).

LOG VOLUMES IN BOARD FEET by ONTARIO LOG RULE*

Diameter (D) in inches	Log length in feet (L)								
	8'	9'	10'	11'	12'	13'	14'	15'	16'
8"	17	19	21	23	26	28	30	32	34
9"	23	25	28	31	34	37	39	42	45
10"	29	32	36	39	43	47	50	54	57
11"	36	40	44	49	53	58	62	67	71
12"	43	49	54	59	65	70	76	81	86
13"	52	58	64	71	77	84	90	97	103
14"	61	68	76	83	91	99	106	114	121
15"	71	79	88	97	106	115	123	132	141
16"	81	91	101	111	122	132	142	152	162
17"	92	104	115	127	139	150	162	173	185
18"	104	117	131	144	157	170	183	196	209
19"	117	132	146	161	176	190	205	220	234
20"	131	147	163	180	196	212	229	245	261
21"	145	163	181	199	217	235	254	272	290
22"	160	180	200	220	240	260	280	300	320
23"	176	198	219	241	263	285	307	329	351
24"	192	216	240	264	288	312	336	360	384
25"	209	235	261	288	314	340	366	392	418
26"	227	255	284	312	341	369	397	426	454
27"	246	276	307	338	369	399	430	461	491
28"	265	298	331	364	398	431	464	497	530
29"	285	321	356	392	428	463	499	535	570
30"	306	344	383	421	459	497	536	574	612

*The Ontario Log Rule is based on the formula: Bd. Ft. = $(0.55D^2 - 1.2D)\ L/12$ and it is used by some mills in Canada (D = diameter small end of log measured inside the bark in inches; and L = log length measured in feet).