10-1986

Research Report No. 6, Estimating Green Weight of Individual Loblolly Pine Trees Planted in East Texas

Thomas J. Wiswell

Jock A. Blackard

J. David Lenhart
Arthur Temple College of Forestry and Agriculture, Stephen F. Austin State University

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

by

Thomas J. Wiswell

Jack A. Blackard

J. David Lenhart

REPORT NUMBER 6

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

October, 1986

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

Subject and content of each ETPPRP 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...

Champion International Corporation,

International Paper Company and

Temple-EssTex, Inc.

is gratefully appreciated.

* * * * * * * * *

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. Jack A. Blackard, as a Graduate Assistant.
3. Dr. J. David Lenhart.

J. David Lenhart

Project Director

October 16, 1986

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

by

Thomas J. Wiswell
Former doctorial candidate, School of Forestry, SFASU

Jock A. Blackard
Former graduate student, MSF '85, School of Forestry, SFASU

J. David Lenhart
Professor, School of Forestry, SFASU

ABSTRACT. Equations are presented to estimate the green weight in pounds of the wood, bark and needles 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 green weight in pounds of individual planted loblolly pines on site-prepared land in East Texas as:

1. Complete Tree Green Weight Wood, Bark and Needles: CTGWWBN.
2. Complete Tree Green Weight Wood and Bark: CTGWWB.
3. Complete Tree Green Weight only: CTGWW.
4. Total Stem Green Weight Wood and Bark: TSGWWB.
5. Partial Stem Green Weight Wood and Bark: PSGWWB.
6. Total Stem Green Weight Wood only: TSGWW.
7. Partial Stem Green Weight Wood only: PSGWW.

By appropriate subtraction, the green weight of needles and bark in the branches can be determined. Green weight of bark on stem can also be calculated by subtraction. In addition, differences between total stem and partial stem values can be obtained for various multiple-product computations.

TREE MEASUREMENTS

A total of 68 loblolly pine sample trees located in the buffer zones of 34 of our 178 ETPPRP permanent plots in loblolly pine plantations were felled during January - March, 1986. Two trees were sampled per plantation. Three of the trees were eventually eliminated due to sampling errors. The distribution of the remaining 65 sample trees by county and by dbh and height classes is shown in Figure 1.

Prior to felling a tree, the dbh and crown class were determined. After felling, the branches were removed and weighed. A typical branch was weighed with and without needles. Eight branch segments (12" long) were cut and weighed with and without bark.

At 3-foot cut points along the stem, dob was recorded. Then the stem was bucked into 3-foot long bolts. Each bolt was weighed. At the bottom of each bolt, a 1- to 2-inch disk was cut. Each disk was weighed with and without bark. In addition, dib for each disk was noted. The top stem segment was also weighed and considered part of the stem.

The necessary field data was now available to compute observed tree green weight of wood with and without needles or bark as:

1. Partial stem to the top of each successive bolt.
2. Total stem.
3. Branches.

Green weight of bark and needles in branches was calculated using appropriate ratios of branch sub-samples. Green weight of bark on stem was determined using ratios from the bolt disks.

PARTIAL AND TOTAL STEM GREEN WEIGHT ESTIMATION

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

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. Also, 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

Content wood only in the stem = $b_0 D^{b1} H^{b2}$

$$- b_3(d^{b4}/D^{b4} - 2)(h - 4.5), \qquad (5)$$

Where d = upper stem diameter o. b.

Equation (5) was used in non-linear regression analysis with a data set comprised of 745 cases of green weight wood and bark . The resulting equation is

$$PSGWWB = 0.060132D^{1.868148}H^{1.290705} - 0.121899d^{2.819859}D^{-0.819859}(H - 4.5) \quad (6)$$

with $R^2 = 98\%$.

If the value for the variable d (upper stem diameter o. b.) in Eq. 6 is set to zero (or the top of the stem), Eq. 6 collapses to

$$TSGWWB = 0.060132D^{1.868148}H^{1.290705}. \quad (7)$$

Equation (5) was also used in non-linear regression analysis with a data set comprised of 745 cases of green weight wood only . The resulting equation is

$$PSGWW = 0.052448D^{1.911549}H^{1.283176} - 0.114417d^{2.823696}D^{-0.823696}(H - 4.5) \quad (8)$$

with $R^2 = 98\%$

and

$$TSGWW = 0.052448D^{1.911549}H^{1.283176}. \quad (9)$$

Tables 1 and 2 show predicted green weight values for various combinations of D, H and d based on Eqs. 6 and 8, respectively.

TABLE 1. ESTIMATED GREEN WEIGHT OF WOOD AND BARK 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 LIMIT (IN)	TOTAL TREE HEIGHT (FEET)						
		20	30	40	50	60	70	80
2	0	10						
4	0	38	65					
	2	34	58					
6	0		138	200	266			
	2		133	193	257			
	4		102	150	203			
8	0			342	456	577		
	2			336	449	568		
	4			303	406	516		
	6			219	298	385		
10	0				692	876	1068	
	2				686	868	1060	
	4				650	825	1008	
	6				561	715	879	
12	0					1231	1502	1784
	2					1225	1495	1776
	4					1187	1450	1725
	6					1093	1339	1597
	8					920	1135	1362
14	0					1642	2003	2380
	2					1630	1997	2372
	4					1603	1957	2327
	6					1520	1860	2215
	8					1368	1680	2008

TABLE 2. ESTIMATED GREEN 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 LIMIT (IN)	TOTAL TREE HEIGHT (FEET)						
		20	30	40	50	60	70	80
2	0	9						
4	0	35	58					
	2	31	52					
6	0		127	183	244			
	2		122	177	236			
	4		93	137	184			
8	0			317	423	534		
	2			312	416	526		
	4			281	376	477		
	6			202	275	354		
10	0				648	818	997	
	2				642	812	989	
	4				609	771	941	
	6				525	668	820	
12	0					1160	1413	1677
	2					1154	1406	1669
	4					1119	1365	1621
	6					1030	1261	1502
	8					869	1070	1281
14	0					1557	1898	2252
	2					1552	1892	2245
	4					1521	1855	2203
	6					1443	1763	2097
	8					1301	1595	1904

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.

Pienaar, L. V., B. D. Shiver and J. W. Rheney. 1985. Revised stem volume and weight equations for site-prepared slash pine plantations. Univ. of Ga., Sch. of For. Resources, Plantation Manage. Res. Coop. Tech. Rep. No. 1985-5. 22 p.

Schumacher, F. X. and F. S. Hall. 1933. Logarithmic expression of timber-tree volume. J. Agr. Res. 47:719-734.