

Measuring Standing Timber and Logs

Lesson 5: Measuring Standing Timber and Logs

Measuring timber is an essential skill for individuals involved in the forest industry. As a buyer or seller of forest products, proper measurements will ensure fair and equitable transactions between you and your patrons. Just as grain crop farmers must know the bushels they produce and sell, tree farmers need an accurate measure of their woodlot production and sales.

There are two common ways of measuring Missouri forest products – by the cord and by board feet. Generally, fuelwood and pulpwood are measured in cords while timber used for lumber is measured in board feet.

Measuring Logs for Fuelwood or Pulpwood

The standard cord is a pile of wood 4 feet high, 4 feet wide, and 8 feet long. It occupies 128 cubic feet of space but actually does not contain 128 cubic feet of wood due to air space.

Since fuelwood is not always so conveniently stacked into standard cords, a formula can be used to calculate the number of standard cords in a stack of wood.

$$\frac{\text{Number of Standard Cords} = \frac{\text{length (feet)} \times \text{width (feet)} \times \text{height (feet)}}{128 \text{ cubic feet}}}$$

For example, the number of standard cords in a stack of wood 10 feet long, 6 feet wide, and 3 feet high is 1.41 cords.

$$\frac{10 \text{ feet} \times 6 \text{ feet} \times 3 \text{ feet}}{128 \text{ cubic feet}} = 1.41 \text{ standard cords}$$

A rick is not a standard measurement. It is customarily 1/3 to 1/2 cord, but these amounts can vary within different localities.

Measuring Logs for Sawlogs and Lumber

Logs used for sawlogs and lumber are measured in board feet. One board foot is 144 cubic inches. Scaling of logs

is the normal basis for determining the number of board feet in logs. Although not as accurate as the actual lumber tally after sawing, it permits prompt settlement for timber. It also eliminates the need for separating logs on the yard by ownership. By measuring the log diameter and length and using a log rule, the number of board feet may be determined.

Diameter Measurement

The first step in scaling logs is measuring the diameter of the log. The diameter is measured at the small end of the log inside the bark to the nearest inch. For logs that are not round, two measurements should be taken at right angles to each other and the average of the two will determine the diameter.

For example, a round log measuring 10.4 inches has a diameter of 10. An oblong log having an average diameter of 10 one way and 12.4 the other has an average diameter of 11.

Length Measurement

The length of logs is measured in even feet (8, 10, 12, etc.). If logs are cut in lengths between these even numbers, the length is scaled to the smaller even number rather than the nearest even number. For example, a log measuring 15 feet 7 inches would be scaled to 14 feet rather than 16 feet.

Once the diameter and length have been measured, the log rule is used to determine the board foot volume. There are over 50 log rules in the United States. The International 1/4-Inch Log Rule is the one commonly used in Missouri and will provide a good estimate of board feet volume.

To use the log rule, find the diameter of the log down the left hand column and then find the length of the log in the top horizontal row. The intersection of this row and column gives the board foot volume of the log. See Figure 5.1.

For example, a log with a diameter of 11 inches and length of 12 feet would have 55 board feet of lumber.

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Figure 5.1 – International 1/4-Inch Log Rule Table

Diameter of Log Small Ends, Inside Bark (inches)	Length of Logs (feet)				
	8	10	12	14	16
	← board feet →				
6.....	10	10	15	15	20
7.....	10	15	20	25	30
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	365	430	505	585
29.....	305	385	465	545	630
30.....	325	410	495	585	675

Credit: *How to Measure Trees and Logs*, University of Missouri Extension Guide G5050.

Figure 5.2 – Cruising Stick

Diameter Measurement and Tree Height Side

Diameters•Inches•25 Inches from Eye to Tree	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70
Prevent Woods Fires•Don't Graze Your Woodlands Harvest Your Tree Crop Wisely	Missouri Conservation Department																For Woodland Management Assistance or Advice See Your Farm Forester or Write the State Forester, Jefferson City, Missouri																
16 Foot Logs•50 Feet from Tree•Hold Stick Plumb 25 Inches from Eye	—										2										3												

International 1/4-Inch Log Rule Side

Diameter•Small End Log• Inside Bark•Inches		6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	
Inter- national Log Rule	LOG LENGTH IN FEET	8	10	10	15	20	30	35	45	55	65	75	85	95	110	125	135	155	170	185	205	220	240	260	280	305	325	350	375	400	425	450	475
	10	10	15	20	30	35	45	55	70	80	95	110	125	140	155	175	195	215	235	255	280	305	330	365	385	410	440	470	500	535	565	600	
	12	15	20	25	35	45	55	70	85	100	115	130	150	170	190	210	235	260	285	310	340	370	400	430	465	495	540	570	605	645	685		
	14	15	25	35	45	55	70	85	100	115	135	155	180	200	225	250	280	305	335	370	400	435	470	505	545	585	630	670	715	760	800		
	16	20	30	40	50	65	80	95	115	135	160	180	205	230	260	290	320	355	390	425	460	500	540	585	630	675	720	770	820	870	930		

Measuring Standing Timber and Logs

Measuring Standing Timber

Often timber is sold on a stumpage basis (selling timber in standing trees rather than cut products such as logs). To determine the volume of a standing tree, its diameter at breast height (d.b.h.) and merchantable (usable) height must be determined. When these two measurements are known, the volume of the tree can be determined directly from a tree volume table.

Measuring Diameter at Breast Height (d.b.h.)

Diameter measurements of standing timber are made at breast height which is 4-1/2 feet above the ground. One tool used to measure diameter is the cruising stick. Cruising sticks are a quick, easy way to estimate tree volumes and they can be obtained free from local farm foresters or the Missouri Department of Conservation district forestry office. See Figure 5.2.

To use the cruising stick for measuring a tree's diameter, hold it horizontally 25 inches from your eye against the tree at breast height (4-1/2 feet above the ground). (One arm's length for the average person is 25 inches. Try measuring yours and see.) Be sure you have the "diameter measurement" side of the stick towards you.

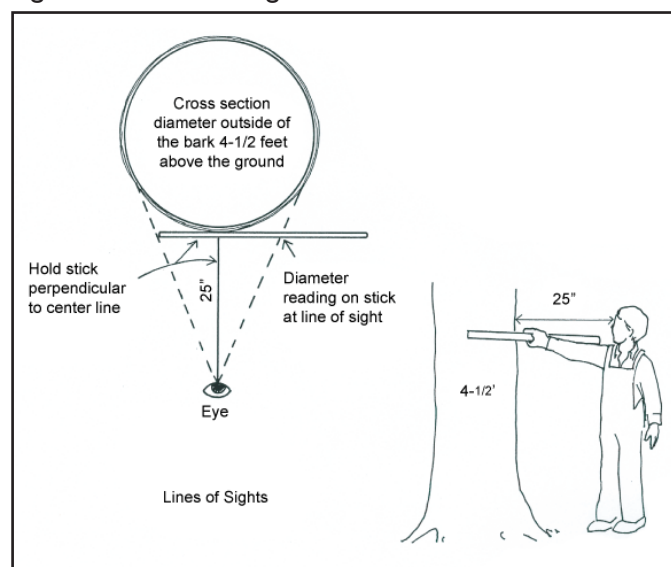
Line up the zero end with the outside of the tree. Then without moving your head and using only one eye, look at the other side of the tree. Read the figure nearest to where your line of sight crossed the stick and this side of the tree. The number you see is the estimate of the tree's diameter at breast height. It is important to move your eye instead of your head, or the reading will not be correct. If the tree is not round, take another reading at a right angle to the first reading and average the two. See Figure 5.3.

Measuring Merchantable (Usable) Height

Individual tree height is normally measured from 12-inch stump height to a point on the tree beyond which salable sawlogs or other products cannot be cut.

For sawlogs, the merchantable height is the point on the tree where the diameter is less than 8 inches. It is

Figure 5.3 – Measuring Diameter



important to note that merchantable height may occur at a height lower on the tree if there are large branch forks or deformities.

To measure the height of a tree, the same side of the cruising stick is used as for diameter. The procedure is as follows. See Figure 5.4.

1. Starting with your heel against the base of the tree, pace out a distance of 50 feet. (Pace toward an opening that will allow you to see the tree you are measuring.) Try to pace out to a point level with the base of the tree.
2. Turn around and look at the tree and determine the point the last cut will be made (merchantable height).
3. Hold the stick **vertically** 25 inches from your eye.
4. Move the stick up or down until the lower end is even with your line of sight to the stump height (12 inches above ground).
5. **Without moving your head** shift your vision upward to the point which you decided was the last cut of the tree. The point where your line of sight crosses the stick gives a reading in terms of 16 foot logs. Make sure the stick is vertical (not tilted forward or backward) when you make this reading. Your reading should be to the nearest 1/2 log.

If it is necessary to go past 50 feet to get a clear view of the tree, you may pace 100 feet (twice the distance) and then double the reading obtained from the stick.

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Figure 5.4 – Measuring Tree Height

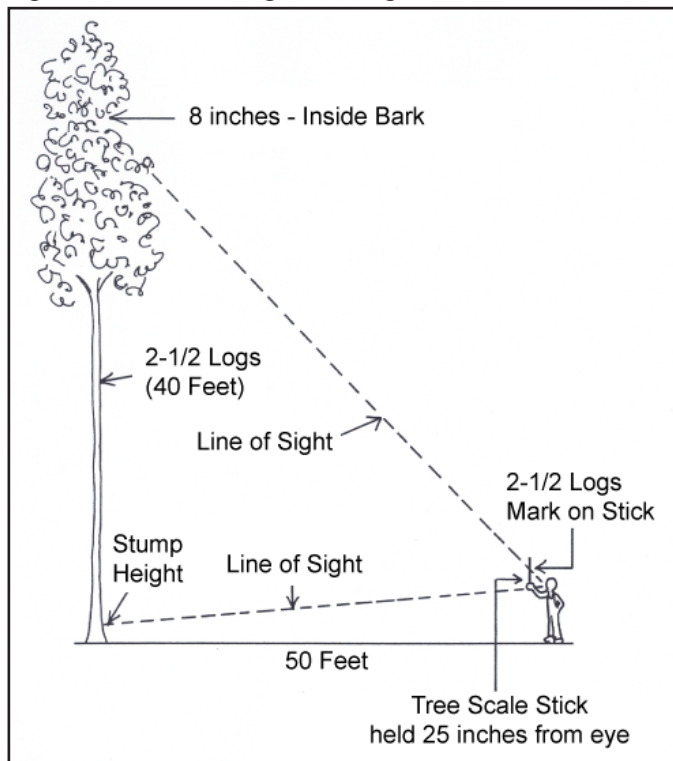


Figure 5.5 – Board Foot Volume of Trees* by Diameter and Height Classes

International Rule – Form Class 76							
D.B.H. (inches)	Number of 16-Foot Logs in Trees						
	1/2	1	1-1/2	2	2-1/2	3	3-1/2
	← volume in board feet →						
10	21	34	44	55			
12	30	52	68	85	98		
14	42	74	99	124	143	162	
16	59	100	134	169	198	226	246
18	74	129	175	221	259	297	325
20	92	162	220	279	328	377	413
22	112	198	271	344	406	467	514
24	133	237	326	415	491	567	622
26	158	284	392	500	592	684	755
28	187	331	458	585	696	806	888
30	220	381	529	677	805	933	1,029
32	254	435	606	776	926	1,077	1,192
34	291	493	687	881	1,054	1,227	1,359
36	333	559	782	1,006	1,205	1,404	1,557
38	374	624	874	1,125	1,354	1,582	1,754
40	415	693	974	1,256	1,510	1,764	1,962

*For estimating board feet in standing trees.

Credit: *How to Measure Trees and Logs*, University of Missouri Extension Guide G5050.

Computing Volume of Standing Trees

With the d.b.h., the merchantable height of the tree, and a tree volume table, an estimate of the board feet in that tree may be determined. See Figure 5.5.

The table is read exactly like the one for logs. Find the d.b.h. down the left column and the number of 16-foot logs across the top. The point where these intersect is the volume in board feet of the tree. For example, if the d.b.h. of a tree is 22 inches and the number of 16-foot logs is 1-1/2, then there are 271 board feet.

Use the cord volume table to determine volume in cords. See Figure 5.6.

Summary

Whether measuring trees or logs for sawlogs or cordwood, a fast estimation of the volumes of wood products may be obtained by finding the diameter, the length, and using the appropriate log rule or volume table.

Credits

Measuring Timber. Pacific Northwest Extension Pub. 31.

Slusher, J.P. *How to Measure Trees and Logs* (Guide G5050). Columbia: University of Missouri Extension, reviewed 1993. Accessed June 4, 2008, from <http://extension.missouri.edu/xplor/agguides/forestry/g05050.htm>.

Figure 5.6 – Cord Volume Table

D.B.H. (inches)	Height in Number of 8-Foot Bolts					
	1	2	3	4	5	6
	← volume in cords – unpeeled →					
6	.02	.03	.04	.06	—	—
8	.03	.05	.07	.09	.12	.14
10	.05	.07	.10	.13	.17	.20
12	.07	.10	.14	.18	.22	.27
14	.10	.13	.18	.23	.29	.35
16	.12	.17	.22	.29	.36	.44
18	—	.20	.27	.35	.44	.53
20	—	.25	.32	.42	.52	.63

Taken from Technical Note 202, Lake States Forest Experiment Station, University Farm, St. Paul, Minnesota, 1943. Volume is stem volume above 1 foot stump in standard unpeeled cords (standard cord is 4' x 4' x 8'). Height is number of usable 8-foot bolts to a variable top diameter; not less than 4 inches inside the bark.