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Research Project No. 7, Estimating the Dry Weight of Individual Loblolly Pine Trees Planted in East Texas

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ESTIMATING THE DRY WEIGHT
OF
INDIVIDUAL LOBLOLLY PINE TREES
PLANTED IN EAST TEXAS

by
Thomas J. Wiswell
Jock A. Blackard
J. David Lenhart

REPORT NUMBER 7
TO
PARTICIPATING COMPANIES
IN THE
EAST TEXAS PINE PLANTATION RESEARCH PROJECT

A STUDY OF
LOBLOLLY AND SLASH PINE PLANTATIONS
IN
EAST TEXAS

CENTER FOR APPLIED STUDIES
SCHOOL OF FORESTRY
STEPHEN F. AUSTIN STATE UNIVERSITY
NACOGDOCHES, TEXAS 75962

Janis Lenhart 1985

This is the seventh in a continuing series of reports describing results from the East Texas Pine Plantation Research Project.

Subject and content of each ETPRP report is regional in scope and of particular interest to loblolly and slash pine plantation owners in East Texas.

Any suggestions, ideas or comments will always be welcomed.

Support from the participating companies...
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This report is based on work by:

1. Mr. Thomas J. Wiswell during the Spring '86 semester, as a doctoral student at SFASU on a T. L. L. Temple Fellowship.
2. Mr. Jock A. Blackard, as a Graduate Assistant.
3. Dr. J. David Lenhart.

J. David Lenhart
Project Director
October 16, 1986

ESTIMATING THE DRY WEIGHT
OF
INDIVIDUAL LOBLOLLY PINE TREES
PLANTED IN EAST TEXAS

by

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ABSTRACT. Equations are presented to estimate the dry weight in pounds of the wood in the stem and branches of individual loblolly pine trees planted on site-prepared land in East Texas.

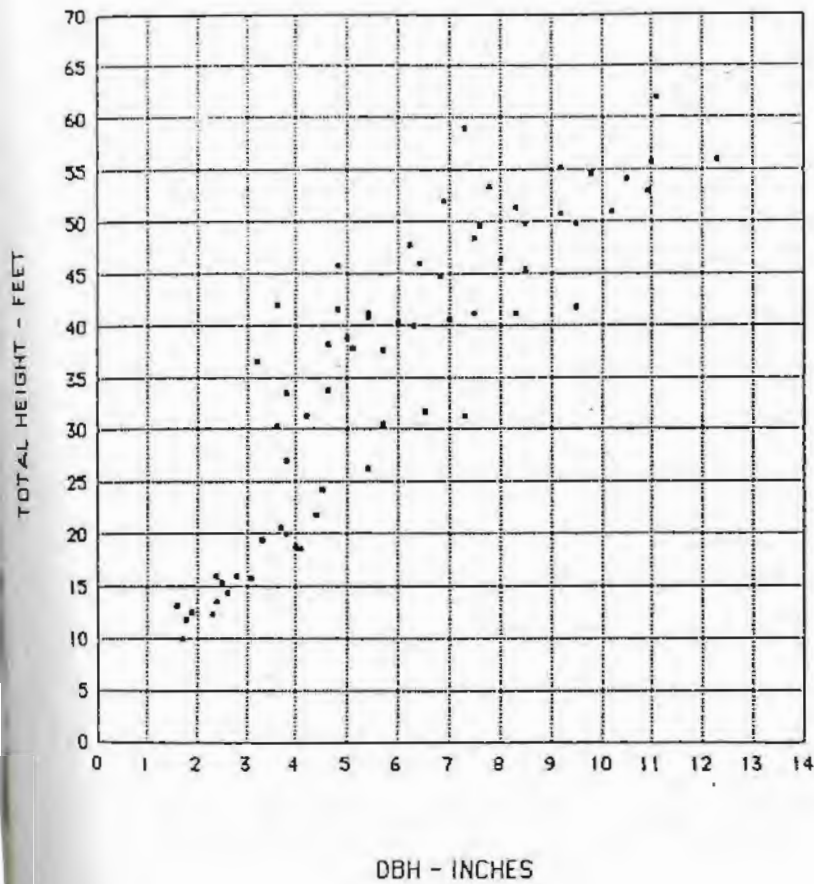
INTRODUCTION

The estimation of the content of individual trees is a principal component in the measurement process to determine per acre yields. In particular, the content of individual trees is a value needed in the last stages of the diameter distribution yield prediction method. Also, tree content information is useful in timber cruising.

In this report, we present equations to estimate the dry weight in pounds of individual planted loblolly pines on non-old-fields in East Texas as:

1. Complete Tree Dry Weight Wood, Bark and Needles: CTDWW.
2. Complete Tree Dry Weight only: CTDWW.
3. Total Stem Dry Weight Wood only: TSDWW.
4. Partial Stem Dry Weight Wood only: PSDWW.

By appropriate subtraction, the dry weight of wood in the branches can be determined. In addition, differences between total stem and partial stem values can be obtained for various multiple-product computations.



NUMBER OF LOBLOLLY PINE SAMPLE TREES
BY DBH AND HEIGHT. n = 65 trees.



LOBLOLLY
n = 65 trees

Number of sample trees by species and county in Texas.

COMPLETE TREE DRY WEIGHT ESTIMATION

Plottings of CTDWW over dbh (D) and total tree height (H) indicated a model originally suggested by Schumacher and Hall (1933) as

$$\text{Tree content} = b_0 D^{b_1} H^{b_2} \quad (1)$$

represented the relationships seen in the plottings.

Non-linear regression analysis of the data set produced the following prediction equations as

$$\text{CTDWW} = 0.060286D^{2.126861}H^{0.970500}, \quad (2)$$

with $R^2 = 99\%*$.

* All R^2 values in this report were calculated using non-linear regression results as:

$$R^2 = ((n-1)(\text{std dev dep var})^2 - \text{Residual SS}) / ((n-1)(\text{std dev dep var})^2) (100)$$

PARTIAL AND TOTAL STEM DRY WEIGHT ESTIMATION

In a dissertation by McTague (1985), a new tree content estimation model was presented, that has several desirable properties as

1. Treats total stem content as a special case of partial stem content.
2. Predicts partial stem content between stump and any upper stem diameter limit.
3. Convertible to a well-behaved taper function.
4. Suitable for estimating green or dry weight of the total or partial stem.

Subsequently, Pienaar and others (1985) developed a variation of the original McTague model as

$$\begin{aligned} \text{Content wood only in the stem} &= b_0 D^{b_1} H^{b_2} \\ &- b_3 (d^{b_4} / D^{b_4} - 2)(h - 4.5), \end{aligned} \quad (3)$$

where d = upper stem diameter a , b .

TABLE 1. ESTIMATED DRY WEIGHT OF WOOD ONLY IN THE STEM TO SPECIFIED UPPER DIAMETER LIMITS FOR INDIVIDUAL LOBLOLLY PINE TREES ON NON-OLD-FIELD PLANTATIONS IN EAST TEXAS.

DBH (IN)	UPPER STEM DIAMETER (IN)	TOTAL TREE HEIGHT (FEET)						
		20	30	40	50	60	70	80
2	0	4						
4	0	17	28					
	2	15	25					
6	0		60	86	115			
	2		58	84	112			
	4		45	66	89			
8	0			149	198	250		
	2			146	195	247		
	4			133	178	226		
	6			98	133	170		
10	0				301	381	464	
	2				299	378	461	
	4				285	361	440	
	6				248	315	387	
12	0					536	654	776
	2					534	651	773
	4					519	634	753
	6					481	589	701
	8					409	503	603
14	0					716	873	1037
	2					714	871	1034
	4					702	856	1017
	6					668	817	972
	8					606	743	886

LITERATURE CITED

- McTague, J. P. 1985. Growth and yield of slash and loblolly pine in the state of Santa Catarina, Brazil. Univ. of Ga., Ph.D. Diss. 219 p.
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