# TIMBER CRUISING

Timber cruising is the method that foresters use to determine the board foot volume of a standing tree and the amount of timber in a forested tract.

Two basic tree measurements are required in order to measure the board foot content of a standing tree. The diameter of the tree is *measured at 4½ feet above the ground*. This is called the "***diameter at breast height***" and is commonly referred to as ***d.b.h.*** The height of a tree includes the total height from ground level to the top of the tree. After determining the diameter at breast height and the total height of the tree, a ***Board Foot Volume Table*** is used to compute the board foot volume. A board foot is the volume of a board measuring 12 inches by 12 inches by 1 inch.

Let's take a closer look at the three steps involved in calculating the board foot volume of a tree:

TREE DIAMETER AT BREAST HEIGHT

A ***diameter tape*** is a commonly used tool for measuring d.b.h. A ***D-tape*** usually has a hook on the end to help attach it to the bark so the tape can be more easily wrapped around the circumference of the tree. A diameter tape differs from a normal measuring tape (calibrated to 12 inches/foot or tenths of feet) because it is calibrated in "Diameter Equivalents of Circumference in Terms of Inches" (a.k.a "***Pi Inches***"). This diameter tape scale allows the user to determine the diameter of a tree simply by measuring the circumference, since measuring with Pi Inches calibration eliminates the need to divide a "tenths of feet" circumference measurement by Pi (3.1416) to calculate the diameter.
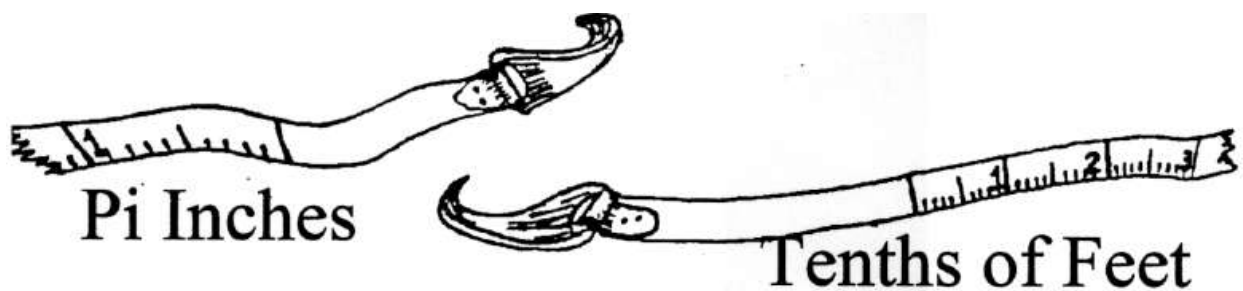
Note: A ***logger's tape*** is often used by foresters to measure both d.b.h. and tree height because one side is calibrated in Pi Inches while the other side is calibrated in feet and tenths of a foot (for measuring distance from the tree or other distances).

To measure d.b.h., first measure 4½ feet up the tree from the ground line (i.e. to "breast height"). Next, place the diameter tape's hook into the bark at that height and extend the tape counterclockwise around the tree, making sure to keep the tape level. Finally, read the tree diameter where the tape crosses the "zero" line (located on the tape next to the hook), as illustrated below.
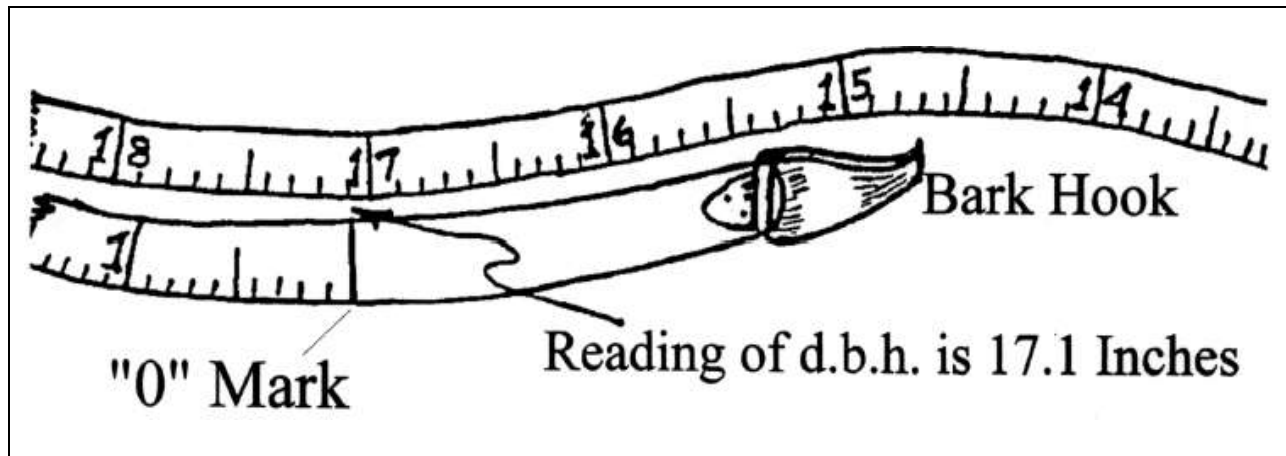

Example of diameter tape in use on a tree

MEASURING TOTAL TREE HEIGHT

A *clinometer* is a tool used to measure total tree height. With a little practice, you will be able to accurately determine the height of a tree. To use the clinometer, hold it up to your eye (with the lanyard ring below the lens opening). Keeping both eyes open, simultaneously look through the lens and alongside the clinometer's housing to the target. By an optical illusion, the horizontal sighting line will appear to project outside the clinometer's housing. Place the projected sighting line on your target and read the adjacent scale.
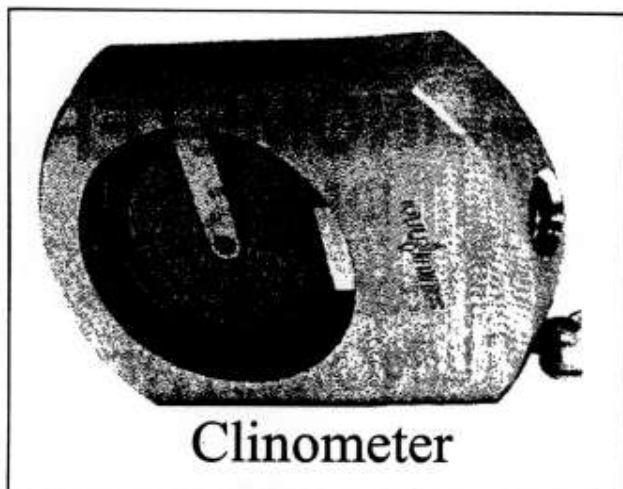
Clinometer

EXAMPLE:
Measuring tree height on level ground using a **clinometer *percent (%) scale***:
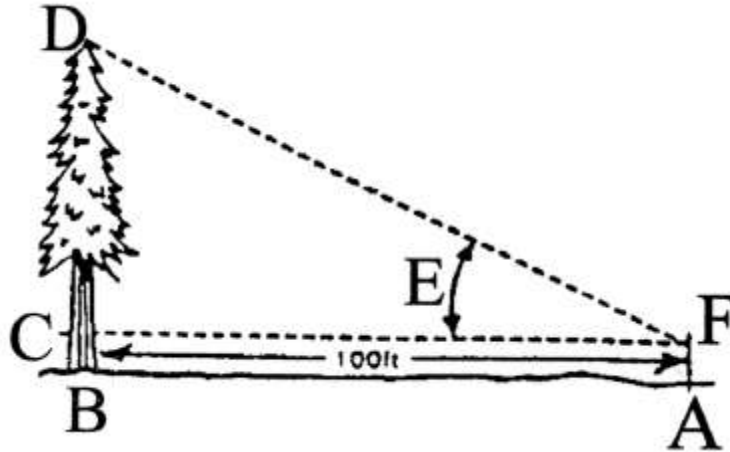
100 feet is the most convenient baseline distance if you are using the percent scale on the clinometer. Back away from the tree 100 feet (from C to F or B to A on the diagram above). Sight the top of the tree (D) and read the percent (%) scale. This reading represents the height of the tree from eye level (0% slope) to the top of the tree (i.e. from C to D). Now, sight on the base of the tree and read the percent scale again. This reading represents the height from eye level down to the base of the tree (B to C). Add this reading to the first reading you took. This will give you the total tree height (i.e. the distance from B to D).

If you are measuring a tree in dense underbrush where it is difficult or impossible to see the top or base of the tree at 100 feet, you might want to use the *topo scale* (the other scale on the clinometer, which is labeled **1/66**). To measure tree height using this scale, you use the same procedure described in the example above, except that you will stand only 66 feet away from the tree (instead of 100 ft.) and you will read the topo scale (1/66 feet) on the clinometer instead of the percent scale.

DETERMINING BOARD FOOT VOLUME

A volume table gives the number of board feet in a tree. This is an estimate of the amount of lumber that can be cut from an individual tree. On the next page is a board foot volume table similar to the one used at the Forestry Contest.

SCRIBNER BOARD FOOT VOLUME TABLE

DBH	TOTAL HEIGHT (feet)										
	50	60	70	80	90	100	110	120	130	140	150
8	11	18	27	36	44	53	58	67			
10	21	32	43	54	65	76	87	93	102		
12	33	50	69	88	105	124	140	155	176	196	225
14	47	74	101	129	156	175	201	224	252	282	318
16	92	102	136	170	205	235	265	296	330	368	410
18	127	154	174	215	257	294	329	367	411	460	510
20	148	177	213	262	311	355	397	440	494	558	618
22	203	221	275	319	366	420	470	520	584	658	732
24	232	286	332	374	425	489	545	607	676	758	848
26			353	436	492	562	626	692	770	866	971
28				498	578	638	708	782	870	975	1096
30				597	652	712	792	876	972	1088	1228
32					672	756	884	980	1102	1234	1286

To use the table, look down the d.b.h. column (on the left side) to find the d.b.h. to the nearest inch of the tree you measured. Then look across the tree height line to find the height to the nearest ten feet of the tree you measured. Look down that column – the point where it intersects with the d.b.h. row is the board foot volume of your tree.

Contest Tip #1: Rounding Tree Heights
Tree heights are listed in 10-foot increments in the volume table
Therefore, round your tree height measurement to the nearest 10-foot increment. For example, a tree measuring 85 to 90 feet tall must be rounded up to 90 feet and you will use the 90 column to determine its volume from the table. A 90 to 94-ft. tree should be rounded down to 90. For a second example, if you measure a tree that is 78-ft tall, you will round up to 80 ft tree height to determine its volume using the volume table.

Contest Tip #2: Rounding Diameters
D.B.H. is given in 2-inch increments in the volume table
The standard practice for rounding diameters at the Forestry Contest is as follows: All trees between 11.1 inches and 13.0 inches d.b.h. are considered to be in the 12-inch diameter class. The 14-inch diameter class includes trees between 13.1 inches and 15.0 inches d.b.h. A 16-inch diameter class includes trees 15.1 to 17.0 inches (and so on).

Use these sample questions to practice using the volume table [correct answers are given at the bottom of the page]:

1) A tree has a d.b.h. of 20.0 inches and a total height of 100 feet. Read down the d.b.h. column to "20" and then read across the tree height row to "100." What is the board foot volume of this tree?

2) How many board feet would be contained in a tree that measures 14.8 inches d.b.h. and 73 feet tall?

3) What is the board foot volume of a tree that is 85 feet tall and 15.2 inches d.b.h.?

4) You measure a tree that is 25.5 inches d.b.h. and 99 feet tall. What is the board foot volume of this tree?

5) How many board feet are in a tree that measures 9.3 inches d.b.h. and 64 feet tall?

Answer 1 = 355 board feet. The d.b.h. and height do not need to be rounded, so the volume can simply be read from the table by running your finger across from row "20" to the answer in column 100 (go down column "100" to row "20")

Answer 2 = 101 board feet. The d.b.h. is rounded down to 14 (because it's less than 15.0 and more than 13.1). The height is rounded down to 70 (the nearest 10-ft increment). Read across row "14" and down column "70" to find the answer.

Answer 3 = 205 board feet. The tree height is rounded up to 90 feet (it measures between 85 and 94 feet, so the nearest 10-ft increment is 90 ft.). The diameter is rounded up to 16 d.b.h. (because it is greater than 15.1 inches and less than 17.0 inches).

Answer 4 = 562 board feet. The diameter of 25.5 inches rounds up to 26 (the nearest 2-inch diameter class) and the height rounds up to 100 feet (the nearest 10-ft increment).

Answer 5=32 bf. The 9.3-inch d.b.h. rounds up to 10 inches d.b.h. and the 64-ft height rounds down to 60.