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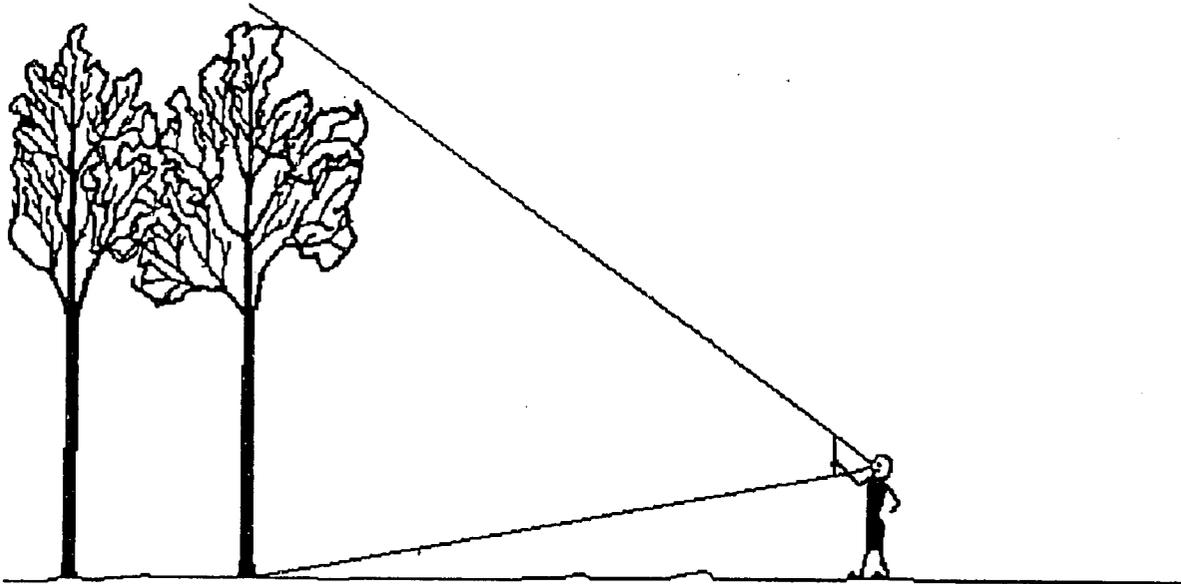


# FORESTRY PLANNING & DEVELOPMENT PROJECT

Government of Pakistan-USAID

## MEASURING FARM GROWN

### TREES



TECHNICAL NOTE NO. 8

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Technical Assistance Team

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# MEASURING FARM GROWN TREES

Technical Note No. 8

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## INTRODUCTION

Farmers know how to determine the physical quantity and market value of their agricultural crops. It is important that they also be able to make these determinations for their tree crops.

Part of the social forester's job is to teach and advise farmers on techniques for estimating the volume and value of their tree crops. The measurement of farm trees is not difficult. Every tree farmer should be familiar enough with the standard methods of measuring trees to go into his or her woodlot with a forester and determine the contents of its standing trees, or the contents of logs, poles and fuelwood after they have been cut.

A simple tool has been devised to assist the farmer in this procedure. Its proper application will enable the person to measure accurately any farm woodlot, regardless of whether it is standing on the stump or converted into logs or other usable products.

## WHAT MEASUREMENTS ARE NEEDED

To determine the quantity of wood in a tree, the following measurements are required.

1. Diameter of the tree at breast height in inches;
2. Total height of the tree in feet; and
3. Height of the tree to a merchantable point in feet.

From these measurement, the cubic foot volume or the weight of the wood in the tree can be determined. A tool which can be used to take these measurements is the "jungle" stick.

## PROCEDURE NO. 1

### MEASURING THE DIAMETER OF TREES

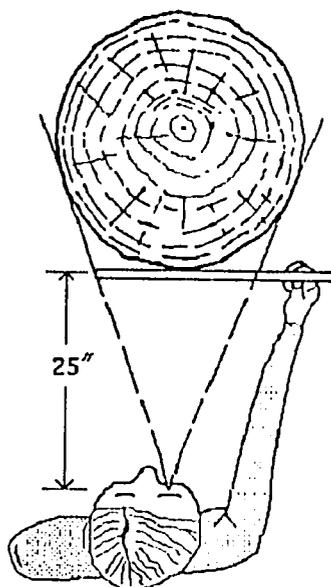
Foresters always measure the diameters of standing trees at breast height (4.5 feet from the ground) outside of bark. This measurement is usually called DBH (Diameter Breast High). The "jungle" stick can be used to take this measurement. The measurement scale on the "jungle" stick is calibrated to measure the diameter of the tree directly in inches if the stick is held 25 inches from your eye. The step-by-step procedure for using the "jungle" stick follows:

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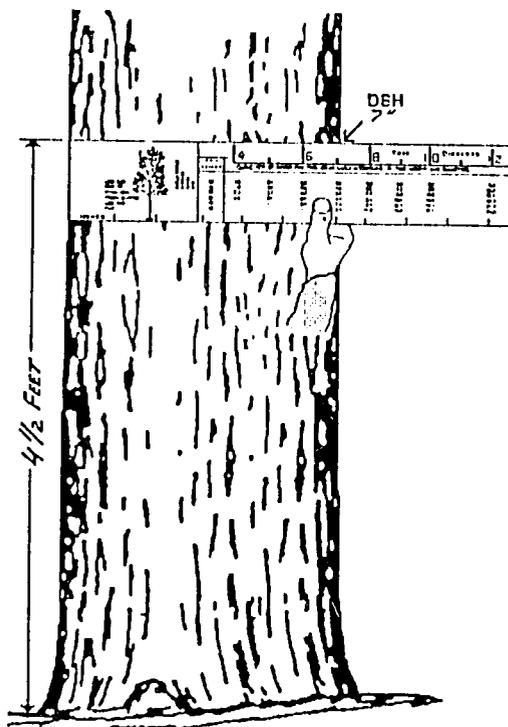
<sup>1</sup>Field Demonstration Forester and <sup>2</sup>Chief of Party, respectively, Winrock International, Forestry Planning and Development Project, GOP-USAID, Islamabad.

1. Hold the stick in the right hand between the thumb and the first two fingers and hold it against the trunk of the tree at DBH. Be sure that the distance from your eye to the stick is exactly 25 inches. Since the stick is 25 inches long it can be used to check this distance.
2. Adjust the stick so that by sighting past the left end of the stick your line of sight is tangent to the outside edge of the tree.
3. Without moving your head sight with the same eye past the right-hand side of the tree and read DBH directly from the stick at the point where your line of sight crosses the stick. Read the diameter to the nearest full inch.

This procedure is illustrated in Figure 1. In this illustration, the DBH of the tree is 7 inches.



Vertical View



Front View

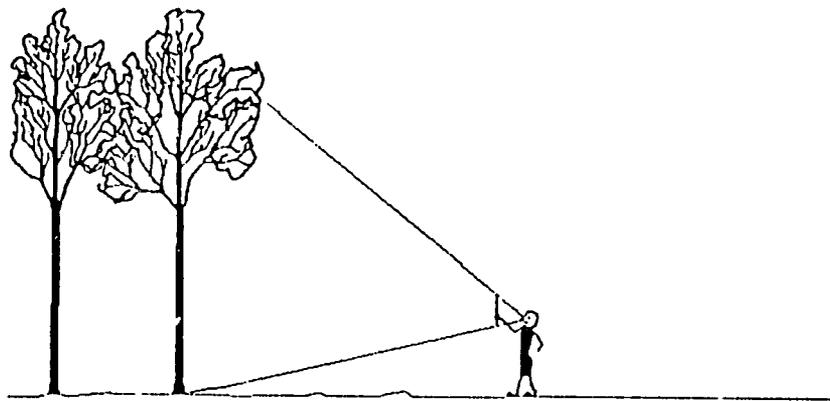
FIGURE 1. Using the "jungle" stick to measure tree diameter.

## PROCEDURE NO. 2

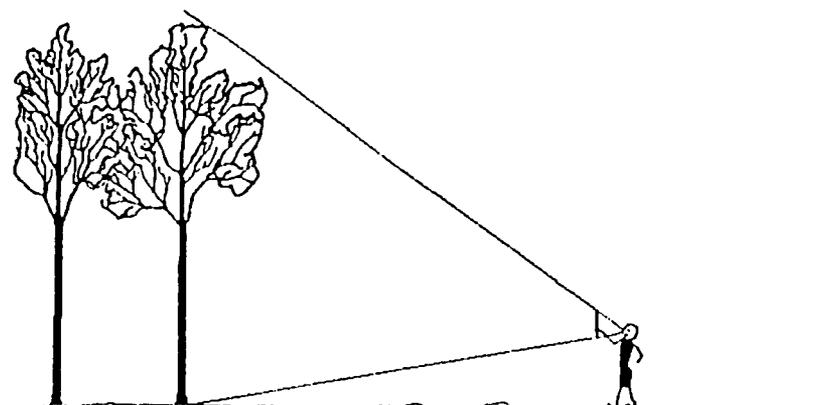
### MEASURING THE TOTAL HEIGHT OF TREES

The total height of a tree is a measurement foresters frequently require in the determination of a tree's cubic foot volume or weight. The "jungle" stick can be used to take this measurement. When it is used in the measurement of tree height it must be held 25 inches from your eye. The step-by-step procedure for using the "jungle" stick follows:

1. Estimate the height of the tree in feet and pace that estimated distance away from the tree to a position where both the top and base of the tree can be seen.
2. Standing at that point, hold the stick erect in the right hand, balancing it using the thumb and index finger. It should be held 25 inches from the eye and straight up and down.
3. Sight past the bottom of the stick to the base of the tree and, without moving your head, sight over the top of the stick towards the top of the tree.
  - a. Move away from the tree if your line of sight over the top of the stick is less than the height of the tree (Figure 2a). Continue to move backwards until your line of sight past the bottom of the stick to the base of the tree and over the top of the stick to the top of the tree exactly brackets the tree (Figure 2b).



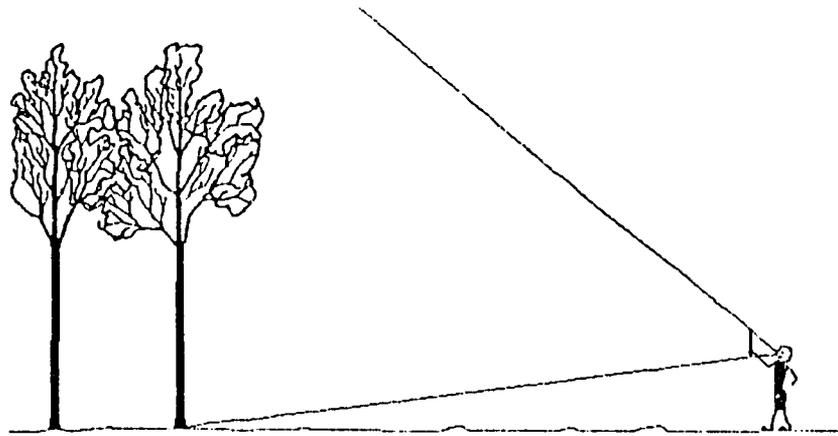
(a)



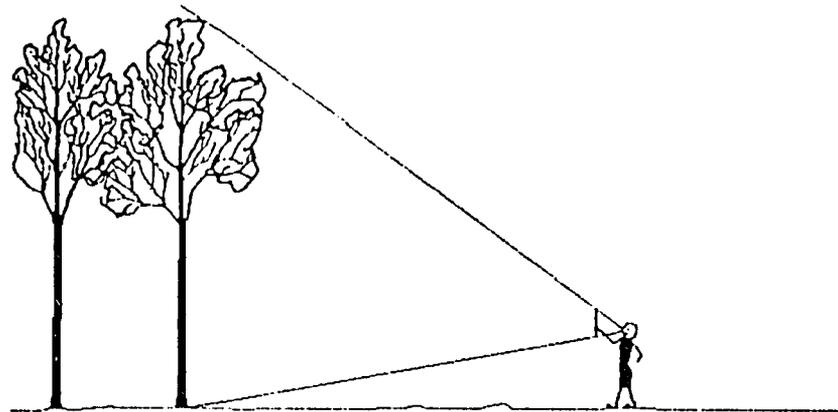
(b)

FIGURE 2. Measurement of tree height (a) too close, and (b) correct position.

- b. Move towards the tree if your line of sight over the top of the stick is greater than the height of the tree (Figure 3a). Continue to move forward until your line of sight past the bottom of the stick to the base of the tree and over the top of the stick to the top of the tree exactly brackets the tree (Figure 3b).



(a)



|<----- Height of Tree ----->|

(b)

FIGURE 3. Measurement of tree height (a) too far, (b) correct position.

4. The height of the tree is equal to the distance from you to the tree (Figure 3b). Measure or pace this distance to determine the height of the tree.

## MEASURING THE HEIGHT OF TREES TO A MERCHANTABLE POINT

On occasion, an individual may wish to know the length of the tree's main stem to some merchantable point. For example, the length of the tree's stem without branches. The "jungle" stick can also be used to take this measurement. Procedure No. 2 described above is used to determine this length with the following modification:

Move towards or away from the tree until your line of sight past the bottom of the stick to the stump of the tree and over the top of the stick to the merchantable point exactly brackets the tree's merchantable length (Figure 4).

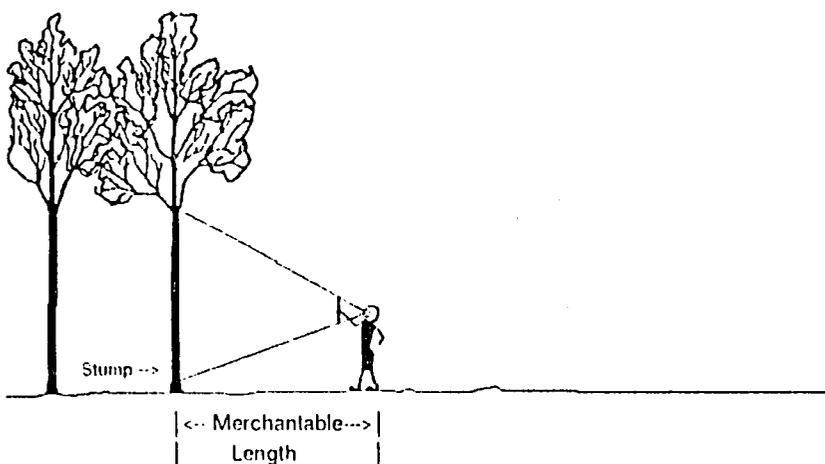


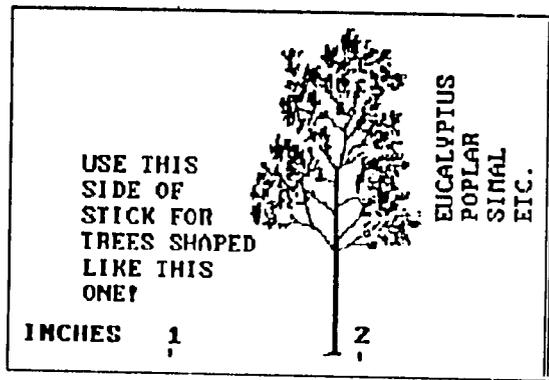
FIGURE 4. Measurement of tree height to a merchantable point.

### PROCEDURE NO. 3

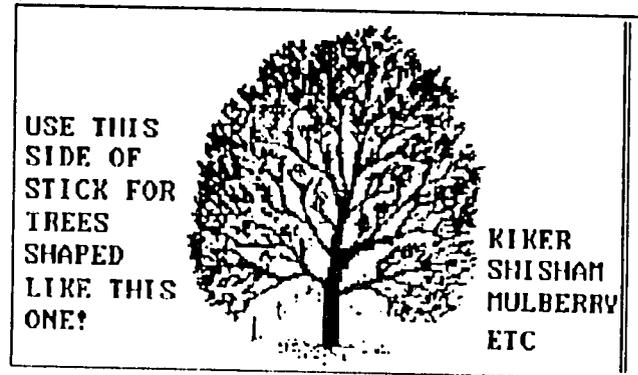
#### DETERMINING THE VOLUME OF TREES

Once the diameter and the total height of the tree have been measured, the tables on the "jungle" stick can be used to estimate the CF (cubic foot volume) of the tree. These tables give the total CF of wood in the tree, including limbs above 1 inch in diameter. The step-by-step procedure for determining CF from the table on the "jungle" stick follows:

1. Select the proper tree shape based on the two different pictures of trees that are shown on alternate sides of the stick. One side of the stick has a picture of trees which look like Eucalyptus, poplar and semal (Figure 5a) and the other side has a picture of trees which look like kiker, shisham and mulberry (Figure 5b). Select the side which has a picture of a tree most similar to the one that you are measuring.



(a)



(b)

FIGURE 5. Tree shapes.

- Based on the tree's shape, its DBH and its total height you can read its volume in CF directly from the table on the "jungle" stick. The procedure is illustrated in Figure 6. In this illustration, a Eucalyptus tree 7 inches in diameter and 50 feet in total height contains 5.6 cubic feet.

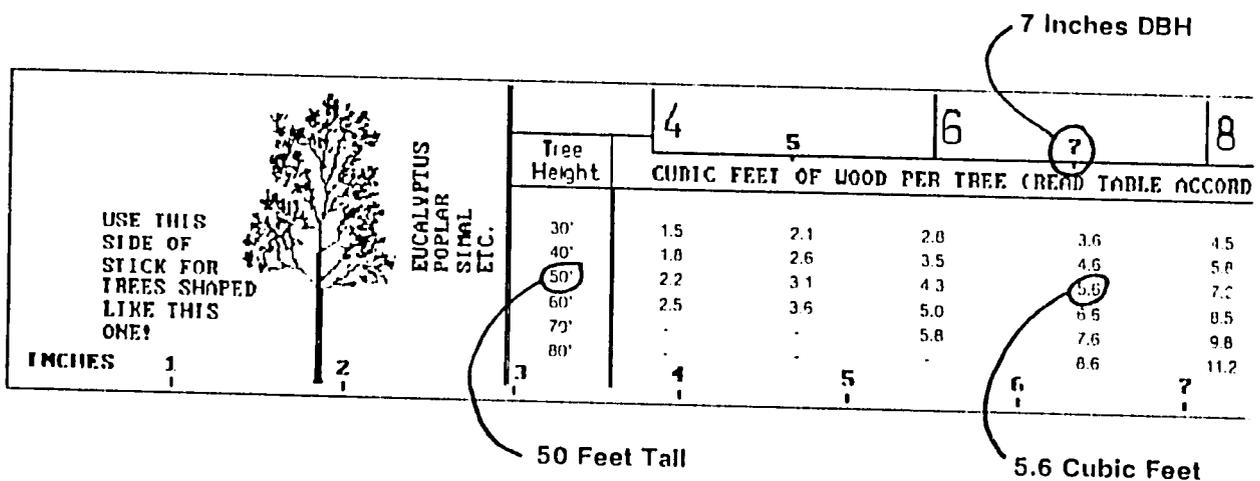


FIGURE 6. Determining the volume of a tree from the "jungle" stick's table.

#### PROCEDURE NO. 4

#### DETERMINING THE WEIGHT OF TREES

If you know the total cubic foot volume of a tree, it is possible to estimate its weight. The freshly cut weight of a tree will vary based on its species and whether it is fast growing in or slow growing. Once cut, its weight will depend on the length of time it has been stacked and allowed to dry. Table 1 gives factors which can be used to convert the total cubic foot volume of a tree to kilograms or maunds.

**TABLE 1. Weight - Cubic Foot volume conversion factors.**

Species	Freshly Cut		Air Dry (6 weeks)	
	Kg/CF	Mds/CF	Kg/CF	Mds/CF
Allanthus	20.4	0.51	13.6	0.3
Bakain	24.5	0.61	16.3	0.4
Ber	29.2	0.73	19.5	0.5
Eucalyptus	30.0	0.75	20.0	0.5
Kiker	35.4	0.88	23.6	0.6
Mango	23.8	0.60	15.9	0.4
Mulberry	32.7	0.82	21.8	0.5
Poplar	20.4	0.51	13.6	0.3
Semal	17.6	0.44	11.7	0.3
Shisham	34.1	0.85	22.7	0.6
Siris	26.6	0.66	17.7	0.4
Tamarix	29.2	0.73	19.5	0.5
Willow	24.5	0.61	16.3	0.4

(Source: PFI, Properties and uses of Pakistan Timber, 1986).

The step-by-step procedure for determining the weight of the tree in kilograms from the cubic foot volume of the tree follows:

1. Compute the CF of the tree using the procedure outlined above.
2. Select the appropriate weight - cubic foot conversion factor from Table 1.
3. Multiply the tree's cubic foot volume by its weight - cubic foot conversion factor. For example, a freshly cut Eucalyptus tree which has 5.6 CF of volume would weigh approximately 168 kilograms or 4.2 maunds.

$$5.6 \text{ CF} \times 30.0 = 168 \text{ kilograms}$$

$$5.6 \text{ CF} \times 0.75 = 4.2 \text{ maunds}$$

## PROCEDURE No 5

### DETERMINING THE VOLUME OR WEIGHT OF SEVERAL TREES

A farmer will probably sell several trees at one time. In order to get a fair market value, it is important that the farmer knows the approximate volume or weight of the tree crop being sold. The step-by-step procedure for determining volume or weight of the tree crop being sold follows:

1. Identify and mark the trees that you wish to sell.

2. Use the "jungle" stick to measure the DBH of each tree you marked. By species, tally its diameter by 1-inch DBH classes in row 3 of Table 2.
3. For the first tree you encounter of each species in each DBH class, use the "jungle" stick to measure the total height of that tree. By species, record its total height under its DBH in row 2 of Table 2.
4. Repeat steps 2 and 3 until all the trees that were marked have been measured.
5. For each species, based on the total height recorded in Table 2, use Procedure No. 3 given above to read the cubic foot volume associated with each DBH class and record it in row 4 of Table 2.
6. For each species, compute the total cubic foot volume of the trees marked in each DBH class by multiplying the tree tally you have entered in row 3 of Table 2 by the cubic foot volume you recorded in row 4 of Table 2 at step 5. Record this value in row 5 of Table 2.
7. For each species, obtain the total cubic foot volume marked by summing each of the values obtained in step 6. Record this value under Total in row 5 of Table 2.
8. For each species, convert total cubic foot volume of the trees being sold to kilograms or maunds by selecting the appropriate conversion factor from Table 1 and multiplying it by the value recorded under Total in row 5 of step 7.

An illustrative example of this procedure follows:

TABLE 2. Tree volume computational and recording form.

1) Species: Eucalyptus

DBH	4	5	6	7	8	9	10	11	12	TOTAL
2) Total Height	30	50		50	70					
3) Tree Tally	10	15		3	2					
4) CF/tree	1.5	3.1		5.6	9.8					
5) Volume	15.0	46.5		16.8	19.6					97.9

Total weight of trees sold = 97.9 cubic feet x 30.0 = 2937 kilograms  
 = 97.9 cubic feet x 0.7 = 73.4 maunds

A blank copy of Table 2 is provided in Appendix A.

A standard Bedford truck will carry 350 to 380 cubic feet of roundwood. Bigger trees and straighter trees give larger loads. Using the conversion factors in Table 1, a load of fresh eucalyptus will weigh about 10,800 kg (270 maunds) and a load of fresh poplar will weigh about 7,350 kg (184 maunds) when properly stacked.

# APPENDIX A

## Tree volume computation and recording form.

1) Species:

DBH	4	5	6	7	8	9	10	11	12	TOTAL
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- 2) Total Height
- 3) Tree Tally
- 4) CF/tree
- 5) Volume

1) Species:

DBH	4	5	6	7	8	9	10	11	12	TOTAL
-----	---	---	---	---	---	---	----	----	----	-------

- 2) Total Height
- 3) Tree Tally
- 4) CF/tree
- 5) Volume

1) Species:

DBH	4	5	6	7	8	9	10	11	12	TOTAL
-----	---	---	---	---	---	---	----	----	----	-------

- 2) Total Height
- 3) Tree Tally
- 4) CF/tree
- 5) Volume

1) Species:

DBH	4	5	6	7	8	9	10	11	12	TOTAL
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- 2) Total Height
- 3) Tree Tally
- 4) CF/tree
- 5) Volume

1) Species:

DBH	4	5	6	7	8	9	10	11	12	TOTAL
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- 2) Total Height
- 3) Tree Tally
- 4) CF/tree
- 5) Volume