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FOREST MEASUREMENTS I

Diameter in Inches
1
2
3
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"TIMBER ESTIMATING AND LOG SCALING"

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NAME _____
CLUB _____ COUNTY _____
PROJECT YEAR _____

RECORD BOOK 54
COOPERATIVE EXTENSION SERVICE
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FOREST MEASUREMENTS I

Timber Estimating and Log Scaling

by

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and

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Objective of Project

The objective of this project is to enable club members to learn how to estimate the volume of timber in an individual tree, the volume of an area of standing timber, and the board-foot contents of individual logs and thereby to determine value of trees and logs through actual measurement.

It can be taken by any boy or girl on whose farm there is a stand of trees or by any boy or girl who obtains permission to make the measurements in an area of timber. No cutting of timber is involved. The project can be very helpful to parents in making an estimate of the volume and value of the timber in their woodland. It will also be very valuable to any club member who wishes to enter the 4-H Forestry Demonstration Contest - "Timber Estimating and Log Scaling." The project may be repeated for credit by taking the measurements in another woodland or in another part of the same woodland.

Time of Year To Do Project

This project may be done at any time of the year. However, unless you can identify trees without their leaves, the plot measurements should be taken before the leaves drop in fall or after they leaf out in the spring.

Requirements

1. Learn to use the V.P.I. Tree and Log Scale Stick.
2. After you are satisfied you can take accurate measurements with the Stick, take the diameter and height measurements on all trees 6" and over in DBH (diameter breast high or 4 1/2' from the ground level) on a 1/5 acre plot. Record the measurements on the form provided for this purpose.
3. Obtain local prices for sawlog and pulpwood stumpage and compute the value of the trees on your sample area.

4. Measure a stack of pulpwood and compute the number of cords of pulpwood in it.
5. Scale 10 sawlogs with your Scale Stick and record the length, diameter, and board feet of each log on the form provided for them.
6. Make a comparison of the board-foot volume of the logs you have scaled, using the International $\frac{1}{4}$ " Kerf Log Rule and the Doyle Log Rule for the comparison.
7. Read Extension Bulletin #282, "What is the Value of My Standing Timber?." Discuss with your father and mother the three most important things that can be done to improve the stumpage value of the future crops of timber on your farm. Explain these things in approximately 100 words.
8. By means of a talk before a group, a demonstration, or an exhibit, describe some of the things you have learned in this project.

Equipment Needed for Project

1. The Tree and Log Scale Stick. You may get this on loan from the county Extension agent's office or you may purchase one for 35¢.
2. A 75' tape or a rope 60' or more in length.
3. Paint, string, or chalk to identify trees to be measured on your plot.
4. Timber Estimating and Log Scaling Project and Record Book.
5. Pencil.

Reference Material

1. Extension Publication 560, How to Use the V.P.I.&S.U. Tree and Log Stick
2. Extension Publication 55, What is the Value of My Standing Timber ?

Suggestions for Scoring Project

1. Quality of work (computations in Project Book should be checked for accuracy)	50 points
2. Completeness of work	40 points
3. Neatness of Project Book	<u>10 points</u>
Total	100 points

Awards

Club members who have completed this project may compete with other club members for a county award.

REQUIREMENT NO. 1 - Learn to use the Tree and Log Scale Stick.

Instructions for the Tree and Log Scale Stick are contained in Publication 560, "How to Use the V.P.I. Tree and Log Scale Stick." With the help of these instructions and with your leader to check your accuracy, you should soon master the use of this rule.

For trees 12" and over, the height should be estimated in the number of 16' logs to the merchantable top. This will be where the tree forks or where the trunk narrows down to 6". For trees 6" to 12" in diameter, heights should be measured in 5' pulpwood sticks to a 4" top.

If several club members are taking this project together, learning will be quicker and more fun if all work together. To aid in checking the accuracy of the measurements, the club leader could have a few readily accessible trees measured as a standard of accuracy.

Incidentally, the Scale Stick may be used to measure the height of barns or other buildings, flag poles, etc. Stand 66' away from the object to be measured as you would for a tree and use the pulpstick scale. Estimate to the nearest $\frac{1}{2}$ stick and multiply the number of sticks by 5 to get the height of the object in feet.

REQUIREMENT NO. 2 - After you are satisfied you can take accurate measurements with the Stick, take the tree diameter and height measurements on all trees 6" and over on a 1/5 acre plot. Record the measurements on the form on pages 5 and 6.

When the volume of timber on a small woodland is computed, all trees of pulpwood size and larger are usually measured. For large areas, or plantations

of uniform size and stocking, a number of plots may be taken and the volume on the plots related to the whole area. This requirement will give you practice in both making a timber inventory and in laying out plots.

These plots may also serve another purpose if you are interested. By laying out a plot with permanent marks on the trees you can measure the volume growth of the trees on the plot. This can be done by measuring the trees on the plot a second time 2 or 3 years after the original measurements. By subtracting the latest volumes from the first ones and dividing this difference by the number of years of growth between measurements, the average annual increase in growth will be determined.

Instructions for Laying Out Plot

1. Select an area in your woods which has some trees more than 12" in diameter on it, if possible. If the area is well stocked, there should be at least 15 to 20 sawlog-size trees on the 1/5 acre plot.
2. Drive a stake in the ground for the center of the plot.
3. The plot is to be circular in size. With a measuring tape or a rope which has a length of 52.7' (the radius of the 1/5 acre plot) marked off on it, identify all trees in the plot with chalk, string, or some other mark. If any trees are on the boundary line of the plot, count them in only if more than half the tree diameter is in the plot.
4. After you have determined and marked the trees which fall within your plot, take the diameter and height measurements of the trees 6" and over and record on the form (pages 5 and 6).
5. After you have measured all the trees on your plot and have recorded the diameter and height of each tree on the form, record the board-foot volumes for the sawlog trees (trees 12" and more) in the board-foot column of the form and the cubic-foot volumes of the pulpwood trees (trees 6" to 12" in diameter) in the cubic-foot column of the form. The board-foot volumes may be taken from the tree scale side of your Stick or from table 1 on the back of the Project Book. The cubic-foot volumes may be taken from table 3 in the back of the Project Book or from the table in Publication 560, "How to Use the V.P.I. Tree and Log Scale Stick."

After you have totaled each column, compute the volume of timber that would be on one acre if it had the same stocking as your 1/5 acre plot. Also, convert the cubic-foot volume of pulpwood to 5' units. A pulpwood unit is a stack of pulpwood 8' long by 4' high by 5' wide. A legal cord is 8' x 4' x 4'.

Form 1. Tree Measurements and Volumes

Tree Number	Species	DBH, inches	# of logs, trees 12" and up	# of pulp sticks, trees 6" to 12"	Board-foot volume, trees 12" and up	Cubic-foot volume, trees 6" to 12"
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
Subtotal						

Form 1 Continued

Tree Number	Species	DBH inches	# of logs, trees 12" and up	# of pulp sticks, trees 6" to 12"	Board-foot volume, trees 12" and up	Cubic-foot volume, trees 6" to 12"
			Subtotal from previous page			
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						
32						
33						
34						
35						
36						
37						
38						
39						
40						
Total volume in plot						
Multiply by 5 to get volume of 1 acre						
Divide cubic feet by 112 to get 5' units of pulpwood						

REQUIREMENT NO. 3 - Obtain local prices for sawlogs and pulpwood stumpage and compute the value of the trees on your sample acre.

1. M Bd. Ft.* of sawlog timber on sample acre _____
(Take from total on Form 1, on page 6)
Multiply by
Value of sawlog stumpage per M Bd. Ft. _____
Total value of sawlog stumpage _____
2. Number of 5' units on sample acre _____
(Take from total on Form 1, page 6)
Multiply by
Value of pulpwood stumpage per unit _____
Total value of pulpwood stumpage _____
3. Total value of sawlog stumpage _____
Total value of pulpwood stumpage _____
Total value of all trees 6" and over on
sample acre _____

*point off 3 decimal places to left to change board feet to M Bd. Ft. (abbreviation for thousand board feet). For example, 12372 board feet = 12.372 M Bd. Ft.

REQUIREMENT NO. 4 - Measure a stack of pulpwood and compute the number of units in it.

The volume of a stack of pulpwood, or a truck load, is found by multiplying length of the stack by width by height.

Since pulpwood used by Virginia pulpmills is 5' long, the width of the stack should always be 5'.

The height of a stack of pulpwood may vary. Usually several measurements are taken and averaged to get an average height for the stack. After the average height has been computed, the total cubic feet in the stack can be obtained.

After the number of cubic feet of pulpwood has been determined, divide by 160 (cubic feet per 5-foot unit) to get the number of units in the stack.

Computations:

Length of stack in feet	_____
Width of stack in feet	_____
Average height of stack in feet	_____

____ (Length) x ____ (width) x ____ (height) = ____ Total cubic feet.

____ (Total cubic feet \div 160 (cubic feet per unit)) = ____ Total number of units in stack.

REQUIREMENT NO. 5 - Scale 10 sawlogs with your Scale Stick and record the length, diameter and board feet (International Log Rule) in Form 2.

Instructions for measuring sawlogs will be found in Publication 560 "How to Use the V.P.I. Tree and Log Scale Stick," and in Farmers Bulletin #1210, "Measuring and Marketing Farm Timber."

Form 2: Sawlog Measurements

Column						
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Log Number	Species	Log Length (feet)	Log Diameter (inches)	Board Feet, Int. Log Scale (Take from Stick)	Board Feet Doyle Log Scale Table 2	Difference in Board Feet
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
Total board feet, International scale					XXXXXXXXXX	XXXXXXXXXX
Total board feet, Doyle Scale						XXXXXXXXXX
Total difference in board feet						

REQUIREMENT NO. 6 - Make a comparison of the board-foot volume of the logs you have scaled, using the International Log Rule and the Doyle Rule for comparison.

The purpose of a log rule is to measure logs in terms of the number of board feet of 1" lumber that can be cut from logs.

There are many log rules in use in different parts of the country. In Virginia the one most commonly used is the Doyle Log Rule. The Virginia Division of Forestry, in marking and estimating timber, uses the International Log Rule - the same one you have on your Scale Stick.

There is a great difference in most log rules. The Doyle Rule is not accurate for logs of small diameters. You can determine this for yourself when you make your comparisons. The International $\frac{1}{4}$ " Kerf Log Rule is designed for mills using a $\frac{1}{4}$ " Kerf ($\frac{1}{4}$ " of wood is lost in sawdust with each board cut), gives the most accurate measure of the amount of 1" lumber that can be cut from logs of all sizes. It should be adopted by buyers and sellers alike because it is the most accurate of all rules.

1. Using the Doyle Log Rule (table 2), find the board-foot volumes of the logs you have scaled. Record these volumes in column 6 on the form on page 9.
2. Compute the difference in board feet between the 2 rules by subtracting the lower volume from the higher and recording the difference in column 7.
3. Complete the computations at the bottom of the table.
4. At \$25 per thousand board feet for sawlogs, how much more would you make on the logs you scaled if sold by the International Log Rule? \$ _____

Table 1. - Contents of logs, in board feet, by the International $\frac{1}{4}$ " log rule

Contents according to length of log					
Diameter of small end of log, inside bark, (inches)	8'	10'	12'	14'	16'
	Bd. ft.	Bd. ft.	Bd. ft.	Bd. ft.	Bd. ft.
5-----	5	5	10	10	10
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

Table 2 - Contents of logs, in board feet, by the Doyle log rule.

Contents, according to length of log					
Diameter of small end of log, inside bark, (inches)	8'	10'	12'	14'	16'
	Bd.ft	Bd.ft	Bd.ft.	Bd.ft.	Bd.ft.
5-----	0	1	1	1	1
6-----	2	2	3	3	4
7-----	4	5	7	8	9
8-----	8	10	12	14	16
9-----	12	16	19	22	25
10-----	18	22	27	31	36
11-----	24	31	37	43	49
12-----	32	40	48	56	64
13-----	40	51	61	71	81
14-----	50	62	75	87	100
15-----	60	76	91	106	121
16-----	72	90	108	126	144
17-----	84	106	127	148	169
18-----	98	122	147	171	196
19-----	112	141	169	197	225
20-----	128	160	192	224	256
21-----	144	181	217	253	289
22-----	162	202	243	283	324
23-----	180	226	271	316	361
24-----	200	250	300	350	400

Table 3. Tree Scale for Pulpwood

Cubic-foot* volume table--including bark

For average second-growth southern pine

Contents in cubic feet of trees having

the following number of 5' bolts

Diameter Breast High (inches)	Volume in cubic feet (including bark)											
	1	2	3	4	5	6	7	8	9	10	11	12
4	0.436	0.72	1.00									
5	0.845	1.25	1.65	2.05	2.46	2.86						
6		1.82	2.38	2.94	3.49	4.05	4.61	5.16	5.72			
7			3.20	3.94	4.68	5.43	6.17	6.92	7.66			
8			4.09	5.06	6.03	6.99	7.96	8.93	9.89	10.9	11.8	12.8
9				6.30	7.52	8.75	9.97	11.2	12.4	13.6	14.9	16.1
10				7.66	9.17	10.7	12.2	13.7	15.2	16.7	18.3	19.8
11				9.13	11.0	12.8	14.7	16.5	18.3	20.2	22.0	23.9
12				10.7	12.9	15.1	17.3	19.5	21.7	23.9	26.1	28.3
13				12.4	15.0	17.6	20.2	22.8	25.4	28.0	30.6	33.2
14				14.3	17.3	20.3	23.3	26.4	29.4	32.4	35.5	38.5
15							26.7	30.2	33.7	37.2	40.7	44.2
16							30.3	34.2	38.2	42.2	46.2	50.2

* To convert the cubic-foot volume to cords, divide by:

90 for standard cords 4' x 4' x 8'

112 for 160-ft. units 4' x 5' x 8'

126 for 180-ft. units 4½' x 5' x 8'

