

# forestry & natural resources

WOODLAND MANAGEMENT

## How to Make and Use the Tree Measuring Stick

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The tree measuring stick is used to estimate the number of board feet of lumber contained in a standing tree. Since the board foot is the most common unit of measurement used in estimating saw-timber-size trees, the tree measuring stick provides woodland owners a simple tool for making a woods inventory and for measuring trees to be harvested.

### How to make a tree measuring stick

Blueprint paper forms of the Purdue Tree Measuring Stick are available from county Cooperative Extension Service offices or by writing the Extension Forester, Department of Forestry, Purdue University, West Lafayette, IN 47907. The paper blueprint includes two forms which should be cut out and pasted to a wood blank 25 inches long, 1-1/8 inches wide, and at least 1/4 inch thick. Rubber cement or a waterproof, clear household cement provides a good adhesion. The glue should be placed on the stick rather than the paper.

In attaching the two forms to the stick, make sure that the left hand edge of each form is even with the end of the stick. After the two forms have been pasted to the stick, trim and sand the corners of the stick so that the edge will be smooth. The stick should be covered with a clear water repellent to protect it in use. Commercially made tree measuring sticks are also available.

### How to use the tree measuring stick

The three steps in using the tree measuring stick are:

- Measure tree diameter (DBH)
- Estimate number of 12-foot logs
- Read tree volume from the tree measuring stick

### How to measure tree diameter (DBH)

To measure tree diameter (DBH), use the scale labeled "25-inch Reach—Diameter in Inches," shown in Figure 1. Place the stick against the tree, with the "Tree Measuring Stick" side toward you and the zero end to your left, as illustrated in Figures 2 and 3. Hold it at 4.5 feet above the ground, tangent and perpendicular to the tree, and exactly 25 inches from your eye to the tree (length of the stick). Now, slide the stick to the left or right until you sight past the zero end and can just see the left side of the tree, including the bark. Without moving the head or stick, glance at the number on the stick where your line of sight cuts the right side of the tree, including the bark. This number is the diameter of the tree. The largest and smallest diameters should be measured. An average of these two measurements is the tree diameter.

### How to estimate 12-foot logs

Pace off a horizontal distance of 50 feet from the base of the tree, and face the tree to be measured, as shown in Figure 4. Grasp the stick between the fingers at a point about 2 inches above the base. This permits you to sight under the base of the stick to a point where the stump should be cut. Hold the stick straight up and down at exactly 25 inches from your eye with the scale, "50 Feet from Tree—Height in 12-Foot Logs," toward you (see Figures 5 and 6). With the base of the stick even with the stump height (about 1.5 feet), and without moving the head or stick, sight past the right hand side of the stick to the tree. The points marked 1, 2, 3, and 4 indicate the top of 12-foot logs. Measure the usable height only, that is, to a minimum of 10 inches diameter at the top or to a usable limit, as indicated by heavy branches, forks, etc.

### How to obtain tree volumes

After the tree DBH and number of 12-foot logs have been determined, the tree volume can be read from the tree measuring stick using the scale labeled "Volume in Board Feet—Doyle Rule" (Figure 1).

Let us assume the tree diameter is 20 inches and has two logs up to the usable limit. Looking at the scale illustrated in Figure 7, we see in the lower left-hand space under the 20-inch diameter that a tree with two 12-foot logs contains 200 board feet. Likewise, if it had contained three logs, it would have been 270 board feet; and if it had four logs, the volume would be 340 board feet, etc.

### Deduction for defect in trees

It is very difficult to estimate the amount of defect present in a standing tree because all of the defect cannot be seen. Trees with dead or dying tops, with punky knots, holes or branch stubs along the stem or with a hollow base may be 20 to 60 percent defective. The gross volume of a tree which appears reasonably free of defect should be reduced by about 10 percent to allow for the hidden defects. Trees that are over 50 percent defective are considered "culls."

### The log estimate method of tree measurement

The volumes given on the tree measuring stick are average volumes for several trees. The volume of a single tree may vary somewhat from the figure given on the stick. For this reason, when high value trees are to be measured, the log estimate method is generally used.

In using this method, the volume of each log in the tree is estimated, and these volumes are added together to obtain the total tree volume. To obtain individual log volumes, the top (small end) diameter (inside bark) and length of each log must be estimated. Estimates of log diameters will be more accurate if the DBH of the tree is measured and the stem taper is estimated from this point to the small end of each log.

Taper is the gradual reduction of tree diameter from the stump to the top log. The average rate of taper for Indiana trees is 1.5 inches in a 12-foot log. Thus, if the top diameter of the first log is about 16 inches, the top of the second log will be about 14.5 inches. Good judgment is needed in estimating taper since most trees will taper more or less than the average. Taper estimates will be improved by checking estimates with measurement of log diameters after trees have been felled.

Sawlogs are generally estimated in even foot lengths from 8 to 16 feet. Length depends upon the location of crook, defects, and utilization. Logs suitable for veneer or special products are cut in both odd and even foot lengths.

Log volumes are obtained from a table called a "Log Rule," which gives the board feet contained in logs of various diameters and lengths. The "Doyle Log Rule" is given in Table 1. To find the number of board feet in any log, move down the left-hand column in the log rule until the number is found which equals the small end diameter of the log. Then move to the right in the table until directly below the log length. The figure in this position is the log volume in board feet. For example, a log 16 inches in diameter and 12 feet long contains 108 board feet. The method of allowing for defect is the same as that described for cut logs.

### How to measure cut logs

Volumes obtained by measuring cut logs on the ground are more exact than estimates of standing trees. In measuring cut logs, use the "Inch Scale" on the tree measuring stick to measure the average diameter of the small end of the log inside the bark and its length in feet. The diameter is determined by averaging measurements of the long and short axis of the small end. Length is always measured to the next lower whole foot. All logs should be cut with 3 or 4 inches of extra length to allow for "squaring up" the ends of boards after the log is sawed. Log volumes are obtained by referring diameter and length measurement to a "Log Rule," as previously described.

Defects such as rot, crooks, fire scars, or windshake may be present in a log. An allowance for defect is made by reducing the diameter or length of the log, or by estimating the part of the log that will be lost because of the defect. In Figure 8, the defective part of the log is accounted for by reducing the scaling length from 12 to 8 feet. The net scale of the 16-inch log would then be 72 board feet.

It is not ordinarily necessary to deduct for surface scars which do not penetrate into the usable portion of the log. Rough or low grade logs have little market value for lumber or specialty products. They may be marketable as pulpwood and fuelwood, or they may be custom sawed into lumber for farm use.



TREE MEASURING STICK		6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38
25	INCH REACH — DIAMETER IN INCHES				20.50	40.90	60.150	80.210	110.270	140.360	180.460	230.560	280.670	330.790	390.930	450.1080	520.1270	590.1410
	VOLUME IN BOARD FEET — BY DOYLE RULE	1-12' LOGS	2-12' LOGS	3-12' LOGS	40	70	110	150	200	250	320	400	470	560	670	770	880	1000

Figure 1. The blueprint form used to measure tree diameter is labeled "Tree Measuring Stick."

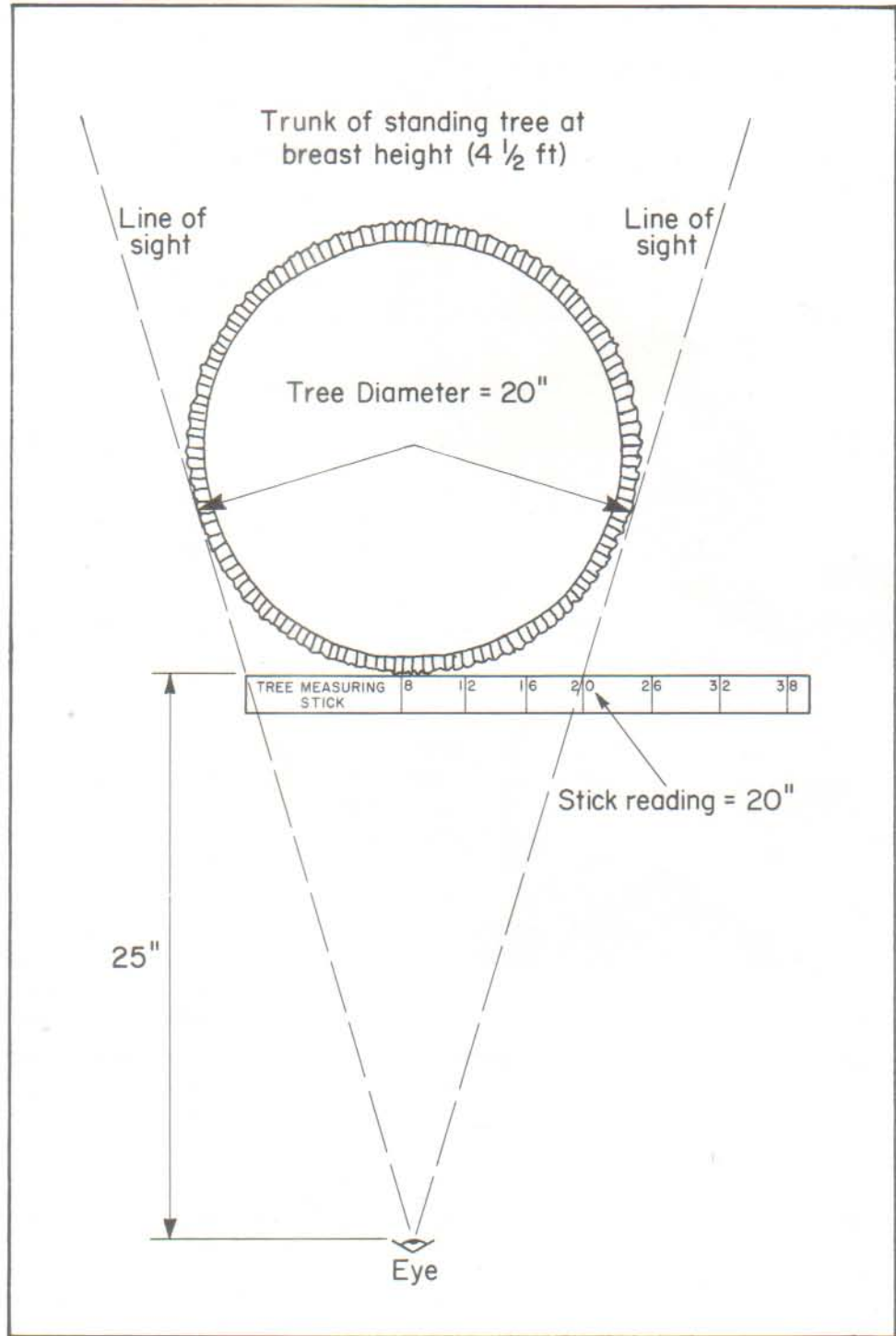


Figure 2. A cross section view of a 20-inch tree illustrates the position of the tree measuring stick to measure diameter.



Figure 3. Tree diameters are measured 4.5 feet above the ground, a convenient and standard point of measurement.

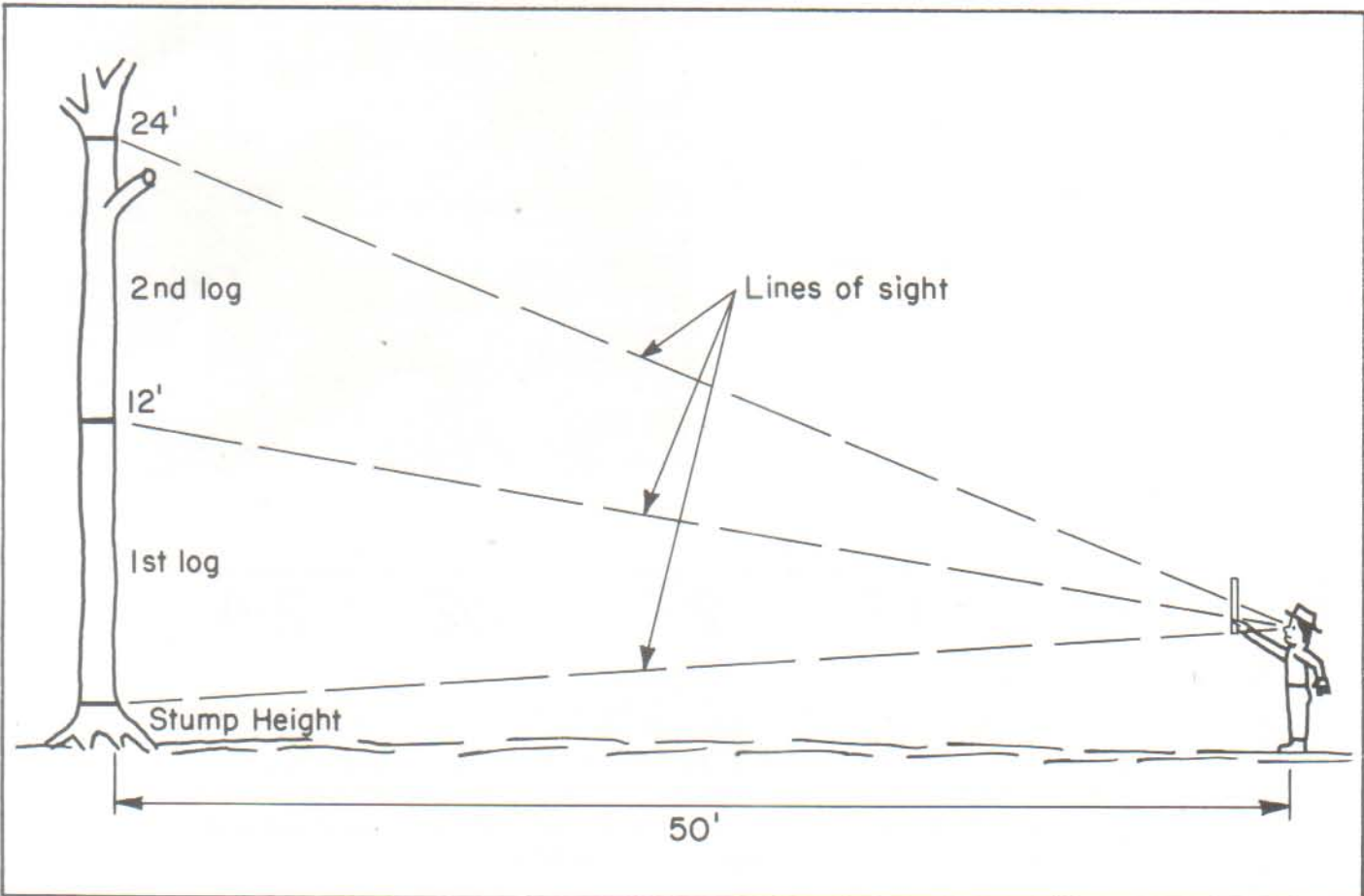


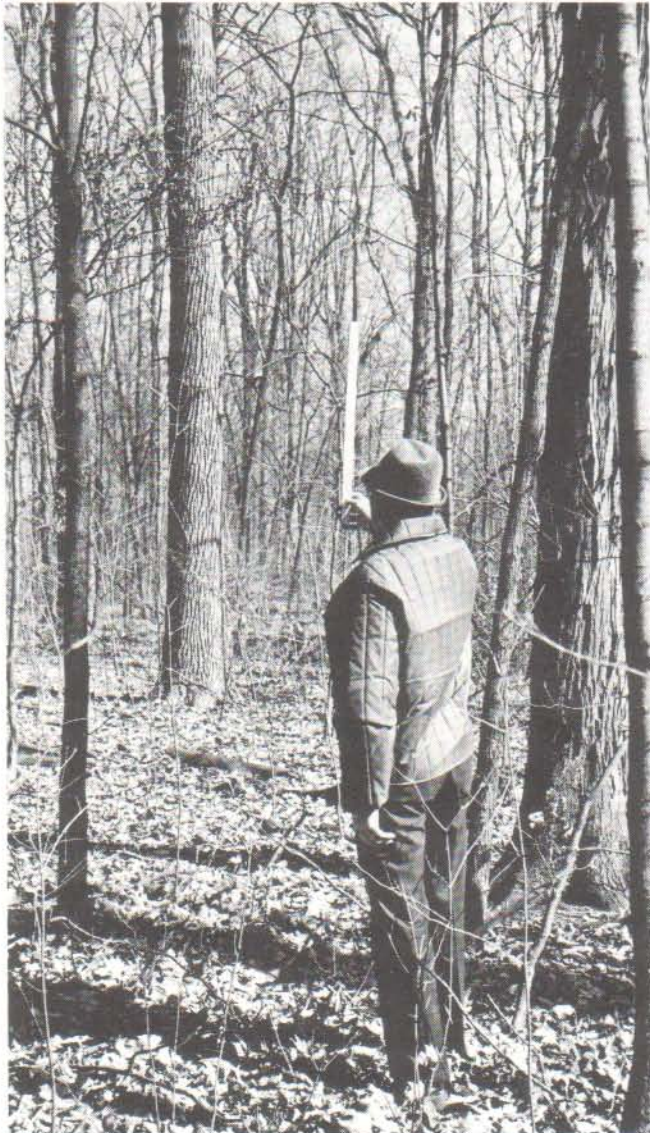
Figure 4. Usable height is estimated by projecting lines of sight from the eye past the **height** scale on the tree measuring stick to the tree.



INCHES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
50 FEET FROM TREE — HEIGHT IN 12' LOGS				—	—	—	—	—	—	—	2	—	—	—	—	—	—	3	—	—	—	—	—	4

Figure 5. The form used to estimate usable height is labeled "50 feet from tree—height in 12-foot logs."

Figure 6. Estimating usable height with the tree measuring stick.



	1	8	2	0	2	2	2	4
one log (@ 12 feet) →	110	270	←	three logs (@ 12 feet)				
two logs (@ 12 feet) →	200	340	←	four logs (@ 12 feet)				

Figure 7. A close-up view of the scale showing volumes in board feet of 20-inch trees having 1, 2, 3, or 4 logs 12 feet in length.

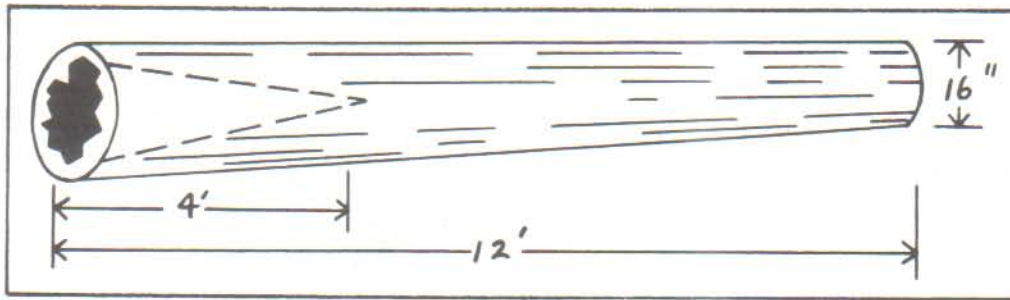


Figure 8. To allow for butt rot shown in the sketch, the scaling length is reduced 4 feet.

Table 1. The Doyle Log Rule.

Diameter (Small end of log inside bark)	Length of Log, Feet													
	6	7	8	9	10	11	12	13	14	15	16	17	18	20
Inches	Volume, board feet													
8	6	7	8	9	10	11	12	13	14	15	16	17	18	20
9	9	11	13	14	16	17	19	20	22	23	25	26	28	31
10	13	16	18	20	23	25	27	29	32	34	36	38	41	45
11	18	21	25	27	31	34	37	40	43	46	49	52	55	61
12	24	28	32	36	40	44	48	52	56	60	64	68	72	80
13	30	35	41	45	51	55	61	66	71	76	81	95	91	101
14	38	44	50	56	63	69	75	81	99	94	100	106	113	125
15	45	53	61	68	76	83	91	98	106	113	121	128	136	151
16	54	63	72	81	90	99	108	117	126	135	144	153	162	180
17	63	74	85	95	106	116	127	137	148	158	169	179	190	211
18	73	85	98	110	123	135	147	159	172	183	196	208	221	245
19	85	98	113	127	141	155	169	183	197	211	225	239	253	281
20	96	112	128	144	160	176	192	208	224	240	256	272	288	320
21	108	126	145	162	181	199	217	235	253	271	289	306	325	361
22	121	142	162	182	203	223	243	263	284	303	324	344	365	405
23	135	156	181	203	226	248	271	293	316	336	361	383	406	451
24	150	175	200	225	250	275	300	325	350	375	400	425	450	500
25	165	193	221	248	276	303	331	358	386	413	441	468	496	551
26	181	212	242	272	303	334	363	393	424	458	484	514	545	605
27	198	231	265	297	331	363	397	430	463	496	529	561	595	661
28	216	252	288	324	360	396	432	468	504	540	576	612	648	720
29	235	273	313	352	391	430	469	508	547	586	625	664	703	781
30	253	295	338	380	423	465	507	549	592	633	676	718	761	845
31	273	319	365	410	456	502	547	592	638	683	729	774	820	911
32	294	343	392	441	490	539	588	637	686	735	784	838	882	980
33	315	368	421	473	526	578	631	684	736	789	841	898	946	1051
34	337	394	450	506	563	619	675	731	788	844	900	956	1013	1125
35	360	420	481	540	601	661	721	781	841	901	961	1020	1081	1201
36	384	448	512	576	640	704	768	832	896	960	1024	1088	1152	1280
37	408	476	545	613	681	749	817	884	953	1021	1089	1157	1225	1361
38	433	505	578	650	723	795	867	939	1012	1083	1156	1228	1301	1445
39	459	535	613	689	766	842	919	996	1072	1149	1225	1301	1378	1551
40	486	566	648	729	810	891	972	1053	1134	1215	1296	1377	1458	1620

RR 10/91 (3M)

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