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# MERCHANDIZER: Adapting USLYCOWG to the Marketplace

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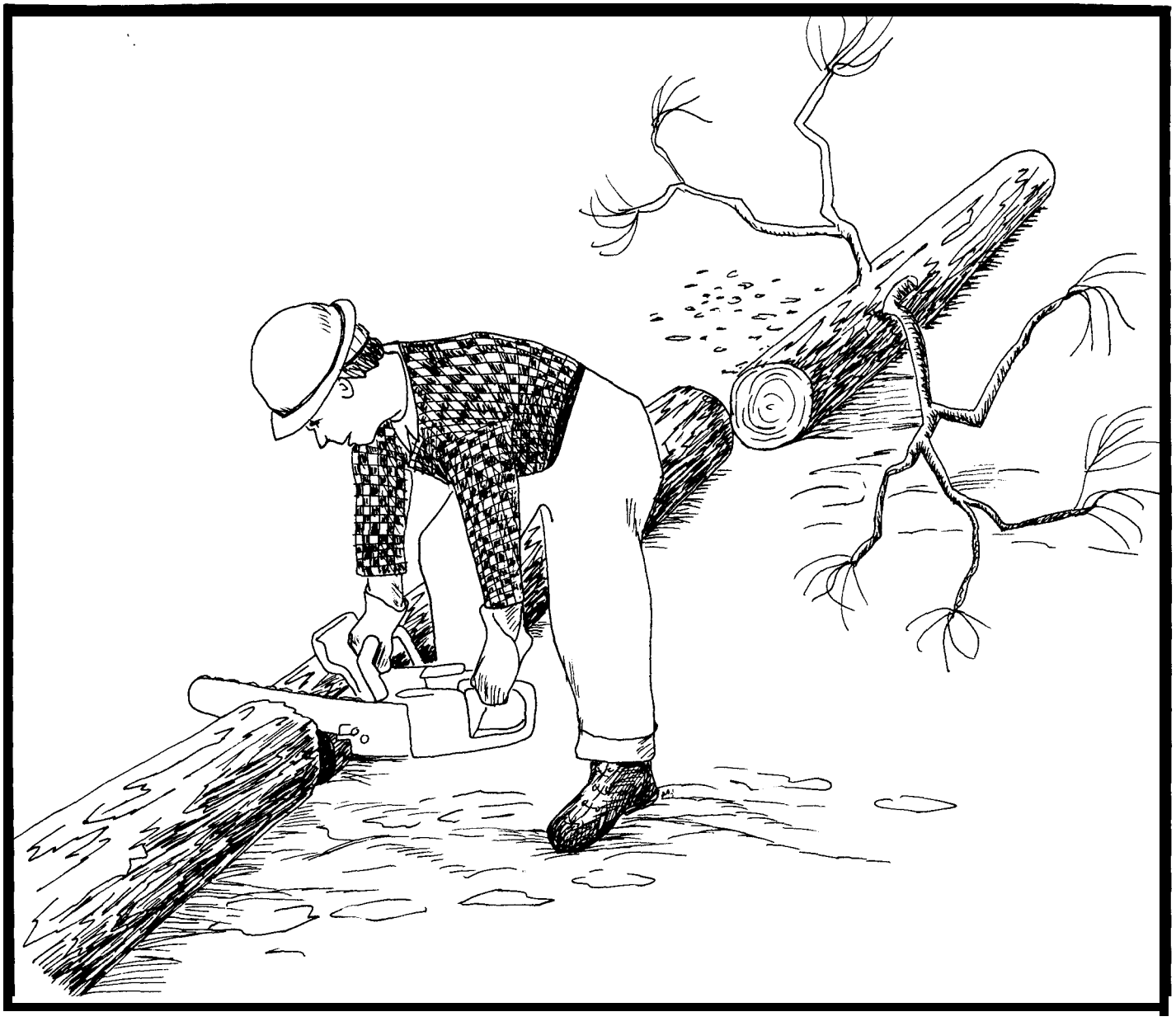

## SUMMARY

USLYCOWG is a computer model that estimates yields in cubic feet per acre from unthinned slash and loblolly pine plantations established on cutover sites in the West Gulf states. However, most stumpage in the West Gulf region is sold in other volumetric units, such as cords, tons, and board feet, or by weight. A series of computer routines has been developed that converts USLYCOWG yields in cubic feet to tons of fuel chips, cords of pulpwood and chip'n'saw logs, and board feet of sawtimber, or weights of all products in tons.

# MERCHANDIZER: Adapting USLYCOWG to the Marketplace

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## INTRODUCTION

Deciding to invest in regeneration or other forest management activities often depends heavily on projected growth of a stand and on yield of stumpage at harvest time. If stumpage volumes are denominated in common marketing units, it is easier to assign market values to the volumes and calculate the economic consequences of management alternatives.

Dell et al. (1979) and Feduccia et al. (1979) developed a computer model (USLYCOWG) that projects the growth and yield of unthinned slash and loblolly pine stands growing on cutover sites in the West Gulf region. USLYCOWG requires the user to enter site index, stand age, and seedling density. The specified density may be either the number of trees surviving at the given stand age or the number of trees planted. If the latter, the user must also specify whether Coile's and Schumacher's survival model or an ideal survival model developed by USLYCOWG's authors is to be used to calculate the number of stems surviving at the stand age desired. From these parameters, the model can project stand diameter and height distributions over time. Diameters, heights, and ages are used, in turn, by tree taper equations to calculate bole volumes in cubic feet for one-inch diameter classes. This report assumes that the reader is familiar with USLYCOWG. Copies of the research papers describing USLYCOWG in detail are available from the Southern Station.

Although the cubic foot is a commonly understood measure of volume, it is not a volume unit of commerce in the marketplace for southern timber. Wood is valued and sold in other volumetric units. For example, pulpwood and chip'n 'saw logs are commonly sold by the cord. Sawlogs are most often sold by the board foot according to the Doyle, International Quarter Inch or Scribner Decimal C Log Rules. Weight scaling and whole tree logging have contributed to the popularity of tons as a unit of commerce, for not only fuelwood chips, but also for pulpwood and logs. Market prices and stumpage bids are denominated in these merchantable units.

Simple multiplicative conversion of USLYCOWG cubic foot volumes to merchantable units is not possible. USLYCOWG estimates cubic foot volumes-say for the 12-inch diameter class—from stump height (0.5 feet) to a 2-, 3-, or 4-inch top (both inside and outside bark). But USLYCOWG is unable to determine what portion of the cubic foot volume of the trees in the 12-inch class should be valued as sawtimber versus the portion to be valued as pulpwood.

A set of computer routines, collectively called MERCHANDIZER, has been developed to convert USLYCOWG yields into merchantable volume measures. These cover the various products that can be obtained from trees in each diameter class. The routines are designed to be embedded in USLYCOWG because they call up existing USLYCOWG subroutines. The purpose of this report is to describe how the MERCHANDIZER routines function and what additional input data are required by MERCHANDIZER. Appendix A is a listing of the USLYCOWG program written in PDP-11 FORTRAN showing the additional program code (in italics) needed to incorporate the MERCHANDIZER routines.[1] Appendix B contains sample USLYCOWG output produced by the program after MERCHANDIZER is incorporated.

[1]The latest version of USLYCOWG incorporating MERCHANDIZER can be obtained in machine-readable form if you send the author a blank g-track computer tape. The program will be written on your tape in ASCII (1600 bpi, 80 characters per record, 1 record per block, unlabelled) and returned to you. If you require different tape characteristics, please write to the author before sending your tape. The mailing address is USDA Forest Service, T-10210 Postal Service Building, 701 Loyola Avenue, New Orleans, Louisiana 70113.

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## APPROACH

Data Required.-MERCHANDIZER requests a second line of input data following the first line called by USLYCOWG. The input specifications, variable names, and default values are listed in table 1.

*Conversion* Philosophy.-MERCHANDIZER begins by calculating the diameter inside bark (dib) at a height of 8.75 feet from the ground, given the diameter at breast height, outside bark (dbh), total tree height, age, and associated taper equation parameters. A height of 8.75 feet represents a stump height of 0.5 feet, a minimum log length of 8.0 feet and a 0.25 foot trim allowance for bucking. The dib at 8.75 feet is first compared to the minimum sawlog scaling diameter, SAWTBR (see table 1). If the dib at 8.7 feet exceeds SAWTBR, the program branches to calculate sawlog volume. If dib does not exceed SAWTBR, but is larger than the maximum pulpwood scaling diameter (PULPMX), the program branches to calculate chip'n'saw log volume. If dib is less than PULPMX, the program branches to calculate pulpwood volume for the entire bole up to the minimum pulpwood scaling diameter (PULPMN).

When the program branches to the sawlog portion of the routine, the height to SAWTBR is calculated. If this height is less than 16.75 feet, the height is rounded to the next lower even-numbered foot (BOLT length). The dib at (BOLT + 0.75 feet)[2] becomes the scaling diameter for the alternative sawlog volume equations. Volumes are calculated for three log rules from:

$$\text{Board Feet Doyle} = \frac{(\text{DIB}-4.)^2(\text{BOLT})}{16} \quad (1)$$

$$\text{Board Feet International} = \frac{(0.796\text{DIB}^2 + 1.375\text{DIB} - 1.23\text{BOLT}}{16} \quad (2)$$

$$\text{Board Feet Scribner} = 0.0494(\text{BOLT})(\text{DIB})^2 - 0.124(\text{BOLT})(\text{DIB}) - 0.269\text{BOLT} \quad (3)$$

The volume from (3) is rounded to the nearest 10 feet to obtain board feet according to the Scribner Decimal C Log Rule. Sawtimber volume in cunits is calculated from the USLYCOWG taper equations.

If the height to SAWTBR exceeds 16.75 feet, then progressive 16.25 foot bolts are cut and scaled as 16 foot logs. When the height is less than 16.25 feet, but more than 8.25 feet remains until SAWTBR is reached, the length is reduced to the next lowest even-numbered foot, the scaling dib calculated, and volume calculated. The height to the top of this final bolt becomes the base height for the next product-either chip'n 'saw logs or pulpwood. When less than 8.25 feet remains, the total height to the top of the last 16-foot log becomes the base height for the next product.

When PULPMX equals or is less than one inch smaller than SAWTBR, no chip'n'saw volumes are calculated and the program branches from the sawtimber volume section directly to the pulpwood volume section. If SAWTBR and PULPMX differ by more than one inch, the height to PULPMX is calculated and the difference between that height and the height to the top of the last sawtimber log becomes the length of the chip'n'saw log. The total chip'n 'saw length is rounded to the next lower even-numbered foot and a cubic foot volume is calculated from the USLYCOWG taper equations. This result is divided by CONV(3)—one of the several conversion factors listed in table l-to obtain chip'n'saw volume in cords. If the bole length for a chip'n'saw log is less than 8.25 feet, no chip'n'saw volumes are calculated. Instead, the program branches to calculate pulpwood volumes using the height to the top of the last sawtimber log as the base of the pulpwood section of, the bole.

Once sawtimber and/or chip'n'saw volumes are calculated and the height to the base of the pulpwood section of the bole is determined, height to PULPMN is calculated. The difference between height to PULPMN and height to the base of the pulpwood section of the bole is the pulpwood bole length. The cubic foot volume of the bole section is calculated from the USLY-COWG taper equations and divided by CONV(2) to obtain the pulpwood volume in cords.

Fuel chip volume is calculated as the difference between the total cubic foot volume, ground to tip outside bark (calculated by USLYCOWG) and the sum of the sawtimber, chip'n'saw, and pulpwood cubic foot volumes calculated by MERCHANDIZER. Because the MERCHAN-DIZER volumes are all calculated based on dibs, fuel chips include not only that portion of the total stem above PULPMN, but also the volume of the bark sheathing the stem below PULPMN. If a clean chip volume (no bark) is desired, a comment card in the program listing describes

[2]The 0.75 feet includes a stump height of 0.5 feet and a 0.25 foot trim allowance.

Table 1.—*MERCHANDIZER inputparameters*

| Column number | Variable format | Variable name | Description and default values |
|---|---|---|---|
| 1-4 | F4.1 | PULPMN | Minimum pulpwood diameter, inside bark, small end. The default is 3.0 inches. |
| 5-8 | F4.1 | PULPMX | Maximum pulpwood diameter, inside bark, small end. The default is 9.5 inches. |
| 9-12 | F4.1 | SAWTBR | Minimum sawlog diameter, inside bark, small end. The default is 9.5 inches. |
| 13-15 | 13 | IRULE | Sawtimber log scaling rule. Enter -2 for weight scaling; -1 for volume in cunits; 0 for board feet Doyle, the default; +1 for board feet International Quarter Inch; or +2 for board feet Scribner Decimal C. |
| 16-19 | F4.0 | CONV(1) | Fuelwood (dirty chips) conversion factor. Cubic feet per ton. The default is 90. |
| 20-23 | F4.0 | CONV(2) | Pulpwood conversion factor. If IRULE is -2, cubic feet per ton with a default of 26. Otherwise, cubic feet per cord with a default of 80. |
| 24-27 | F4.0 | CONV(3) | Chip'n'saw conversion factor. If IRULE is -2, cubic feet per ton with a default of 30. Otherwise, cubic feet per cord with a default of 90. |
| 28-31 | F4.0 | CONV(4) | Sawtimber conversion factor. If IRULE is -2, cubic feet per ton with a default of 30. Not used otherwise, with a default of 0. |
| 32-38 | F7.2 | VALUE(l) | Fuelwood (dirty chip) value. Dollars per green ton. The default is $0.00 for all VALUE(I). |
| 39-45 | F7.2 | VALUE(2) | Pulpwood stumpage value. Dollars per green ton if IRULE = -2; dollars per cord otherwise. |
| 46-52 | F7.2 | VALUE(3) | Chip'n'saw stumpage value. Dollars per green ton if IRULE = -2; dollars per cord otherwise. |
| 53-59 | F7.2 | VALUE(4) | Sawtimber stumpage value. If IRULE = -2, dollars per green ton; if IRULE = -1, dollars per cunit; if IRULE is 0, +1, or +2, dollars per thousand board feet, applicable log rule. |
| 60-62 | 13 | ICULLP | Percentage of sawtimber volume in a diameter class less than or equal to ICULLD that is unsuitable for sawing lumber. Expressed as an integer between 5 and 100. The default is 0. |
| 63-65 | 13 | ICULLD | The maximum sawtimber diameter class where ICULLP percent of the volume is unsuitable for manufacturing sawn lumber. Default is SAWTBR rounded down to the next whole inch. |
| 66-68 | 13 | ICULLV | The product class where the sawtimber cull volume is added. Enter -1 for fuelwood chips; 0 for pulpwood, the default; or +1 for chip'n'saw logs. |

how to save the USLYCOWG total volume ground to tip *inside* bark instead of total volume ground to tip outside bark for chip calculations. The total chip volume in cubic feet is divided by CONV(l) to obtain chip weight in tons.

If IRULE is -2, the program reports weights instead of volumes. The total cubic foot volume of each product in each diameter class is calculated, as just discussed. However, CONV(4) is used to convert the volume into a green wood tonnage. The result is an "inside bark" weight, because inside bark taper equation coefficients are used to calculate the volumes. The total weight for each product is then increased by 10 percent to account for bark. Sample output is included in Appendix B.

In some stands, a certain percentage of the sawtimber-sized trees are unsuitable for manufacturing sawn lumber. For example, a loblolly pine stand infested with fusiform rust at an early age often has a certain percentage of butt logs deformed by rust cankers. A cull deduction option has been included in the routines to allow the user to specify the percentage of the total sawtimber volume in a particular diameter class that is cull and the maximum sawtimber diameter class where this cull percentage applies. When the user enters an integer between 5 and 100 and the ICULLP value, the routine subtracts ICULLP percent of the sawtimber volume, whatever the scaling rule selected, from the diameter class total. Then, ICULLP percent of the saw-

timber cubic foot volume is added to chip'n'saw volume if ICULLV is set at 1, to pulpwood volume if ICULLV is set at 0, or to fuelwood chips if ICULLV is set at -1.

## DISCUSSION

MERCHANDIZER adds no precision to USLYCOWG yield estimates. It only converts the estimated yields to merchantable units. The flexibility inherent in being able to specify diameter cutpoints and cubic foot conversion factors for the various stumpage categories can be detrimental if unrealistic diameter limits or conversion factors are entered. The routine looks for wildly inaccurate limits or factors (less than 50 percent of the default value), and, if found, replaces them with the default values. If the user has better estimates of the cord or tonnage conversion factors than the defaults, they should be used. The default values were obtained from Koch's (1972) review of the literature.

MERCHANDIZER assumes the midpoint of the dbh class is the diameter of the average tree in the class, calculates volume for that average tree, and multiplies those volumes by the number of trees in the class to get diameter class volume totals. If USLYCOWG were altered to generate diameter distributions having smaller dbh class widths, some marginal improvement in the precision of volume estimates would occur. Wider dbh class intervals would result in poorer volume estimates, especially for sawtimber. However, one-inch classes should give estimates that are sufficiently precise for most users.

If one or more of the volume categories are not of interest, the diameter limits for that class should be set accordingly. For example, if a market for chip'n'saw logs does not exist in the user's area, SAWTBR and PULPMX should be equal. Merely setting chip'n'saw value equal to $0 will not result in chip'n'saw volumes being incorporated into either pulpwood or sawtimber volumes. Fuel chip volumes are always calculated.

MERCHANDIZER provides no information on log quality. Users desiring to know what proportion of chip'n'saw or sawtimber logs might be suitable for plywood peelers must look elsewhere for that information. However, if one knows, for example, that 60 percent of the logs exceeding 7.5 inches dib small end are suitable for veneer bolts and veneer bolts are bought on an MBF Doyle basis, then one could set SAWTBR at 7.5 inches and multiply the volume result by 60 percent to estimate veneer bolt volume. More precise estimates cannot be obtained from MERCHANDIZER.

The VALUEs entered need not be stumpage values. Prices for products delivered to the mill (FOB the mill) could also be used. Landowners who are vertically integrated wood growers, harvesters, and transporters could use MERCHANDIZER to estimate wood value per acre in terms of prices paid for wood delivered to the mill. Total value per acre of products priced F.O.B. the mill would allow cost analyses to include harvesting and transportation cost components in addition to stand establishment and management costs.

## CONCLUSION

MERCHANDIZER breaks down USLYCOWG cubic foot volumes by diameter class into four merchantable product categories. When dollar values are assigned to these volumes, land managers have a better basis for evaluating forest regeneration and stand management investments.

## LITERATURE CITED


Dell, T.R.; Feduccia, D.P.; Campbell, T.E.; Mann, W.F., Jr.; Polmer, B.H. Yields of unthinned slash pine plantations on cutover sites in the West Gulf region. Res. Pap. SO-147. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station: 1979.84 p.

Feduccia, D.P.; Dell, T.R.; Mann W.F., Jr.; Campbell, T.E.; Polmer, B.H. Yields of unthinned loblolly pine plantations on cutover sites in the West Gulf region. Res. Pap. SO-148. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station; 1979.88 p.

Koch, P. Utilization of the southern pines. Vol. 2 — Processing. Agric. Handb. 420. Washington, DC: U.S. Department of Agriculture; 1972. 2 vol.

# Appendix A

USLYCOWG Program Listing Incorporating MERCHANDIZER

(MERCHANDIZER PDP-11FORTRAN statements added to USLYCOWG are in italics)

```
C-------      YIELD TABLES AND STAND STRUCTURE FOR UNTHINNED SLASH
C-------      AND LOBLOLLY PINE PLANTATIONS ON CUT-OVER (UNPREPARED BUT
C-- -- - --   PROBLEM FREE) SITES IN THE WEST GULF COASTAL PLAIN.
C-------      REFERENCES:
C--se---
C-------           SLASH--
C-------                 DELL,T.R.,D.P.FEDUCCIA,T.E.CAMPBELL,W.F.MANN,JR.,
C -------                AND B.H.POLMER.
C-------
C-------                 1979. YIELDS OF UNTHINNED SLASH PINE PLANTATIONS
 --em---                 ON CUTOVER SITES IN THE WEST GULF REGION,
; - ----- -              U.S. DEP. AGRIC. FOR. SERV. RES. PAP. SO-147,
C-------                 84 P. SOUTH. FOR. EXP. STN., NEW ORLEANS, LA.
C-------
C-------           LOBLOLLY--
C -------                FEDUCCIA,D.P.,T.R.DELL,W.F.MANN,JR.,T.E.CAMPBELL,
C-------                 AND B.H.POLMER.
C ---- - - -
C-------                 1979. YIELDS OF UNTHINNED LOBLOLLY PINE PLANTATIONS
 --se---                   ON CUTOVER SITES IN THE WEST GULF REGION,
; -------                  U.S. DEP. AGRIC. FOR. SERV. RES. PAP. SO-148,
C-------                   88 P. SOUTH. FOR. EXP. STN., NEW ORLEANS, LA.
C-------
c-------           YIELD CONVERSIONS--
C-------                 GULDIN, R.W.
c-------
c-------                 1984. MERCHANDIZER: USLYCOWG-COMPATIBLE ROUTINES
c-------                   FOR CONVERTING CUBIC FOOT YIELDS TO STUMPAGE
c--em---                   VOLUMES, WEIGHTS, AND VALVES IN OTHER UNITS.
c-------                   U.S. DEP. AGRIC. FOR. SERV. GEN. TECH. REPT.
c-------                   SO-XX. XX P. SOUTH. FOR. EXP. STN. NEW ORLEANS, LA.
C-------
C -------      ACKNOWLEDGMENTS:
C-------         THIS COLLECTION OF ROUTINES IS ESSENTIALLY AN ADAPTATION
C ---- - --     OF ROUTINES PROVIDED BY SMALLEY AND BAILEY IN CONJUNCTION
 ----e--        WITH USDA FS RESEARCH PAPERS SO-96 AND SO-97. WE DID
c" ---- -- -    DIFFER FROM THEIR PROCEDURES IN THE APPLICATION OF TAPER
C-------        EQUATIONS TO DEFINE TREE VOLUME AND WERE ASSISTED IN THIS
C --- - - --     ENDEAVOR BY F. THOMAS LLOYD AND EDWARD W. WHITEHORNE OF
C-------        THE SOUTHEASTERN FOREST EXPERIMENT STATION. THE YIELD
C-------        CONVERSION ROUTINES WERE PREPARED ESPECIALLY FOR VSLYCOWG.
C-------
C-------
C ---- . - -
C-------        THIS PROGRAM READS TWO CONTROL CARDS AND PRINTS TABLES. INPUT
C - -- -- ----  UNIT IS INPT, OUTPUT UNIT IS IOUT. CONTROL CARD FORMAT :
C ----a--
  200 FORMAT (9I4,2F4.0,2I3)
  202 FORMAT(3F4.1,I3,4F4.0,4F7.2,3I3)
C-------
C------- FIRST CARD
C-------   COLUMN      VARIABLE                MEANING
C-----------------   --------    ----------------------------------
C-------    1- 4         ISB        SITE INDEX:    BEGINNING
C---- ----  5- 8         ISE                       ENDING
C-------    9-12         ISS                       STEP SIZE
C--e-s--
C-------   13-16         IAB              AGE:     BEGINNING
C-------   17-20         IAE       (YEARS SINCE    ENDING
C-------   21-24         IAS          PLANTING)    STEP SIZE
C -------                          (DO NOT USE PLANTATION
C-------                        AGES LESS THAN 6 YEARS)
C-------
C -------  25-28         INB      NUMBER STEMS:    BEGINNING  N
C-------   29-32         INE           (N)         ENDING N
C-------   33-36         INS         PER ACRE      STEP SIZE FOR N
C - -- ----
C-------   37-40        BAGE     BASE AGE FOR SITE INDEX(USUALLY 25)
```

```
C-------   41-44        ABAGE      ALTERNATE BASE AGE FOR CORRESPONDING
C -- -----                          SITE INDEX (OPTIONAL - USUALLY 50)
C-------
C --- --- -   45-47        KEY      =1 USE N AS NUMBER PLANTED AND
C-------                             CALCULATE SURVIVAL FROM IDEAL
C-------                             SURVIVAL MODEL
C- -- -- --                        =2 USE N AS NUMBER PLANTED AND
C-------                             CALCULATE SURVIVAL FROM COILE +
C-------                             SCHUMACHER 1964 MODEL
C --- ----                        =3 USE N AS NUMBER SURVIVING
C-------
C -------   48-50        KSPCE    =1 SLASH
C-------                         =2 LOBLOLLY
C-------
c------- SECOND CARD
C-----------------
c-------    1- 4        PULPMN   =XX.X MINIMUM PULPWOOD DIAMETER, I.B.,
C-------                             SMALL END.  DEFAULT IS 3.0 INCHES
c-------
c-------    5- 8        PULPMX   =XX.X MAXIMUM PULPWOOD DIAMETER, I.B.,
C-------                             LARGE END.  DEFAULT IS 9.5 INCHES
c-------
C-------    9-12        SAWTBR   =XX.X MINIM&l SAWLOG DIAMETER, I.B.,
c-a-----                             SMALL END.  DEFAULT IS 9.5 INCHES
c-------
c -------                          IF PULPMX.NE.SAWLOG, AND THESE TWO
c -------                          DIAMETERS ARE SEPARATED BY MORE THAN
c -------                          8.25 FEET OF BOLE, CHIP'N'SAW LOG VOLUMES
c -------                          ARE CALCULATED USING PULPMX AS MINIMUM
C-------                          CHIP'N'SAW LOG DIAMETER, INSIDE BARK,
c -------                          SMALL END.  OTHERWISE, THE BOLE BELOW
c-------                          SAWTBR DIAMETER IS CONVERTED TO PULPWOOD.
c -------
c -------   13-15         IRULE = -2 WEIGHT SCALE (ALL PRODUCTS IN TONS)
C ---- ---                        -1 SAWTIMBER VOLUME IN CVNITS
C-------                            0 IN BOARD FEET, DOYLE RULE (THE DEFAULT')
c -------                          +1 IN BOARD FEET, INTERNATIONAL 1/4 INCH
c -------                          +2 IN BOARD FEET, SCRIBNER DECIMAL C
C---- -- --
c -------   16-19        CONV(1) = FUELWOOD (DIRTY CHIPS) CONVERSION FACTOR
c -------                          CUBIC FEET PER TON. DEFAULT IS 90.
C -------
c -------   20-23        CONV(2) = PULPWOOD CONVERSION FACTOR (I.B.)
cm-e----                           IF IRULE IS -2, CUBIC FEET PER TON WITH A
C-------                           DEFAULT OF 26.  OTHERWISE, CUBIC FEET PER
c -------                          CORD WITH A DEFAULT OF 80.
C-------
c -------   24-27        CONV(3) = CHIP'N'SAW CONVERSION FACTOR (I.B.)
C-------                           IF IRULE IS -2, CUBIC FEET PER TON WITH A
c -------                          DEFAULT OF 30.  OTHERWISE, CUBIC FEET PER
c -------                          CORD WITH A DEFAULT OF 90.
c -------
c -------   28-31        CONV(4) = SAWTIMBER CONVERSION FACTOR
c -------                          IF IRULE IS -2, CUBIC FEET PER TON WITH A
c -------                          DEFAULT OF 30.  NOT USED OTHERWISE WITH A
C-------                           DEFAULT OF 0.
c -------
c-------   THE FOLLOWING DATA FIELDS FOR STUMPAGE VALUES ALL HAVE 2 DECIMAL
c-------   PLACES EMBEDDED TO READ COLLARS AND CENTS.  WHEN THE WEIGHT SCALING
c-------   OPTION IS SELECTED, ALL VALUES ARE IN DOLLARS PER GREEN TON.
cw-e----
c-------   32-38        VALUE(1) = FUEL (DIRTY) CHIP VALUE ($/GREEN TON)
C-------
c-------   39-45        VALUE(2) = PULPWOOD STUMPAGE VALUE ($/CORD)
C-------
c-------   46-52        VALUE(3) = CHIP'N'SAW STUMPAGE VALUE ($/CORD)
c-------
c-------   53-59        VALUE(4) = SAWTIMBER STUMPAGE VALUE
c-------                           IF IRULE = -1, $/CUNIT
C---a---                           IF IRULE = 0, +1 OR t2, $/MBF
```

```
C-------
C-------    60-62          ICULLP = PERCENTAGE OF SAWTIMBER-SIZED LOGS IN A
C-------                            SPECIFIED DIAMETER CLASS LESS THAN OR
C-------                            EQUAL TO DIAMETER CLASS 'ICULLD' THAT ARE
C-------                            UNSUITABLE FOR MANUFACTURING SAWN LUMBER.
C-------                            EXPRESSED AS AN INTEGER BETWEEN 5 AND 100
C-------                            WITH A DEFAULT OF 0.
C-------
C-------    63-65          ICULLD = THE MAXIMUM SAWTIMBER DIAMETER CLASS WHERE
C-------                            'ICULLP' PERCENT OF THE LOGS ARE UNSUITABLE
C-------                            FOR MANUFACTURING SAWN LUMBER. DEFAULT IS
C-------                            'SAWTBR' ROUNDED DOWN TO THE NEXT WHOLE INCH.
C-------
C-------    66-68          ICULLV = PRODUCT CLASS WHERE THE SAWTIMBER CULL
C-------                            VOLUME IS ADDED: -1 FOR FUELWOOD CHIPS;
C-------                            0 FOR PULPWOOD, THE DEFAULT; +1 FOR
C-------                            CHIP'N'SAW LOGS.
C-mm----

      INTEGER YIELD(2,9),CRATIO
      DIMENSION BASAL(2),ITREES(41),VOLT(2),VOLM(6),COEFLM(2,4),CONV(4),
     1COEFCR(2,4),BETA(4),STUMPV(2,9),VALUE(4),STUMPG(40,6),FYIELD(40)
C-------
C---------  INITIALIZE LAMBDA COEFFICIENTS --
C--em---      COLUMN 1 OF COEFLM IS SLASH
C-------      COLUMN 2 OF COEFLM IS LOBLOLLY
C-------
      DATA COEFLM/
     1   1.99830 ,         -5.6919  ,
     2 -0.85518 ,          2.2974  ,
     3  0.43365 ,          0.16988 ,
     4 -0.24879 ,          0.77763 /
C-------
C-------  INITIALIZE MEAN CROWN RATIO COEFFICIENTS --
C-------    COLUMN 1 OF COEFCR IS SLASH
C--e-w--    COLUMN 2 OF COEFCR IS LOBLOLLY
C-------
      DATA COEFCR/
     1 214.600 ,      248.63  ,
     2 -44.814 ,      -35.872 ,
     3 -27.049 ,      -43.565 ,
     4 -23.453 ,      -33.424 /
      DATA INPT,IOUT/5,1/
      OPEN (UNIT=1,NAME='USLY.OUT',TYPE='NEW',DISP='SAVE',
     1CARRIAGECONTROL='FORTRAN')
      READ (INPT,200) ISB,ISE,ISS,IAB,IAE,IAS,INB,INE,INS,BAGE,ABAGE,
     1                KEY,KSPCE
      READ (INPT,202) PULPMN,PULPMX,SAWTBR,IRULE,(CONV(I),I=1,4),
     1                (VALUE(I),I=1,4),ICULLP,ICULLD,ICULLV
C-------
C-------  CHECK FOR LIMITS ON AGE -- NOT LESS THAN 1
C--e-w--
      IF (IAB.LT.1.OR.IAE.LT.1) Go To 220
      GO TO (701,702),KSPCE
  701 WRITE (IOUT,101)
      GO TO 703
  702 WRITE (IOUT,201)
  703 WRITE (IOUT,301)
  101 FORMAT (1H1///33X,66HYIELDS BY DIAMETER CLASSES FOR UNTHINNED SLAS
     1H PINE IN PLANTATIONS)
  201 FORMAT (1H1///32X,69HYIELDS BY DIAMETER CLASSES FOR UNTHINNED LOBL
     1OLLY PINE IN PLANTATIONS)
  301 FORMAT (1H ,43X,47HON CUT-OVER (UNPREPARED BUT PROBLEM FREE) SITES
     1/63X,6HIN THE/55X,23HWEST GULF COASTAL PLAIN)
C-------
C-------  CHECK INPUT PARAMETERS AND BUILD MERCHANDIZER HEADER
C-------
      IF(PULPMX.LT.4.95) PULPMX=9.5
      IF(PULPMN.LT.1.95) PULPMN=3.0
      IF(SAWTBR.LE.5.95)  SAWTBR=9.5
```

```
      IF(SAWTBR-PULPMX).LT.1.) PULPMX=SAWTBR
      IF(IRULE.EQ.-2) GO TO 31
      IF(CONV(1).LE.49.) CONV(1)=90.
      IF(CONV(2).LE.49.) CONV(2)=80.
      IF(CONV(3).LE.49.) CONV(3)=90.
      IF(CONV(4).NE.0.)  CONV(4)=0.
      GO TO 32
   31 IF(CONV(1).LE.49.) CONV(1)=90.
      IF(CONV(2).LE.14.) CONV(2)=26.
      IF(CONV(3).LE.14.) CONV(3)=30.
      IF(CONV(4).LE.14.) CONV(4)=30.
   32 IF(IABS(IRULE).GE.3) IRULE=0
      DO 33 I=1,4
      IF(VALUE(I).LT.0.) VALUE(I)=0.
   33 CONTINUE
      CULLP=FLOAT(ICULLP)/100.
      IF(ICULLP.LT.5)ICULLD=INT(SAWTBR-1.)
      IF(IABS(ICULLV).GT.1) ICULLV=0
      WRITE(IOUT,119)
  119 FORMAT(/////54X,26(1H_)//)
      WRITE(IOUT,120) SAWTBR
  120 FORMAT(1H ,49X,34H*** MERCHANTABILITY PARAMETERS***,/54X,26(1H_),
     1///15X,67HSAWTIMBER VOLUMES ARE CALCULATED FROM STUMP HEIGHT (0.5
     2FEET) TO A ,F4.1,33H INCH TOP DIAMETER (INSIDE BARK)./10X,111HLOGS
     3 ARE BUCKED INTO 16 FOOT LENGTHS, PLUS A 3 INCH ALLOWANCE.  LOG S
     4CALING DIAMETER IS THE DIAMETER INSIDE  /10X,112HBARK AT THE SMAL
     5L END OF EACH LOG.  IF THE LAST LOG BEFORE REACHING THE MINIMUM SC
     6ALING DIAMETER EXCEEDS 8 FEET,/10X,110HBUT IS LESS THAN 16 FEET, I
     7T IS BUCKED TO THE NEXT SMALLER EVEN-NUMBERED FOOT OF LENGTH, PLUS
     8 TRIM ALLOWANCE. /10X,109HTHE REMAINING LENGTH IS DROPPED INTO THE
     9 NEXT LOWER STUMPAGE VALUE CATEGORY.  IF THE LAST LOG TO THE MINIM
     AUM /10X,106HSCALING DIAMETER IS LESS THAN 8 FEET LONG, THE ENTIRE
     BLENGTH IS DROPPED INTO THE NEXT LOWER STUMPAGE VALUE/10X,9HCATEGOR
     CY./)
      WRITE(IOUT,121) PULPMN,CONV(1),VALUE(1),PULPMN,PULPMX,CONV(2),
     1                VALUE(2),PULPMX,SAWTBR,CONV(3),VALUE(3)
  121 FORMAT(25X,8HSTUMPAGE,15X,8HDIAMETER,20X,6HVOLUME,20X,8HSTUMPAGE/
     127X,5HVALUE,17X,6HLIMITS,22X,4HUNIT,22X,5HVALUE/27X,5HCLASS,18X,4H
     2(IB),22X,7HFACTORS,19X,8HPER UNIT/25X,88(1H_)//25X,14HFUELWOOD CHI
     3PS,3X,10HLESS THAN ,F4.1,7H INCHES,8X,F4.0,11H CUBIC FEET,9X,2H $,
     4F7.2,8H PER TON/46X,13H NO BRANCHES ,17X,7HPER TON//25X,15HPULPWOO
     5D BOLTS ,6X,F4.1,2H -,F4.1,15X,F4.0,11H CUBIC FEET,7X,4H   $,F7.2,
     69H PER CORD/76X,8HPER CORD//25X,15HCHIP'N'SAW LOGS,6X,F4.1,2H -,F4
     7.1,15X,F4.0,11H CUBIC FEET, 7X,4H   $.F7.2,9H PER CORD/76X,8HPER CO
     8RD//)
      IF(IRULE) 342,343,344
  342 WRITE(IOUT,125) VALUE(4), SAWTBR
  125 FORMAT(25X,15HSAWTIMBER LOGS ,6X,12HGREATER THAN,13X,16H     CUNIT
     1S     ,8X,3H $,F7.2,10H PER CUNIT/46X,F4.1, 7H INCHES/25X,88(1H_))
      GO TO 349
  343 WRITE(IOUT,126) VALUE(4),SAWTBR
  126 FORMAT(25X,15HSAWTIMBER LOGS ,6X,12HGREATER THAN,13X,
     116HBOARD FEET DOYLE, 7X,3H  $,F7.2,8H PER MBF/46X,F4.1,7H INCHES/25
     2X,88(1H_))
      GO TO 349
  344 IF(IRVLE.EQ.2) GO TO 345
      WRITE(IOUT,127) VALUE(4),SAWTBR
  127 FORMAT(25X,15HSAWTIMBER LOGS ,6X,12HGREATER THAN,13X,
     116HBOARD FEET INT'L,7X,3H $,F7.2.8H PER MBF/46X,F4.1,7H INCHES/25
     2X,88(1H_))
      GO TO 349
  345 WRITE(IOUT,128) VALUE(4),SAWTBR
  128 FORMAT(25X,15HSAWTIMBER LOGS ,6X,12HGREATER THAN,6X,
     129HBOARD FEET SCRIBNER DECIMAL C,X,3H $,F7.2,8H PER MBF/46X,
     2F4.1,7H INCHES/25X,88(1H_))
      GO TO 349
  372 WRITE(IOUT,373) PULPMN,CONV(1),VALUE(1),PULPMN,PULPMX,CONV(2)
     1                VALUE(2),PULPMX,SAWTBR,CONV(3),VALUE(3),CONV(4)
     2                VALUE(4),SAWTBR
```

```
  373 FORMAT(25X,8HSTUMPAGE,15X,8HDIAMETER,20X,6HWEIGHT,20X,8HSTUMPAGE/
     127X,5HVALUE,17X,6HLIMITS,22X,4HUNIT,22X,5HVALUE/27X,5HCLASS,18X,4H
     2(IB),22X,7HFACTORS,19X,8HPER UNIT/25X,88(1H )//25X,14HFUELWOOD CHI
     3PS,3X,10HLESS THAN ,F4.1, 7H INCHES,8X,F4.0,11H CUBIC FEET,9X,2H $,
     4F7.2,8H PER TON/46X,13H NO BRANCHES ,17X, 7HPER TON//25X,15HPULPWOO
     5D BOLTS ,6X,F4.1,2H -,F4.1,15X,F4.0,11H CUBIC FEET,9X,2H $,F7.2,9H
     6 PER TON /76X, 7HPER TON//25X,15HCHIP'N'SAW LOGS,6X,F4.1,2H -,F4.1,
     715X,F4.0,11H CUBIC FEET,9X,2H $,F7.2,8H PER TON/76X,7HPER TON//25X
     8,15HSAWTIMBER LOGS ,6X,12HGREATER THAN,13X,F4.0,11H CUBIC FEET,9X,
     92H $,F7.2,8H PER TON/46X,F4.1,7H INCHES,19X, 7HPER TON/25X,88(1H )/
     A/25X,90HWEIGHT UNIT FACTORS FOR PRODUCTS OTHER THAN FUELWOOD CHIPS
     B ARE IN CUBIC FEET OF GREEN WOOD/25X,85HPER TON.  TOTAL WEIGHT OF
     CTHE GREEN WOOD OF THESE PRODUCTS IS INCREASED BY 10 PERCENT/25X,27
     DHTO ACCOUNT FOR BARK WEIGHT.)
  349 IF(ICULLP.NE.0) WRITE(IOUT374) ICULLP,ICULLD
  374 FORMAT(//10X,81HSPECIAL NOTE: THIS RUN HAS ACTIVATED THE SAWTIMBER
     1 CULL FEATURE OF MERCHANDIZER. ,I3,25H PERCENT OF THE SAWTIMBER/24
     2X,53HVOLUME IN EACH DIAMETER CLASS BELOW AND INCLUDING THE,I3, 36H
     3 INCH CLASS HAS BEEN ASSIGNED TO THE)
      IF(ICULLV)  380,381,382
  380 WRITE(IOUT,383)
  383 FORMAT(24X,79HFUELWOOD CHIP VOLUME CATEGORY BECAUSE, AS CULL VOLUM
     1E, IT WAS DEEMED UNSUITABLE/24X,23HTO PRODUCE SAWN LUMBER.)
      GO TO 386
  381 WRITE(IOUT,384)
  384 FORMAT(24X,74HPULPWOOD VOLUME CATEGORY BECAUSE, AS CULL VOLUME, IT
     1 WAS DEEMED UNSUITABLE/24X,23HTO PRODUCE SAWN LUMBER.)
      GO TO 386
  382 WRITE(IOUT,385)
  385 FORMAT(24X,76HCHIP'N'SAW VOLUME CATEGORY BECAUSE, AS CULL VOLUME,
     1IT WAS DEEMED UNSUITABLE/24X,23HTO PRODUCE SAWN LUMBER.)
C-------
C-------  END OF MERCHANDIZER HEADER
C---we--
  386  IBAGE=BAGE
 C-------
 C-------  ANY STEP SIZES LESS THAN 1 ARE SET EQUAL TO 1 -- THIS IS DONE TO
 C-------    ALLOW BLANK STEP SIZES AS INPUT WHEN OUTPUT IS GENERATED FOR ONLY
 C-------    ONE SITE INDEX, AGE, OR NUMBER VALUE
 C-------
       IF (ISB.EQ.ISE) ISS=1
       IF (INB.EQ.INE) INS=1
       I F (IAB.EQ.IAE) IAS=1
 C-------
 C-------  SET UP DO LOOPS TO GENERATE TABLES FOR EACH COMBINATION OF SITE,
 C-------    AGE, AND NUMBER
 C-------
       DO 100 IS=ISB,ISE,ISS
       SI=IS
       DO 100 IN=INB,INE,INS
       ANO=IN
       ANNOW=IN
       DO 100 IA=IAB,IAE,IAS
       AGE=IA
       AS=AGE
 C-------
 C-------  CALL ROUTINE TO COMPUTE MEAN HEIGHT OF DOMS AND CODOMS PLUS THE
 C-------    SITE INDEX FOR THE ALTERNATE BASE AGE (ABAGE)
 C ---- ---
       CALL HEIGHT (H,AS,BAGE,SI,KSPCE,ABAGE,IASI)
 C-------
 C-------  CALL ROUTINE TO CALCULATE SURVIVAL IF INPUT IS NUMBER PLANTED
 C-------
       IF (KEY.EQ.1.OR.KEY.EQ.2)  ANNOW=SURVIV(H,AGE,ANO,KSPCE,KEY)
       IF (KSPCE.EQ.1) WRITE (IOUT,114)
       IF (KSPCE.EQ.2) WRITE (IOUT,115)
       WRITE (IOUT,102)IS,IBAGE
   102 FORMAT (1HO,52X,10HSITE INDEX,I4,11H (BASE AGE,I3,1H))
   114 FORMAT (1H1//61X,10HSLASH PINE)
   115 FORMAT (1H1//60X,13HLOBLOLLY PINE)
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```
      IF (KEY.EQ.3)GO TO 10
    5 WRITE (IOUT,103) IN
  103 FORMAT (1HO,52X,I4,23H STEMS PER ACRE PLANTED)
      GO TO 11
   10 WRITE (IOUT,112) IN
  112 FORMAT (1HO,5X,I4,25H STEMS PER ACRE SURVIVING)
   11 IF (KEY.EQ.1) WRITE (IOUT,116)
      IF (KEY.EQ.2) WRITE (IOUT,117)
  116 FORMAT (1HO,56X,20HIDEAL SURVIVAL MODEL)
  117 FORMAT (1HO,57X,18HC-S SURVIVAL MODEL)
      IH=H+.5
      WRITE (IOUT,104)
  104 FORMAT (1HO/58X,24(1H-),17HCUBIC FOOT VOLUME,24(1H-)/6X,7HGROWING,
     145X,9HALL TREES,9X,47H5-INCH CLASS AND GREATER, STUMP HEIGHT .5 FE
     2ET,/6X,12HSEASONS AV.,8X,5HSTEMS,28X,6HGROUND,11X,19HFOR O.B. TOP
     3S OF --/7X,23HSINCE   D+C   DBH   PER,5X,17HBASAL   CR  AV.,7X,6
     4HTO TIP,11X,8H2 INCHES,11X,8H3 INCHES,11X,8H4 INCHES/8X,10HEST.
     5HT.,9X,4HACRE,5X,4HAREA,9X,3HHT.,6X,11HO.B.  I.B.,6X,11HO.B. I .
     6B.,8X,11HO.B.  I.B. ,8X,11HO.B.  I.B.)
      WRITE (IOUT,105)
  105 FORMAT (1X,3H***,122X,3H***)
      DO 12 J1=1,2
      DO 12 J2=1,9
   12 YIELD(J1,J2)=0
C-------
C-------  CALL ROUTINE TO CALCULATE DIAMETER DISTRIBUTION USING WEIBULL
C-------    PARAMETER ESTIMATES
C-------
      CALL  DIADST  (AGE,H,ITREES,DMAX,ANNOW,A,B,C,KSPCE)
C-------
C-------  EXTRACT COEFFICIENTS FROM COEFLM (LAMBDA) AND COEFCR (MEAN CROWN
C-------    RATIO) ACCORDING TO SPECIES BEING SUMMARIZED AND CALCULATE
C-------    LAMBDA AND MEAN CROWN RATIO
C-------
      DO 18 K1=1,2
      00 15 K2=1,4
      GO TO (13,14),K1
   13 BETA(K2)=COEFLM(KSPCE,K2)
      GO TO 15
   14 BETA(K2)=COEFCR(KSPCE,K2)
   15 CONTINUE
      DUM=BETA(1)+BETA(2)*ALOG10(H)+BETA(3)*ALOG10(AGE)
     1    +BETA(4)*ALOG10(ANNOW)
      IF (DUM.LT.0.0) DUM=0.0
      GO TO (16,17),K1
   16 ALAMDA=DUM
      GO TO 18
   17 ACROWN=DUM
   18 CONTINUE
C-------
C-------  IF CROWN RATIO IS GREATER THAN 100, THEN SET IT EQUAL TO 100
C-------
      IF (ACROWN-100.) 20,20,19
   19 ACROWN=99.9995
C-------
C-------  CALCULATE ARITHMETIC MEAN DBH (DA) AND QUADRATIC MEAN DBH (DQ)
C-------
   20 DA=A+B*GAMMA(C**(-1.)+1.)
      DQ=SQRT(A**2+2.*A*B*GAMMA(C**(-1.)+1.)+B**2*GAMMA(2.*C**(-1.)+1.))
      BASAL(2)=0.
      KDFST=0
      LINCK=0
      ITREES(41)=0
C-------
C-------  FOR EACH DBH CLASS (1-40) MAKE VARIOUS CALCULATIONS. THE ARRAY
C-------    YIELD HAS TWO ROWS AND 9 COLUMNS. ROW 1 CONTAINS INFORMATION FOR
C-------    THE DBH CLASS, ROW 2 HOLDS TOTALS OVER ALL CLASSES. COLUMN 1
C-------    CONTAINS AVERAGE TREE HEIGHT, COLUMNS 2-3 HOLDS VOLUME FROM
C-------    GROUND TO TIP, AND COLUMNS 4-9 HOLDS MERCHANTABLE VOLUME IN
C-------    CUBIC FEET.
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```
C-------
      DO 90 IDBH=1,40
      DBH=IDBH
C-------
C-------  CALL FUNCTION ROUTINE TO COMPUTE AVERAGE HEIGHT OF TREE
C -------
      YIELD(1,1)=MEANHT(DBH,DMAX,AGE,H,ANNOW,KSPCE)+.5
      FREQ=FLOAT(ITREES(IDBH))
      IF (FREQ) 22,22,23
C  22 IF (ITREES(41)) 90,90,95
C-------
 ------- SET AVERAGE HEIGHT TO 5 IF IT IS LESS THAN 5
C-------  23 IF (YIELD(1,1)-5) 24,25,25
   24 YIELD(1,1)=5
C-------
C-------  ACCUMULATE TOTAL NUMBER STEMS PER ACRE IN ITREES(41) AND TOTAL
C-------    BASAL AREA IN BASAL(2). ALSO CALCULATE BASAL AREA IN BASAL(1)
C-------    AND CROWN RATIO.
C-------
   25 ITREES(41)=ITREES(41)+ITREES(IDBH)
      BASAL(1)=.00545415*DBH*DBH*FREQ
      BASAL(2)=BASAL(2)+BASAL(1)
      CRATIO=100.*(1.-EXP((DBH/DA)**ALAMDA*ALOG(1.-ACROWN/100.)))+.5
C-------
C-------  SELECT CROWN RATIO CLASS
C-------
      IF (CRATIO-35) 26,26,27
   26 ICRG=1
      GO TO 30
   27 IF (CRATIO-50) 28,28,29
   28 ICRG=2
      GO TO 30
   29 ICRG=3
   30 HT=FLOAT(YIELD(1,1))
      LINCK=LINCK+1
      L5LIN=(FLOAT(LINCK)/5.-FLOAT(LINCK/5))*10.
C-------
C-------  CALL ROUTINE TO COMPUTE TOTAL VOLUME FOR THIS DBH CLASS
C-- --- --
      CALL  TVOL  (DBH,ICRG,HT,VOLT,KSPCE)
C-------
C-------  STORE TOTAL VOLUME FOR DBH CLASS AND ACCUMULATE OVERALL TOTALS
C-------
      DO 35 J1=2,3
      YIELD(1,J1)=VOLT(J1-1)*FREQ+.5
   35 YIELD(2,J1)=YIELD(2,J1)+YIELD(1,J1)
C-------
C-------  IF DBH CLASS IS 5 OR GREATER, CALCULATE MERCHANTABLE VOLUMES AND
Ce-s----    STORE, OTHERWISE SKIP CALCULATIONS
C --- -- --
      IF (IDBH-5) 40,45,45
   40 JT1=3
      GO TO 70
C-------
C-------  CALL ROUTINE TO COMPUTE MERCHANTABLE VOLUMES FOR  THIS DBH CLASS
C-------
   45 CALL  MVOL  (DBH,ICRG,HT,VOLM,KSPCE)
      DO 65 J1=4,9
      YIELD(1,J1)=VOLM(J1-3)*FREQ+.5
   65 YIELD(2,J1)=YIELD(2,J1)+YIELD(1,J1)
      JT1=9
   70 IF (KDFST) 75,75,80
   75 WRITE (IOUT,106) IA,IH,IDBH,ITREES(IDBH),BASAL(1),CRATIO,
     1                 (YIELD(1,J1),J1=1,JT1)
      KDFST-1
      GO TO 85
   80 WRITE (IOUT,107) IDBH,ITREES(IDBH),BASAL(1),CRATIO,
     1                 (YIELD(1,J1),J1=1,JT1)
   85 IF ((L5LIN.EQ.0).AND.(ITREES(IDBH+2).NE.0).AND.(IDBH.LT.38))
     1    WRITE (IOUT,108)
  108 FORMAT (1H )
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C-------
C-------  CALL 'MERCHAWDIZER' ROUTINE TO CONVERT CUBIC FOOT MERCHANTABLE
C-------    VOLUMES TO MERCHANTABLE VOLUMES FOR FUEL CHIPS (TONS)
C-------    PULPWOOD AND/OR CHIP'W'SAW LOGS (CORDS OR TOWS), AND SAWTIMBER
C-------    (TOWS, CUNITS, OR MBF DOYLE, INTERNATIONAL QUARTER INCH, OR
C-------    SCRIBWER DECIMAL C LOG RULES)
C-------
      CALL MRCHDZ(DBH,HT,ICRG,KSPCE,STUMPG,CONV,IRULE,PULPMN,PULPMX,
     1SAWTBR)
C-------
C-------  FUEL CHIPS ARE THE DIFFERENCE BETWEEW THE TOTAL VOLME OB AND
C-------    THE PULPWOOD, CHIP'W'SAW, AND SAWTIMBER VOLUMES (ALL 3 IB AND
C-------    ALL MEASURED IN CUBIC FEET).  TO OMIT BARK VOLUME FROM THE FUEL
C-------    CHIP CALCULATIONS, CHANGE YIELD(1,2) TO YIELD(1,3) BELOW.
C-------
      FYIELD(IDBH)=FLOAT(YIELD(1,2))/FREQ
C-------
C-------END OF MERCHAWDIZER CALCULATIONS IN LOOP "Do 90"
C-------
   90 CONTINUE
C-------
C-------  WRITE OUT OVERALL TOTALS FOR STEMS, BA, AND VOLUMES
C-------
   95 WRITE(IOUT,109) ITREES(41),BASAL(2),(YIELD(2,J1),J1=2,9)
      TS=ITREES(41)
C-------
C-------  IF INPUT IS NUMBER PLANTED, CALCULATE PERCENT SURVIVAL,
C-------    OTHERWISE SKIP THIS CALCULATION
C-------
      IF (KEY.EQ.3) GO TO 98
      PCTSUR=TS/ANO*100.
      WRITE (IOUT,110) DA,DQ,A,B,C,PCTSUR,ACROWN,ALAMDA
      GO TO 99
   98 WRITE (IOUT,113) DA,DQ,A,B,C,ACROWN,ALAMDA
      PCTSUR=0.
C-------
C-------  IF THERE IS AN ALTERNATE BASE AGE GIVEN AS INPUT, PRINT IT,
C-------    OTHERWISE SKIP THIS WRITE STATEMENT
C-------
   99 IF (ABAGE-0.) 97,97,96
   96 IF (AS.LT.6) GO TO 97
      IABAGE=ABAGE
      WRITE (IOUT,111) IABAGE,IASI
   97 WRITE (IOUT,105)
C-------
C-------  WRITE 'MERCHAWDIZER' OUTPUT
C-------
      IF(KSPCE.EQ.1) WRITE(IOUT,114)
      IF(KSPCE.EQ.2)WRITE(IOUT,115)
      WRITE(IOUT,102) IS, IBAGE
      IF(KEY.EQ.3) GO TO 340
      WRITE(IOUT,103) IN
      GO TO 341
  340 WRITE(IOUT,112) IN
  341 IF(KEY.EQ.1) WRITE(IOUT,116)
      IF(KEY.EQ.2)WRITE(IOUT,117)
      IF(IRULE.EQ.-2) GO TO 370
C-I-----
C-------  BUILD A TABLE HEADER FOR WG SCALE OPTION
C-------
      WRITE(IOUT,129)
  129 FORMAT(//8X,7HGROWING,15X,38H-----------VOLUMES PER ACRE----------
     1-,7X,49H-------------STUMPAGEVALUEPERACRE-------------/8X,7HSEA
     2SONS,8X, 5HSTEMS,2X,4HFUEL,4X,8HPUPLWOOD,X,10HCHIP'N'SAW,2X,9HSAWT
     3IMBER,7X,4HFUEL,3X,8HPULPWOOD,2X,10HCHIP'N'SAW,2X,9HSAWTIMBER,2X,9
     4HDBH CLASS/9X,5HSINCE,4X,3HDBH,3X,3HPER,3X,5HCHIPS,5X,5HBOLTS,5X,4
     5HLOGS,7X,4HLOGS,10X,5HCHIPS,4X,5HBOLTS,6X,4HLOGS,7X,4HLOGS,7X,5HTO
     6TAL
      IF(ITRULE) 346,347,347
  346 WRITE(IOUT,132)
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  132 FORMAT(10X,4HEST.,3X,5HCLASS,2X,4HACRE,2X,6H(TONS),3X,7H(CORDS),3X
     1,7H(CORDS),3X,8H(CUNITS),8X,3H($),6X,3H($),8X,3H($),8X,3H($),8X,3H
     2(4),2X//)
      GO TO 348
  347 WRITE(IOUT,134)
  134 FORMAT(10X,4HEST.,3X,5HCLASS,2X,4HACRE,2X,6H(TONS),3X,7H(CORDS),3X
     1,7H(CORDS),3X,9H (MBF)   ,8X,3H($),6X,3H($),8X,3H($),8X,3H($),8X,3
     2H($),X/)
      GO TO 348
C-------
C-------  BUILD A TABLE HEADER FOR WEIGHT SCALE OPTION
C-------
  370 WRITE(IOUT,140)
  140 FORMAT(//8X,7HGROWING,15X,38H----------WEIGHTS PER ACRE----------
     1-,7X,49H------------STUMPAGE  VALUE  PER  ACRE------------/8X,7HsEA
     2SONS,8X,  5HSTEMS,2X,4HFUEL,4X,8HPULPWOOD,X,10HCHIP'N'SAW.2X.9HSAWT
     3IMBER,7X,4HFUEL,3X,8HPULPWOOD,2X,10HCHIP'N'SAW.2X.9HSAWTIMBER.2X.9
     4HDBH CLASS/9X,5HSINCE,4X,3HDBH,3X,3HPER,3X,5HCHIPS,5X,5HBOLTS.5X.4
     5HLOGS,7X,4HLOGS,10X,5HCHIPS,4X,5HBOLTS,6X,4HLOGS,7X,4HLOGS,7X,5HTO
     6TAL/10X,4HEST.,3X,5HCLASS,2X,4HACRE,2X,6H(TONS).3X.6H(TONS).4X.6H(
     7TONS),6X,6H(TONS),9X,3H($),6X,3H($),8X,3H($),8X,3H($),8X,3H($)/)
  348 WRITE(IOUT,135) IA
  135 FORMAT(8X,I4)
C-------
C------- CALCULATE MERCHANDIZED STUMPAGE VALUES
C-------
      DO 357 J=1,9
      STUMPV(2,J)=0.0
  357  CONTINUE
      DO 360 IDBH=1,DMAX
      IF(ITREES(IDBH).EQ.0) GO TO 360
      DO 358 J=1,9
      STUMPV(1,J)=0.0
  358  CONTINUE
      TREEz=FLOAT(ITREES(IDBH))
      STUMPV(1,1)=TREEZ*(FYIELD(IDBH)-STUMPG(IDBH,1)
     1            -STUMPG(IDBH,2)-STUMPG(IDBH,3))/CONV(1)
      IF(STUMPV(1,1).LT.0.0) STUMPV(1,1)=0.0
      IF(IRULE.EQ.-2) GO TO 371
      STUMPV(1,2)=TREEZ*STUMPG(IDBH,1)/CONV(2)
      STUMPV(1,3)=TREEZ*STUMPG(IDBH,2)/CONV(3)
      IF(IRULE) 351,352,353
  351 STUMPV(1,4)=TREEZ*STUMPG(IDBH,3)/100.
      GO TO 354
  352 STUMPV(1,4)=TREEZ*STUMPG(IDBH,4)/1000.
      GO TO 354
  353 STUMPV(1,4)=TREEZ*STUMPG(IDBH,5)/1000.
      IF(IRULE.EQ.2) STUMPV(1,4)=TREEZ*STUMPG(IDBH,6)/1000.
      GO TO 354
C-------
C-------  CALCULATE WEIGHTS AND VALVES FOR WEIGHT SCALE OPTION
C-------    WEIGHT OF THE WOOD INT HE DIAMETER CLASS Is CALCULATED BY
C-------    PRODUCT AND THE TOTAL WEIGHT INCREASED 10 PERCENT To ACCOUNT
C-------    FOR BARK WEIGHT.
C------
  371 STUMPV(1,2)=1.1*TREEZ*STUMPG(IDBH,1)/CONV(2)
      STUMPV(1,3)=1.1*TREEZ*STUMPG(IDBH,2)/CONV(3)
      STUMPV(1,4)=1.1*TREEZ*STUMPG(IDBH,3)/CONV(4)
C-------
C-------  DEDUCT CULL FROM SAWTIMBER, CALCULATED AS A PERCENTAGE OF
C-------    SAWTIMBER CUBIC FOOT VOLUME, AND ASSIGN THE CULL VOLUME TO
C-------    THE NEXT LOWER-VALUED PRODUCT MERCHANDIZED
C-------
  354 IF(STUMPV(1,4).LE.0.000) GO To 361
      IF(IDBH.GT.ICVLLD) GO TO 361
      STUMPV(1,4)=STUMPV(1,4)*(1.0-CULLP)
   CULVOL=TREEZ*STUMPG(IDBH,3)*CULLP
      IF(ICVLLV)375,376,377
  375 IF(IRULE.EQ.-2)STUMPV(1,1)=STUMPV(1,1)+(1.1*CULVOL/CONV(1))
      IF(IRULE.NE.-2)STUMPV(1,1)=STUMPV(1,1)+(CULVOL/CONV(1))
      GO TO 361
```

```
  376 IF(IRULE.EQ.-2) STUMPV(1,2)=STUMPV(1,2)+(1.1*CULVOL/CONV(1))
      IF(IRULE.NE.-2) STUMPV(1,2)=STUMPV(1,2)+(CULVOL/CONV(1))
      GO TO 361
  377 IF(IRULE.EQ.-2) STUMPV(1,3)=STUMPV(1,3)+(1.1*CULVOL/CONV(2))
      IF(IRULE.NE.-2) STUMPV(1,3)=STUMPV(1,3)+(CULVOL/CONV(2))
C-----
C     CALCULATE STUMPAGE VALVES AND AGGREGATE VOLUMES AND VALVES
C       BY DBH CLASS
C-------
  361 DO 355 J=5,8
      STUMPV(1,J)=STUMPV(1,J-4)*VALVE(J-4)
      IF(STUMPV(1,J).LT.0.0) STUMPV(1,J)=0.
  355 STUMPV(1,9)=STUMPV(1,9)+STUMPV(1,J)
      DO 356 J=1,9
  356 STUMPV(2,J)=STUMPV(2,J)+STUMPV(1,J)
C-------
C     END OF MERCHANDIZER OUTPUT CALCULATIONS
C-------
      WRITE(IOUT,136) IDBH, ITREES(IDBH),(STUMPV(1,J),J=1,9)
  136 FORMAT(19X,I2,2X,I4,4X,F4.1,4X,F5.1,5X,F5.1,4X,F7.3,9X,F6.2,2X,F7.
     12,4X,F7.2,4X,F7.2,4X,F7.2/)
  360 CONTINUE
      WRITE (IOUT,137)
  137 FORMAT(/23X,4H____,3X,4H____,5X,5H_____,5X,5H_____,6X,5H_____,9X,6
     1H______,2X,7H_______,4X,7H_______,4X,7H_______,4X,7H________77)
      WRITE(IOUT,138)ITREES(41),(STUMPV(2,J),J=1,9)
  138 FORMAT(23X,I4,4X,F4.1,4X,F5.1,5X,F5.1,4X,F7.3,9X,F6.2,2X,F7.2,4X,F
     17.2,4X,F7.2,4X,F7.21
C-------
C-------  END OF MERCHANDIZER OUTPUT
C-------
  100 CONTINUE
      GO TO 230
  220 WRITE (IOUT,118)
  106 FORMAT (8X,I3,4X,I4,2X,I3,3X,I4,3X,F6.1,3X,I3,3X,I3,2(5X,I5,2X,I5)
     1        ,2(7X,I5,2X,I5))
  107 FORMAT (          21X,I3,3X,I4,3X,F6.1,3X,I3,3X,I3,2(5X,I5,2X,I5)
     1        ,2(7X,I5,2X,I5))
  109 FORMAT (1H,26X,4H----,3X,6H------,17X,2(5H-----,2X,5H-----,5X),
     1        2X,2(5H-----,2X,5H-----,7X)/27X,I4,3X,F6.1,17X,
     2        2(I5,2X,I5,5X),2X,2(I5,2X,I5,7X))
  110 FORMAT (1HO,12X,16HARITH. MEAN DBH= F5 1 ,25H ,     QUADRATIC MEAN D
     1BH=,F5.1,27H ,     WEIBULL PARAMETERS A,F4.1,6H     B=,F6.2,6H , C
     2=,F5.2/30X,17HPERCENT SURVIVAL=,F5.1,25H ,       MEAN CROWN RATIO=,
     3F5.1,14H ,      LAMBDA=,F6.3)
  111 FORMAT (1H ,43X,37HCORRESPONDING SITE INDEX FOR BASE AGE,I3,1H=,I3
     1)
  113 FORMAT (1HO,12X,16HARITH. MEAN DBH= F5 1 ,25H ,     QUADRATIC MEAN D
     1BH=,F5.1,27H ,     WEIBULL PARAMETERS A,F4.1,6H ,  B=,F6.2,6H , C
     2=,F5.2/46X,17HMEAN CROWN RATIO=,F5.1,14H ,      LAMBDA=,F6.3)
  118 FORMAT (1H1,43HAGE LIMITS ARE TOO SMALL -- PROGRAM ABORTED)
  230 STOP
      END
C-------
C-------
C-------
      BLOCK DATA
      COMMON /TAPER/COEFSS(3,14),COEFSL(3,14)
C-------
C******* TAPER COEFFICIENTS
C-------
C------- INITIALIZE SLASH TAPER COEFFICIENTS -- BY CROWN RATIO GROUP
C       BETA10B = B(1)
C       BETA20B = B(2)
C       BETA30B = B(3)
C       BETA40B = B(4)
C       ETAOB   = ETAOB
C       GAMMA10B = G(1)
C       GAMMA20B = G(2)
C       BETA11B
```

```
C-------     BETA2IB
C-------     BETA3IB
C-------     BETA4IB
C-------     ETAIB
C-------     GAMMA1IB
C-------     GAMMA2 IB
C-------   COLUMN 1 OF COEFS IS CROWN RATIO LESS THAN 36
C-------   COLUMN 2 OF COEFS IS CROWN RATIO 36-50
C-------   COLUMN 3 OF COEFS IS CROWN RATIO GREATER THAN 50
C-------
      DATA COEFSS/
     1  19.685000,    9.142700,    6.062700,
     2   0.520310,    1.634400,    1.919300,
     3   0.015268,   -0.041715,   -0.068244,
     4 -13.065000:   -8.588700,   -7.181500,
     5  -0.135320,   -0.135320,   -0.135320,
     6   0.000000,    0.000000,    0.000000,
     7   1.000000,    1.000000,    1.000000,
     8  10.991000,    2.739100,    0.774720,
     9   0.524640,    1.495400,    1.610900,
     A   0.022500,   -0.036476,   -0.053570,
     B  -6.630700,   -2.873900,   -1.801600,
     C  -0.109430,   -0.109430,   -0.109430,
     0  -0.481480,   -0.481480,   -0.481480,
     E   0.892630,    0.892630,    0.8926301
C-------
C-------   INITIALIZE LOBLOLLY TAPER COEFFICIENTS -- BY CROWN RATIO GROUP
C-------
      DATA COEFSL/
     1  21.901200,   14.118000,    9.610800,
     2
     3   0.059713,    0.130381,   -0.163847,   -0.556774, 0.062742,
     4 -15.313400,  -12.350600,   -4.239100,
     5   -0.101050,   -0.110650,   -0.122970;
     6   0.000000,    0.000000,    0.000000,
     7   1.000000,    1.000000,    1.000000,
     8  16.526100,    9.573100,    6.278900,
     9   -0.150774:    1.153531,   -0.567733,
     A   0.089512,   -0.012421,    0.077350,
     B  -9.852540,   -7.888530,   -1.695430,
     C  -0.102870,   -0.103780,   -0.103700,
     0  -0.462060,   -0.462060,   -0.462060,
     E   0.931570,    0.931570,    0.931570/
      END
C-se----
C******* NUMBER TREES SURVIVING, IDEAL AND C-S
C-------
C-------     ARGUMENTS:
C-------     (1) H    = AVERAGE HEIGHT OF DOMS AND CODOMS
C-------     (2) AGE  = AGE OF TREES
C-------     (3) ANO  = NUMBER STEMS PLANTED
C-------     (4) KSPC = SPECIES
C-------     (5) KEY  = SELECTED SURVIVAL MODEL
C-------
      FUNCTION SURVIV(H,AGE,ANO,KSPC,KEY)
      DIMENSION BETA(3,2),BETAG(3,2)
C-------
C-------  IDEAL MODEL COEFFICIENTS
C-------     ROW 1 IS SLASH
C-------     ROW 2 IS LOBLOLLY
C-------
      DATA BETA/
     1-0.015038,-0.00063965, +0.0095738,
     2-0.013480,-0.00060783, +0.0084124/
C--w--m-
C-------  C-S MODEL COEFFICIENTS
C-------     ROW 1 IS SLASH
C-------     ROW 2 IS LOBLOLLY
```

```
C-------
      DATA BETAG/
     1   2.3949,     -1.2505,         0.0,
     2   2.1346,     -1.1103,     -0.1384/
      GO TO (5,10),KEY
C-------
C-------  COMPUTE SURVIVAL FOR IDEAL MODEL
C-------
    5 SURVIV= ANO*10.**( BETA(1,KSPC)*AGE*ALOG10(ANO)
     1       +BETA(2,KSPC)*AGE*H + BETA(3,KSPC)*AGE*SQRT(H))
      RETURN
C-------
C-------  COMPUTE SURVIVAL FOR C-S MODEL
C-------
   10 SURVIV=10.**(ALOG10(ANO)+(BETAG(1,KSPC)+BETAG(2,KSPC)
     1       *ALOG10(ANO)+BETAG(3,KSPC))*AGE/100.)
      RETURN
      END
C-------
C******* MEAN HEIGHT OF DOMS AND CODOMS AND SITE INDEX
C-------
C-------    ARGUMENTS:
C-------     (1) H     = AVERAGE HEIGHT OF DOMS AND CODOMS
C-------     (2) AS    = AGE OF TREES
C-------     (3) BAGE  = BASE AGE
C-------     (4) SI    = SITE INDEX
C-------     (5) KSPC  = SPECIES
C-------     (6) ABAGE = ALTERNATE BASE AGE
C-------     (7) IAST  = ALTERNATE SITE INDEX
C-------
      SUBROUTINE   HEIGHT(H,AS,BAGE,SI,KSPC,ABAGE,IASI)
      DIMENSION BETA(4,2),COL(4)
C-------
C-------  BETA  COEFFICIENTS
C-------    ROW 1 IS SLASH
C-------    ROW 2 IS LOBLOLLY
C-------
      DATA BETA/
     1   -8.80405 ,   22.7952  ,    0.0000  ,    0.0000  ,
     2  -21.0977 , 316.282    ,-2443.85    ,  6318.86  /
C-------
C-------  IF AGE LT 6 THEN USE  INTERPOLATION
C-------
      IF (AS.GE.6) GO TO 4
      DO 2 J=1,4
   2  COL(J)=BETA(J,KSPC)
      CALL HTSI(COL,BAGE,AS,SI,1,6.0,H)
      IF (ABAGE-0.) 10,10,5
C-------
C-------  COMPUTE AVERAGE HEIGHT
C-------
   4  H=SI*10.**(BETA(1,KSPC)*(1./AS-1./BAGE)+BETA(2,KSPC)*((1./AS)**2
     1-(1./BAGE)**2)+BETA(3,KSPC)*((1./AS)**3-(1./BAGE)**3)
     2+BETA(4,KSPC)*((1./AS)**4-(1./BAGE)**4))
C-------
C-------  COMPUTE ALTERNATE SITE INDEX IF ALTERNATE BASE AGE IS GIVEN
C-------
      IF (ABAGE-0.) 10,10,5
    5 IASI=H*10.**(BETA(1,KSPC)*(1./ABAGE-1./AS)+BETA(2,KSPC)*((1./ABAGE
     1)**2-(1./AS)**2)+BETA(3,KSPC)*((1./ABAGE)**3-(1./AS)**3)
     2+BETA(4,KSPC)*((1./ABAGE)**4-(1./AS)**4))+.5
   10 RETURN
      END
      SUBROUTINE   HTSI(CO,AI,X,SH,I,AL,H)
      REAL CO(4),AI,X,SH,I,AL
      V1=CO(1)/AI+CO(2)/AI**2+CO(3)/AI**3+CO(4)/AI**4
      IF (X.GE.AL) GO TO 10
      IF (I.LT.0) GO TO 20
      V2=CO(1)/AL+CO(2)/AL**2+CO(3)/AL**3+CO(4)/AL**4
      TSH=(X*(SH*10.**(V2-V1)))/AL
      H=TSH
      RETURN
```

```
10     V2=CO(1)/X +CO(2)/X**2 + CO(3)/X**3 + CO(4)/X**4
       TSH=(SH*10.**(I*(V2-V1)))
       H=TSH
       RETURN
20     H=0.
       RETURN
       END
C-------
C******* MERCHANTABLE VOLUME OB AND IB FROM .5 STUMP TO 2, 3, AND
C-------     4 INCH TOP OB
C-------
C-------     ARGUMENTS:
C-------     ( 1) D        = DBH OB
C-------     ( 2) ICRG     = CROWN RATIO GROUP
C-------     ( 3) HT       = TOTAL HEIGHT OF TREE
C-------     ( 4) VOLM(1) = OB VOLUME TO 2 INCH TOP OB
C-------     ( 5) VOLM(2) = IB VOLUME TO 2 INCH TOP OB
C-------     ( 6) VOLM(3) = OB VOLUME TO 3 INCH TOP OB
C-------     ( 7) VOLM(4) = IB VOLUME TO 3 INCH TOP OB
C-------     ( 8) VOLM(5) = OB VOLUME TO 4 INCH TOP OB
C-------     ( 9) VOLM(6) = IB VOLUME TO 4 INCH TOP OB
C-------     (10) KSPCE = SPECIES
C-------
       SUBROUTINE   MVOL(D,ICRG,HT,VOLM,KSPCE)
       DIMENSION VOLM(6),B(4),G(2)
       COMMON /TAPER/COEFSS(3,14),COEFSL(3,14)
       HL=.5
C-------
C------- HL (STUMP HEIGHT) COULD BE DEFINED AS A FUNCTION, SAY OF DBH
C-------
       DO 30 L=1,3
       GO TO (5,6,7),L
     5 GD=2
       GO TO 10
     6 GD=3
       GO TO 10
     7 GD=4
C-------
C-------  ARRAY B CONTAINS BETA COEFFICIENTS, FIRST FOR OB, THEN FOR IB.
C-------    ETA HOLDS THE OB ETA, THEN THE IB ETA.
C-------    ARRAY G CONTAINS GAMMAS FOR OB, THEN FOR IB.
C-------
    10 DO 30 I=1,2
       K=(I-1)*7
       IF(KSPCE.EQ.2) GO TO 21
       DO 15 J=1,4
    15 B(J)=COEFSS(ICRG,K+J)
       ETA=COEFSS(ICRG,K+5)
       DO 20 J=6,7
    20 G(J-5)=COEFSS(ICRG,K+J)
       GO TO 24
    21 DO 22 J=1,4
    22 B(J)=COEFSL(ICRG,K+J)
       ETA=COEFSL(ICRG,K+5)
       DO 23 J=6,7
    23 G(J-5)=COEFSL(ICRG,K+J)
    24 GO TO (25,26),I
C-------
C-------  CALL ROUTINE TO CALCULATE HEIGHT OF TREE, GIVEN THE DIAMETER
C-------
    25 HU=HGD(D,HT,GD,ETA,G,B)
    26 M=2*(L-1)
C-------
C-------  CALL ROUTINE TO CALCULATE VOLUME BETWEEN TWO HEIGHTS. LOWER
C-------    HEIGHT IN THIS CASE IS ALWAY$ .5 (STUMP HEIGHT).
C-------
       VOLM(M+I)=VIOB(D,HT,HL,HU,ETA,G,B)
    30 CONTINUE
       RETURN
       END
```

```
C-------
C*******  TOTAL VOLUME FROM GROUND TO TIP OB AND ALSO IB
C-------
C--------    ARGUMENTS:
C--------    (1)    D     = DBH OB
C--------    (2) ICRG     = CROWN RATIO GROUP
C--------    (3) HT       = TOTAL HEIGHT OF TREE
C--------    (4) VOLT(1) = VOLUME OB
C--------        VOLT(2) = VOLUME IB
C--------    (5) KSPCE    = SPECIES
C--------
      SUBROUTINE   TVOL(D,ICRG,HT,VOLT,KSPCE)
      DIMENSION VOLT(2),B(4),G(2)
      COMMON /TAPER/COEFSS(3,14),COEFSL(3,14)
      HL=0.
      HU=HT
C-------
C-------  ARRAY B CONTAINS BETA COEFFICIENTS, FIRST FOR OB, THEN FOR IB.
C-------    ETA HOLDS THE OB ETA, THEN THE IB ETA.
C--------   ARRAY G CONTAINS GAMMAS FOR OB, THEN FOR IB.
C-------
      DO 30 I=1,2
      K=(I-1)*7
      IF(KSPCE.EQ.2) GO TO 20
      DO 10 J=1,4
   10 B(J)=COEFSS(ICRG,K+J)
      ETA=COEFSS(ICRG,K+5)
      DO 15 J=6,7
   15 G(J-5)=COEFSS(ICRG,K+J)
      GO TO 28
   20 DO 22 J=1,4
   22 B(J)=COEFSL(ICRG,K+J)
      ETA=COEFSL(ICRG,K+5)
      DO 24 J=6,7
   24 G(J-5)=COEFSL(ICRG,K+J)
C-------
C-------  CALL ROUTINE TO CALCULATE VOLUME BETWEEN TWO HEIGHTS
C-------
   28 VOLT(I)=VIOB(D,HT,HL,HU,ETA,G,B)
   30 CONTINUE
      RETURN
      END
C--------
C*******  MEAN HEIGHT OF TREE
C-------
C--------    ARGUMENTS:
C--------    (1) DBH = DIAMETER CLASS
C--------    (2) DMAX = LARGEST DIAMETER CLASS WITH COMPUTED VALUE
C--------    (3) AGE = AGE OF TREES
C--------    (4) H    = AVERAGE HEIGHT OF DOMS AND CODOMS
C--------    (5) ANOW = NUMBER STEMS SURVIVING
C--------    (6) KSPC = SPECIES
C--------
      FUNCTION   MEANHT(DBH,DMAX,AGE,H,ANOW,KSPC)
      DIMENSION BETA(6,2)
C--------
C------- BETA COEFFICIENTS
C------- ROW  1 IS  SLASH
C-------- ROW 2  IS LOBLOLLY
      DATA BETA/
     1+0.050341,3.1868,1.5708E-5,0.0114942,-2.0981,
     2 1.1034,
     3 0.032876,1.9930,2.5047E-5,0.0043249,-1.0360,
     4-0.026038/
      MEANHT=10.**(ALOG10(H)+BETA(1,KSPC)-(1./DBH-1./DMAX)*
     1       (BETA(2,KSPC)+BETA(3,KSPC)*AGE*ANOW+BETA(4,KSPC)*ANOW/AGE
     2
     3  +BETA(5,KSPC)*ALOG10(ANOW/AGE)+BETA(6,KSPC)*ALOG10(H/AGE)))+  .5
      RETURN
      END
```

```
C-------
C*******  WEIBULL  PARAMETER  ESTIMATES
C-------
C-------     ARGUMENTS:
C-------     (1) AGE = AGE OF TREES
C-------     (2) H     = AVERAGE HEIGHT OF OOMS AND CODOMS
C-------     (3) ANT  = NUMBER STEMS SURVIVING
C-------     (4) A     = WEIBULL LOCATION PARAMETER
C-------     (5) B     = WEIBULL SCALE PARAMETER
C-------     (6) C     = WEIBULL SHAPE PARAMETER
C-------     (7) KSPC = SPECIES
C-------
      SUBROUTINE   PARMS(AGE,H,ANT,A,B,C,KSPC)
      DIMENSION  BETA(4,3,2),PRE(3)
C-------
C-------  BETA  COEFFICIENTS
C-------     1ST DIMENSION OF ARRAY IS 1 FOR SLASH, 2 FOR LOBLOLLY
C-------     2ND DIMENSION OF ARRAY IS 1 FOR PARAMETER A, 2 FOR A+B,
C-------     3 FOR C
      DATA BETA/
     1   1.3986  ,  2.9217  ,  -1.1126  ,  -1.8477  ,
     2  2.5800  , 10.1380  , -3.6275  , -2.5005  ,
     3   9.1471  ,  6.5959  ,  -2.4479  ,  -7.6706  ,
     4  0.13391  , -0.076245,  -0.70442  , 2.3569 ,
     5  2.14570  , 8.1415  , -4.13600  , 2.1264  ,
     6  2.69350 , 5.3594 , -0.53123  , -5.1274  /
      DO 10 K=1,3
C-------
C -------  PARAMETERS A, A+B, AND C ARE COMPUTED BELOW
C-------
   10 PRE(K)=BETA(1,K,KSPC)+BETA(2,K,KSPC)*ALOG10(H)+BETA(3,K,KSPC)*ALOG
     110(ANT)+BETA(4,K,KSPC)*ALOG10(AGE)
      IF (PRE(2).LT.0.02) PRE(2)=0.02
      IF  (PRE(3).LT.1.1) PRE(3)=1.1
      A=PRE(1)
      IF (A.LT.0.) A=.01
      B=PRE(2)-PRE(1)
      C=PRE(3)
      RETURN
      END
C-------
C*******  EVALUATES  THE  GAMMA  FUNCTION  (GENERALIZED  FACTORIAL)  OF  DN
C-------
      FUNCTION  GAMMA(DN)
      DLGGM=0.
      IF (DN) 90,90,91
   91 DTERM=0.
      DNX=DN
    7 IF (DNX-20.) 11,10,10
   11 DTERM=DTERM+ALOG(DNX)
      DNX=DNX+1.
      GO TO 7
   10 DLGGM=(DNX-.5)*ALOG(DNX)-DNX+1./(12.*DNX)
     1       -1./(36.E1*DNX**3)+1./(1.26E3*DNX**5)-1./(1.68E3*DNX**7)
     2       +1./(1188.E1*DNX**9)-6.91E2/(36036.E1*DNX**11)
     3       +1./(1.56E2*DNX**13)+0.918938533204673-DTERM
      GAMMA=EXP(DLGGM)
   99 RETURN
   90 WRITE (6,100) DN
  100 FORMAT (1HO,10X,57HARGUMENT GIVEN TO GAMMA FUNCTION .LE. ZERO, ARG
     1UMENT  =  ,F15.8)
      GO TO 99
      END
C-------
C*******  DIAMETER AT GIVEN HEIGHT ABOVE GROUND EITHER OUTSIDE OR
C-------     INSIDE BARK DEPENDING ON ARGUMENTS 4, 5, AND 6
C-------
C-------     ARGUMENTS:
C-------     ( 1) D    = DBH OB
C-------     ( 2) HT = TOTAL HEIGHT OF TREE
```

```
C-------     ( 3) H    = HEIGHT ABOVE GROUND
C-------     ( 4) ETA  = PARAMETER OF LOWER STEM CURVE
C-------     ( 5) G    = PARAMETERS OF BARK RELATIONS AT 4.5 FEET
C-------                 ( G(1)=0, G(2)=1 FOR OB DIAMETER)
C-------     ( 6) B    = PARAMETERS OF UPPER STEM CURVE
C-------
      FUNCTION  DIO(D,HT,H,ETA,G,B)
      DIMENSION G(2),B(4)
      IF(H.GT.4.5) GO TO 10
C-------
C-------  CALCULATE DIAMETER IF TREE HEIGHT IS'BELOW BREAST HEIGHT
C-------
      DIO=(G(1)+G(2)*D)*(H/4.5)**ETA
      RETURN
 ---a---
C-------  CALCULATE DIAMETER IF TREE HEIGHT IS ABOVE BREAST HEIGHT
C-------
   10 FD=G(1)+G(2)*D
      FH1=(HT-H)/(HT-4.5)
      FH2=(HT-H)*(H-4.5)/(HT*HT)
      FH3=FD*FH2
      FH4=FD*FH3
      FH5=(FH2*(HT+HT-H-4.5))/HT
      DIO=FD*FH1+B(1)*FH2+B(2)*FH3+B(3)*FH4+B(4)*FH5
      RETURN
      END
C-------
C******* HEIGHT TO GIVEN DIAMETER EITHER OUTSIDE OR INSIDE BARK
C-m-s---     DEPENDING ON ARGUMENTS 3-6
C-------     HEIGHT IS CALCULATED BY AN ITERATIVE PROCESS, COMPUTING
C-------     DIAMETER MIDWAY BETWEEN GRADUALLY DECREASING UPPER AND
C-------     GRADUALLY INCREASING LOWER HEIGHT VALUES UNTIL THE COMPUTED
C--w-m--     DIAMETER IS FINALLY VERY CLOSE TO THE GIVEN DIAMETER
C-------
C-------     ARGUMENTS:
C-------     (11 D    = DBH OB
C-------     (2) HT = TOTAL HEIGHT OF TREE
C---e-v-     (3) GD  = GIVEN DIAMETER
C-------     (4) ETA = PARAMETER OF LOWER STEM CURVE
C-------     (5) G    = PARAMETERS OF BARK RELATIONS AT 4.5 FEET
C-------                 ( G(1)=0, G(2)=1 FOR OB DIAMETER)
C-------     (6) B    = PARAMETERS OF UPPER STEM CURVE
C-------
      FUNCTION  HGD(D,HT,GD,ETA,G,B)
      DIMENSION G(2),B(4)
C-------
C-------  DETERMINE WHETHER GIVEN DIAMETER IS ABOVE OR BELOW BREAST HEIGHT
C-------
      DD=G(1)+G(2)*D
      IF(GD-DD) 20,80,10
C-------
C-------  GIVEN DIAMETER IS BELOW BREAST HEIGHT HERE
C---I---
   10 HU=4.5
      HL=0.
      GO TO 30
C-------
C-------  GIVEN DIAMETER IS ABOVE BREAST HEIGHT HERE
C-------
   20 HU=HT
      HL=4.5
   30 H=(HU-HL)/2.+HL
C e-e----
C-------  CALL ROUTINE TO CALCULATE DIAMETER AT A GIVEN HEIGHT
C-------
      DB=DIO(D,HT,H,ETA,G,B)
      IF(ABS(DB-GD)-.05) 70,70,40
   40 IF(DB-GD) 50,50,60
   50 HU=H
      GO TO 30
```

```
   60 HL=H
      GO TO 30
   70 HGD=H
      RETURN
   80 HGD=4.5
      RETURN
      END
C-------
C******* VOLUME BETWEEN TWO HEIGHTS ABOVE GROUND EITHER OUTSIDE
C-------    OR INSIDE BARK DEPENDING ON ARGUMENTS 5, 6, AND 7
C-------
C-------    ARGUMENTS:
C-------    ( 1) D    = DBH OB
C-------    ( 2) HT = TOTAL HEIGHT OF TREE
C-------    ( 3) HL  = LOWER HEIGHT ABOVE GROUND
C-------    ( 4) HU  = UPPER HEIGHT ABOVE GROUND
C-------    ( 5) ETA = PARAMETER OF LOWER STEM CURVE
C-------    ( 6) G    = PARAMETERS OF BARK RELATIONS AT 4.5 FEET
C-------                ( G(1)=0, G(2)=1 FOR OB VOLUME)
C-------    ( 7) B    = PARAMETERS OF UPPER STEM CURVE
C-------
      FUNCTION VIOB(D,HT,HL,HU,ETA,G,B)
      DIMENSION G(2),B(4)
      VIOB=0.
      HNP=HU
      HNV=HL
C-------
C-------  IF UPPER HEIGHT IS BELOW BREAST HEIGHT, THEN VOLUME IS
C-------    CALCULATED FOR LOWER PORTION OF TREE
C-------  IF LOWER HEIGHT IS BELOW BREAST HEIGHT AND UPPER HEIGHT IS
C-------    ABOVE BREAST HEIGHT, VOLUME IS CALCULATED FOR LOWER PORTION,
C-------    THEN ADDED TO UPPER PORTION VOLUME
C-------
      IF(HU.LT.4.5) GO TO 10
      IF(HL.LT.4.5) GO TO 20
C-------
C-------  CALCULATE VOLUME ABOVE BREAST HEIGHT
C-------
   30 HTSQ=HT*HT
      HT45=HT-4.5
      HT3=HTSQ*HT
      DSQ=D*D
      DHT=D/HT
      D2HT=DSQ/HT
      DHT2=D/HTSQ
      D2HT2=DSQ/HTSQ
      RO=G(1)*HT/HT45+G(2)*HT*D/HT45-4.5*B(1)/HT-4.5*G(1)*B(2)/HT-4.5*G(
     12)*B(2)*DHT-4.5*G(1)*G(1)*B(3)/HT-9.*G(1)*G(2)*B(3)*DHT-4.5*G(2)*G
     2(2)*B(3)*D2HT-9.*B(4)/HT+20.25*B(4)/HTSQ
      R1=-G(1)/HT45-G(2)*D/HT45+B(1)/HT+4.5*B(1)/HTSQ+G(1)*B(2)/HT+4.5*G
     1(1)*B(2)/HTSQ+G(2)*B(2)*DHT+4.5*G(2)*B(2)*DHT2+G(1)*G(1)*B(3)/HT+4
     2.5*G(1)*G(1)*B(3)/HTSQ+2.*G(1)*G(2)*B(3)*DHT+9.*G(1)*G(2)*B(3)*DHT
     32+G(2)*G(2)*B(3)*D2HT+4.5*G(2)*G(2)*B(3)*D2HT2+2.*B(4)/HT+9.*B(4)/
     4HTSQ-20.25*B(4)/HT3
      R2=-(B(1)/HTSQ+G(1)*B(2)/HTSQ+G(2)*B(2)*DHT2+G(1)*G(1)*B(3)/HTSQ+2
     1.*G(1)*G(2)*B(3)*DHT2+G(2)*G(2)*B(3)*D2HT2+3.*B(4)/HTSQ)
      R3=B(4)/HT3
      HNP2=HNP*HNP
      HNP3=HNP*HNP2
      HNP4=HNP*HNP3
      HNP5=HNP*HNP4
      HNP6=HNP*HNP5
      HNP7=HNP*HNP6
      HNV2=HNV*HNV
      HNV3=HNV*HNV2
      HNV4=HNV*HNV3
      HNV5=HNV*HNV4
      HNV6=HNV*HNV5
      HNV7=HNV*HNV6
      VIOB=5.4541538E-3*(RO*RO*(HNP-HNV)+RO*R1*(HNP2-HNV2)+(R1*R1+2.*RO*
```

```
     1R2)/3.*(HNP3-HNV3)+(RO*R3+R1*R2)/2.*(HNP4-HNV4)+(R2*R2+2.*R1*R3)/5
     2.*(HNP5-HNV5)+(R2*R3)/3.*(HNP6-HNV6)+(R3*R3)/7.*(HNP7-HNV7))+VIOB
      RETURN
C-------
C-------   CALCULATE VOLUME OF TREE BELOW BREAST HEIGHT ONLY
C-------
   10 VIOB=.00545415*(G(1)+G(2)*D)**2/(4.5**(2.*ETA)*(2.*ETA+1.))*(HNP
     1**(2.*ETA+1.)-HNV**(2.*ETA+1.))
      RETURN
C-------
C-------   CALCULATE VOLUME OF TREE BELOW BREAST HEIGHT AND TRANSFER TO
C-------     UPPER VOLUME COMPUTATION
C-------
   20 HNP=4.5
      VIOB=.00545415*(G(1)+G(2)*D)**2/(4.5**(2.*ETA)*(2.*ETA+1.))*(HNP
     1**(2.*ETA+1.)-HNV**(2.*ETA+1.))
      HNV=4.5
      HNP=HU
      GO TO 30
      END
C*******
C*******   DIAMETER   DISTRIBUTION
C ----em-
C-------     ARGUMENTS:
C-------     (1) AGE    = AGE OF TREES
C ----se-    (2) H      = AVERAGE HEIGHT OF DOMS AND CODOMS
C-------     (3) IDST   = DIAMETER DISTRIBUTION
C-------     (4) DMAX   = LARGEST DIAMETER CLASS COMPUTED VALUE
C-------     (5) ANNOW  = NUMBER STEMS SURVIVING
C-------     (6) A      = WEIBULL LOCATION PARAMETER
C-------     (7) B      = WEIBULL SCALE PARAMETER
C-------     (8) C      = WEIBULL SHAPE PARAMETER
C-------     (9) KSPC   = SPECIES
C-------
      SUBROUTINE    DIADST(AGE,H,IDST,DMAX,ANNOW,A,B,C,KSPC)
      DIMENSION AIDST(41),IDST(41)
C-------
C-------  CALL ROUTINE TO GENERATE WEIBULL ESTIMATES
C ---- ---
      CALL   PARMS(AGE,H,ANNOW,A,B,C,KSPC)
      CUM=0.0
      NNOW=ANNOW+.5
      ICUM=0
      MODE=0
C*******
C-------   COMPUTE  DIAMETER  DISTRIBUTION
C*******
      DO 11 I=1,41
      X=FLOAT(I)+.5
      AIDST(I)=0
      IF(ABS(CUM-ANNOW)-.001)1,3,3
    3 IF(X-A)1,1,2
    2 AIDST(I)=(1.-EXP(-((X-A)/B)**C))*ANNOW-CUM
      CUM=CUMtAIDST(I)
    1 IDST(I)=AIDST(I)+.5
      ICUM=ICUMtIDST(I)
      IF(IDST(I)-MODE)11,11,4
    4 K=I
      MODE=IDST(I)
   11 CONTINUE
      IDST(K)=IDST(K)tNNOW-ICUM
      DMAX=0.
C-------
C-------   DETERMINE LARGEST DIAMETER CLASS HAVING A COMPUTED VALUE
C-------
      DO 34 J=1,40
      K=41-J
      ITWEN=AIDST(K)+.5
      IF(ITWEN.EQ.0) GO TO 34
      IF(DMAX)35,35,34
```

```
   35 DMAX=K
   34 CONTINUE
      IDST(41)=NNOW
      RETURN
      END
C-------
C******* MERCHANDIZER: A ROUTINE TO CONVERT USLYCOWG YIELDS IN CUBIC
C-------                FEET TO STUMPAGE VOLUMES IN OTHER UNITS
C-------
C-------    ARGUMENTS:
C-------    (1) D       = DBH OB
C-------    (2) HT      = TOTAL HEIGHT OF TREE
C-------    (3) ICRG    = CROWN RATIO GROUP
C-------    (4) KSPCE   = SPECIES, 1=SLASH, 2=LOBLOLLY
C-------    (5) STUMPG(D,1) = PVLFWOOD STVMPAGE VOLUME/TREE (CUBIC FT IB)
C-------        STUMPG(D,2) = CHIP'N'SAW STUMPAGE VOLUME/TREE (CUBIC FT IB)
C-------        STUMPG(D,3) = SAWTIMBER VOLUME/TREE (CVNITS IB)
C-------        STUMPG(D,4) = SAWTIMBER VOLUME/TREE (BOARD FEET DOYLE)
C-------        STUMPG(D,5) = SAWTIMBER VOLUME/TREE (BOARD FEET INT'L 1/4")
C-------        STUMPG(D,6) = SAWTIMBER VOLUME/TREE (BOARD FEET SCRIBNER DEC.C.
C-------    (6) CONV(1) = FUEL CHIP CONVERSION FACTOR (CUBIC FEET TO TONS)
C-------        CONV(2) = PULPWOOD CONVERSION FACTOR (CUBIC FEET TO CORDS OR
C-------                  OR TONS, DEPENDING ON IRULE)
C-------        CONV(3) = CHIP'N'SAW CONVERSION FACTOR (CUBIC FEET TO CORDS OR
C-------                  OR TONS, DEPENDING ON IRVLE)
C-------        CONV(4) = SAWTIMBER CONVERSION FACTOR (CUBIC FEET TO TONS,
C-------                  USED ONLY WHEN IRVLE = -2)
C-------    (7) IRVLE   = SAWTIMBER VOLUME RULE (-2, WEIGHT SCALE; -1, CVNITS;
C-------                  (0, DOYLE; +1, INT'L 1/4 INCH; +2, SCRIBNER DEC. C)
C-------    (8) PULPMN = MINIMUM PULPWOOD DIAMETER, IB
C-------    (9) PULPMX = MAXIMUM PULPWOOD (MINIMUM CHIP'N'SAW) DIAMETER, IB
C-------   (10) SAWTBR = MINIMUM SAWTIMBER (MAXIMUM CHIP'N'SAW) DIAMETER, IB
C-------
      SUBROUTINEMRCHDZ(D,HT,ICRG,KSPCE,STUMPG,CONV,IRULE,PULPMN,
     1PULPMX,SAWTBR)
C-------
C-------  ARRAY B CONTAINS BETA COEFFICIENTS FOR INSIDE BARK EQNS
C-------    ETA HOLDS THE INSIDE BARK ETA
C-------    ARRAY G CONTAINS GAMMAS FOR INSIDE BARK
C-------
      DIMENSIONB(4),G(2),STUMPG(40,6),CONV(4)
      COMMON/TAPER/COEFFS(3,14),COEFSL(3,14)
      ID=D
      DO 5 J=1,6
    5 STUMPG(ID,J)=0.000
      IFfKS~E.EQ.2)  GO  TO  20
      DO 10 J=1,4
   10 B(J)=COEFSS(ICRG,7+J)
      ETA=COEFSS(ICRG,12)
      DO 15 J=6,7
   15 G(J-5)=COEFSS(ICRG,7+J)
      GO TO 28
   20 DO 22 J=1,4
   22 B(J)=COEFSL(ICRG,7+J)
      ETA=COEFSL(ICRG,12)
      DO 24 J=6,7
   24 G(J-5)=COEFSL(ICRG,7+J)
C-------
C-------  DIB AT THE TOP OF THE 8-FOOT BUTT LOG DETERMINES INITIAL. PRODUCT
C-------    IS THE BUTT LOG BIG ENOUGH FOR SAWTIMBER? IF SO, GO TO 310.
C-------    IF NOT, IS IT BIG ENOUGH FOR A CHIP'N'SAW LOG? IF SO, W TO 320.
C-------    IF NOT, THE ENTIRE STEM IS PULPWOOD AND FUEL CHIPS.
C-------
   28 H=8.75
      DIB=DIO(D,HT,H,ETA,G,B)
      IF(DIB.GE.SAWTBR) GO TO 310
      IF(DIB.GT.PULPMX) TO TO 320
      PBAZ=0.5
      GO TO 331
  330 PBAZ=CBAZ
```

```
C-------
C-------  CALCULATE PULPWOOD CUBIC FOOT VOLUME AND CONVERT IT TO CORDS
C-------
  331 HITE=HGD(D,HT,PULPMN,ETA,G,B)
      STUMPG(ID,1)=VIOB(D,HT,PBAZ,HITE,ETA,G,B)
      RETURN
C-------
C-------  CALCULATE CHIP'N'SAW CUBIC FOOT VOLUME AND CONVERT IT TO CORDS
C-------
  320 CBAZ=0.5
  321 HITE=HGD(D,HT,PULPMX,ETA,G,B)
      IF(HITE-CBAZ-8.25)330,322,322
  322 BOLT=2*(AINT((HITE-CBAZ)/2))
      HU=CBAZ+BOLT
      STUMPG(ID,2)=VIOB(D,HT,CBAZ,HU,ETA,G,B)
      PBAZ=CBAZ+BOLT+0.25
      GO TO 331
C-------
C-------  CALCULATE SAWTIMBER VOLUMES
C-me----
  310 HITE=HGD(D,HT,SAWTBR,ETA,G,B)
      IF(HITE.LT.8.75) GO TO 320
      BOLT=2*(AINT(HITE/2))
      SBAZ=0.5
  311 STUMPG(ID,3)=VIOB(D,HT,SBAZ,BOLT,ETA,G,B)
      CBAZ=BOLT+0.75
      IF(IRULE) 321,312,312
  312 IF(BOLT.GT.16.0) GO TO 313
C-------
C-------  BOARD FOOT VOLUME OF THE LAST SAWTIMBER BOLE SECTION (8 TO 16 FT)
C-------
    H=BOLT+0.75
  315 DIB=DIO(D,HT,H,ETA,G,B)
      STUMPG(ID,4)=STUMPG(ID,4)+((DIB-4.)**2)*BOLT/16
      STUMPG(ID,5)=STUMPG(ID,5)+((BOLT/16.)*((0.796*DIB**2)+
     1(1.375*DIB)-1.23))
      STUMPG(ID,6)=STUMPG(ID,6)+(0.0494*BOLT*DIB**2)-(0.124*DIB*BOLT)-
     1(0.269*BOLT)
      STUMPG(ID,6)=INT((STUMPG(ID,6)/10)+0.5)*10
      CBAZ=H
      W TO 321
C-------
C-------  BOARD FOOT VOLUMES OF 16-FOOT LOGS PROGRESSING UP THE BOLE
C-------
  313 NLOGS=IFIX((HITE-0.5)/16.25)
      DO 314 N=1,NLOGS
      SLOGS=FLOAT(N)
      H=0.5+(SLOGS*16.25)
      DIB=DIO(D,HT,H,ETA,G,B)
      STUMPG(ID,4)=STUMPG(ID,4)+(DIB-4.)**2
      STUMPG(ID,5)=STUMPG(ID,5)+((0.796*DIB)**2)+(1.375*DIB)-1.23
  314 STUMPG(ID,6)=STUMPG(ID,6)+(0.7904*DIB**2)-(1.984*DIB)-4.304
      BOLT=2*(AINT((HITE-H)/2))
      H=H+BOLT
      GO TO 315
      END
```

# Appendix B

## Sample USLYCOWG Output With MERCHANDIZER Activated

Output from three runs is included. The first two batches of output show sawtimber volumes in board feet International Quarter Inch Log Rule. The initial run did not activate the cull option feature, the second did. The third batch of output is from a run where the weight scaling option was activated.

YIELDS BY DIAMETER CLASSES FOR UNTHINNED LOBLOLLY PINE IN PLANTATIONS
ON CUT-OVER (UNPREPARED BUT PROBLEN FREE) SITES
IN THE
WEST GULF COASTAL PLAIN

*** MERCHANTABILITY PARAMETERS ***

SAWTIMBER VOLUMES ARE CALCULATED FROM STUMP HEIGHT (0.5 FEET) TO A 9.5 INCH TOP DIAMETER (INSIDE BARK). LOGS ARE BUCKED INTO 16 FOOT LENGTHS, PLUS A 3 INCH ALLOWANCE. LOG SCALING DIAMETER IS THE DIAMETER INSIDE BARK AT THE SMALL END OF EACH LOG. IF THE LAST LOG BEFORE REACHING THE MINIMUM SCALING DIAMETER EXCEEDS 8 FEET, BUT IS LESS THAN 16 FEET, IT IS BUCKED TO THE NEXT SMALLER EVEN-NUMBERED FOOT OF LENGTH, PLUS TRIM ALLONANCE. THE REMAINING LENGTH IS DROPPED INTO THE NEXT LOWER STUMPAGE VALUE CATEGORY. If THE LAST LOG TO THE MINIMUM SCALING DIAMETER IS LESS THAN 8 FEET LONG, THE ENTIRE LENGTH IS DROPPED INTO THE NEXT LOWER STUMPAGE VALUE CATEGORY.

| STUMPAGE VALUE CLASS | DIAMETER LIMITS (IB) | VOLUME UNIT FACTORS | STUMPAGE VALUE PER UNIT |
|---|---|---|---|
| FUELWOOD CHIPS | LESS THAN 3.0 INCHES NO BRANCHES | 90. CUBIC FEET PER TON | $ 5.00 PER TON |
| PULPWOOD BOLTS | 3.0 - 7.5 | 80. CUBIC FEET PER CORD | $ 17.00 PER CORD |
| CHIP'N'SAW LOGS | 7.5 - 9.5 | 90. CUBIC FEET PER CORD | $ 45.00 PER CORD |
| SAWTIMBER LOGS | GREATER THAN 9.5 INCHES | BOARD FEET INT'L | $ 150.00 PER MBF |

LOBLOLLY PIKE

SITE INDEX 85 (BASE AGE 50)

726 STEMS PER ACRE PLANTED

C-S SURVIVAL MODEL

| GROWING SEASONS SINCE EST. | AV. D+C HT. | DBH | STEMS PER ACRE | BASAL AREA | CR | AV. HT. | CUBIC FOOT VOLUME: ALL TREES GROUND TO TIP O.B. | ALL TREES GROUND TO TIP I.B. | 5-INCH CLASS AND GREATER, STUMP HEIGHT .5 FEET, FUR O.B. TOPS OF -- 2 INCHES O.B. | 2 INCHES I.B. | 3 INCRES O.B. | 3 INCRES I.B. | 4 INCHES O.B. | 4 INCHES I.B. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *** | | | | | | | | | | | | | | *** |
| | 58 | 3 | 3 | 0.1 | 24 | 33 | 3 | 2 | | | | | | |
| | | 4 | 11 | 1.0 | 27 | 41 | 20 | 15 | | | | | | |
| | | 5 | 24 | 3.3 | 31 | 46 | 73 | 57 | 68 | 54 | 59 | 47 | 34 | 25 |
| | | 6 | 42 | 8.2 | 33 | 50 | 199 | 159 | 188 | 151 | 178 | 143 | 145 | 115 |
| | | 7 | 59 | 15.8 | 36 | 53 | 408 | 329 | 398 | 314 | 376 | 305 | 349 | 282 |
| | | 8 | 68 | 23.7 | 38 | 55 | 643 | 526 | 614 | 505 | 604 | 497 | 579 | 475 |
| | | 9 | 65 | 20.7 | 40 | 57 | 810 | 670 | 777 | 646 | 769 | 639 | 747 | 621 |
| | | 10 | 49 | 26.7 | 42 | 59 | 783 | 653 | 753 | 631 | 747 | 626 | 734 | 615 |
| | | 11 | 29 | 19.1 | 44 | 60 | 573 | 481 | 552 | 465 | 548 | 462 | 541 | 456 |
| | | 12 | 13 | 10.2 | 46 | 61 | 311 | 263 | 300 | 254 | 299 | 253 | 296 | 251 |
| | | 13 | 4 | 3.7 | 40 | 62 | 114 | 97 | 110 | 94 | 110 | 94 | 109 | 93 |
| | | 14 | 1 | 1.1 | 49 | 63 | 34 | 29 | 33 | 28 | 32 | 28 | 32 | 28 |
| | | | 368 | 141.7 | | | 3971 | 3281 | 3783 | 3142 | 3722 | 3094 | 3566 | 2961 |

ARITH. MEAN DBH= 8.1 , QUADRATIC MEAN DBH= 8.4 , WEIBULL PARAMETERS A= 1.5 , B= 7.39 , C= 3.62

PERCENT SURVIVAL= 50.7 , MEAN CROYM RATIO= 38.6 , LAMBDA= 0.597

CORRESPONDING SITE INDEX FOH BASE AGE 25= 58

*** ***

LOBLOLLY PINE

SITE INDEX 85 (BASE AGE 50)

726 STEMS PER ACRE PLANTED

C-S SURVIVAL MODEL

| GROWING SEASONS SINCE EST. | DBH CLASS | STEMS PER ACRE | VOLUMES PER ACRE: FUEL CHIPS (TONS) | PULPWOOD BOLTS (CORDS) | CHIP'N'SAW LOGS (CORDS) | SAWTIMBER LUGS (MBF) | STUMPAGE VALUE PER ACRE: FUEL CHIPS ($) | PULPWOOD BOLTS ($) | CHIP'N'SAW LUGS ($) | SAWTIMBER LOGS ($) | DBH CLASS TOTAL ($) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 25 | | | | | | | | | | | |
| | 3 | 3 | 0.0 | 0.0 | 0.0 | 0.000 | 0.17 | 0.00 | 0.00 | 0.00 | 0.17 |
| | 4 | 11 | 0.2 | 0.1 | 0.0 | 0.000 | 0.83 | 1.06 | 0.00 | 0.00 | 1.89 |
| | 5 | 24 | 0.3 | 0.5 | 0.0 | 0.000 | 1.69 | 9.03 | 0.00 | 0.00 | 10.73 |
| | 6 | 42 | 0.7 | 1.7 | 0.0 | 0.000 | 3.40 | 29.28 | 0.00 | 0.00 | 32.68 |
| | 7 | 59 | 1.2 | 3.8 | 0.0 | 0.000 | 5.93 | 64.02 | 0.00 | 0.00 | 69.95 |
| | 8 | 68 | 1.7 | 6.1 | 0.0 | 0.000 | 8.40 | 104.51 | 0.00 | 0.00 | 112.91 |
| | 9 | 65 | 2.0 | 5.5 | 2.1 | 0.000 | 10.06 | 93.48 | 94.54 | 0.00 | 198.07 |
| | 10 | 45 | 1.8 | 3.4 | 3.9 | 0.000 | 9.06 | 57.16 | 175.46 | 0.00 | 241.68 |
| | 13 | 29 | 1.3 | 1.5 | 3.7 | 0.000 | 6.36 | 25.98 | 168.14 | 0.00 | 200.48 |
| | 12 | 13 | 0.7 | 0.6 | 0.8 | 1.084 | 3.56 | 10.65 | 37.30 | 162.61 | 214.12 |
| | 13 | 4 | 0.2 | 0.2 | 0.2 | 0,453 | 1.24 | 2.90 | 10.08 | 67.90 | 82.12 |
| | 14 | 1 | 0.1 | 0.0 | 0.0 | 0.158 | 0.37 | 0.60 | 2.06 | 23.65 | 26.68 |
| | | 368 | 10.2 | 23.5 | 10.8 | 1.694 | 51.08 | 398.67 | 487.58 | 254.16 | 1191.48 |

YIELDS BY DIAMETER CLASSES FUR UNTHINNED LOBLOLLY PINE IN PLANTATIONS
ON CUT-OVER (UNPREPARED BUT PROBLEM FREE) SITES
IN 'THE
WEST GULF COASTAL PLAIN

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*** MERCHANTABILITY PARAMETERS ***

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SAWTIMBER VOLUMES ARE CALCULATED FROM STUMP HEIGHT (0.5 FEET) TO A 9.5 INCH TOP DIAWETER (INSIDE BARK). LOGS ARE BUCKED INTO 16 FOOT LENGTHS, PLUS A 3 INCH ALLOWANCE. LOG SCALING DIAMETER IS THE DIAMETER INSIDE BARK AT THE SMALL END OF EACH LOG. IF THE LAST LOG BEFORE REACHING THE MINIMUM SCALING DIAMETER EXCEEDS 8 FEET, BUT IS LESS THAN 14 FEET, IT IS BUCKED TO THE NEXT SMALLER EVEN-NUMBERED FUDT OF LENGTH, PLUS TRIM ALLOWANCE. THE REMAINING LENGTH Is DROPPED INTO THF NEXT LOWER STUMPAGE VALUE CATEGORY. IF THE LAST LOG TO THE MINIMUM SCALING DIAMETER I S LESS THAN 8 F E E T LONG, THE ENTIRE LENGTH IS DROPPED INTO THE NEXT LOWER STUMPAGE VALUE CATEGUKX.

| STUMPAGE VALUE CLASS | DIAMETER LIMITS (IB) | VOLUME UNIT FACTORS | STUMPAGE VALUE PER UNIT |
|---|---|---|---|
| F UELWOOD CHIPS | LESS THAN 3.0 INCHES NO BRANCHES | 90. CUBIC FEET PER TON | $ 5.00 PER TON |
| PULPWOOD BOLTS | 3.0 - 7.5 | 80. CUBIC FEET PER CORD | $ 17.00 PER CORD |
| CHIP'N'SAW LOGS | 7.5 - 9.5 | 90. CUBIC FEET PER CURD | $ 45.00 PER CORD |
| SAWTIMBER LOGS | GREATER THAN 9.5 INCHES | BOARD FEET INT'L | $ 150.00 PER MBF |

SPECIAL NOTE: THIS RUN HAS ACTIVATED THE SAWTIMBER CULL FEATURE OF MERCHANDIZER. 25 PERCENT OF THE SAWTIMBER VOLUME IN EACH DIAMETER CLASS BELOW AND INCLUDING THE 13 INCH CLASS HAS BEEN ASSIGNED TO THE PULPWOOD VOLUME CATEGORY BECAUSE, AS CULL VOLUME, XT WAS DEEMED UNSUITABLE TO PRODUCE SAWN LUMBER.

LOBLOLLY PINE

SITE INDEX 85 (BASE AGE 50)

726 STEMS PER ACRE PLANTED

C - S SURVIVAL MODEL

| GROWING SEASONS SINCE EST. | AV. D+C HT. | DBH | STEMS PER ACRE | BASAL AREA | CR | AV. HT. | CUBIC FOOT VOLUME: ALL TREES GROUND TO TIP O.B. | ALL TREES GROUND TO TIP I.B. | S-INCH CLASS AND GREATER, STUMP HEIGHT .5 FEET, FOR O.B. TOPS OF -- 2 INCHES O.B. | 2 INCHES I.B. | 3 INCHES O.B. | 3 INCHES I.B. | 4 INCHES O.B. | 4 INCHES I.B. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 25 | 58 | 3 | 3 | 0.1 | 24 | 33 | 3 | 2 | | | | | | |
| | | 4 | 11 | 1.0 | 27 | 41 | 20 | 15 | | | | | | |
| | | 5 | 24 | 3.3 | 31 | 46 | 73 | 57 | 68 | 54 | 59 | 47 | 34 | 25 |
| | | 6 | 42 | 8.2 | 33 | 50 | 199 | 159 | 188 | 151 | 178 | 143 | 145 | 115 |
| | | 7 | 59 | 15.8 | 36 | 53 | 408 | 329 | 388 | 314 | 376 | 305 | 349 | 282 |
| | | 8 | | 23.7 | 38 | 55 | 643 | 526 | 614 | 505 | 604 | 497 | 579 | 475 |
| | | 9 | [illegible] | 28.7 | 40 | 57 | 810 | 670 | 777 | 646 | 769 | 639 | 747 | 621 |
| | | 10 | 49 | 26.7 | 42 | 59 | 783 | 653 | 753 | 631 | 747 | 626 | 734 | 615 |
| | | 11 | 29 | 19.1 | 44 | 60 | 573 | 481 | 552 | 465 | 548 | 462 | 541 | 456 |
| | | 12 | 13 | 10.2 | 46 | 61 | 311 | 263 | 300 | 254 | 299 | 253 | 296 | 251 |
| | | 13 | 4 | 3.7 | 48 | 62 | 114 | 97 | 110 | 94 | 110 | 94 | 109 | 93 |
| | | 14 | 1 | 1.1 | 49 | 63 | 34 | 29 | 33 | 28 | 32 | 28 | 32 | 28 |
| | | | 368 | 141.7 | | | 3971 | 3281 | 3783 | 3142 | 3722 | 3094 | 3566 | 2961 |

ARITH. MEAN DBH= 8.1 , QUADRATIC MEAN DBH= 8.4 , WEIBULL PARAMETERS A= 1.5 , B= 7.39 , C= 3.62

PERCENT SURVIVAL= 50.7 , MEAN CROWN RATIO= 38.6 , LAMBDA= 0.597

CORRESPONDING SITE INDEX FOR BASE AGE 25= 58

LOBLOLLY PINE

SITE INDEX 85 (BASE AGE 50)

726 STEMS PER ACRE PLANTED

C-S SURVIVAL MODEL

| GROWING SEASONS SINCE EST. | DBH CLASS | STEMS PER ACRE | VOLUMES PER ACHE: FUEL CHIPS (TONS) | PULPWOOD BOLTS (CORDS) | CHIP'N'SAW LOGS (CORDS) | SAWTIMBER LOGS (MBF) | STUMPAGE VALUE PER ACRE: FUEL CHIPS ($) | PULPWOOD BOLTS ($) | CHIP'N'SAW LOGS ($) | SAWTIWBER LOGS ($) | DBH CLASS TOTAL ($) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 25 | | | | | | | | | | | |
| | 3 | 3 | 0.0 | 0.0 | 0.0 | 0.000 | 0.17 | 0.00 | 0.00 | 0.00 | 0.17 |
| | 4 | 11 | 0.2 | 0.1 | 0.0 | 0.000 | 0.83 | 1.06 | 0.00 | 0.00 | 1.89 |
| | 5 | 24 | 0.3 | 0.5 | 0.0 | 0.000 | 1.69 | 9.03 | 0.00 | 0.00 | 10.73 |
| | 6 | 42 | 0.7 | 1.7 | 0.0 | 0.000 | 3.40 | 29.28 | 0.00 | 0.00 | 32.68 |
| | 7 | 59 | 1.2 | 3.8 | 0.0 | 0.000 | 5.93 | 64.02 | 0.00 | 0.00 | 69.95 |
| | 8 | 68 | 1.7 | 6.1 | 0.0 | 0.000 | 8.40 | 104.51 | 0.00 | 0.00 | 112.91 |
| | 9 | 65 | 2.0 | 5.5 | 2.1 | 0.000 | 10.06 | 93.48 | 94.54 | 0.00 | 198.07 |
| | 10 | 49 | 1.8 | 3.4 | 3.9 | 0.000 | 9.06 | 57.16 | 175.46 | 0.00 | 241.68 |
| | 11 | 29 | 1.3 | 1.5 | 3.7 | 0.000 | 6.36 | 25.98 | 168.14 | 0.00 | 200.40 |
| | 12 | 13 | 0.7 | 4.0 | 0.8 | 0.813 | 3.56 | 68.24 | 37.30 | 121.96 | 231.06 |
| | 13 | 4 | 0.2 | 1.6 | 0.2 | 0.339 | 1.24 | 26.95 | 10.08 | so.92 | 89.19 |
| | 14 | 1 | 0.1 | 0.0 | 0.0 | 0.158 | 0.37 | 0.60 | 2.06 | 23.65 | 26.68 |
| | | I--- | ---- | ----- | ----- | ----- | ----- | ------- | ------- | ------- | ------- |
| | | 368 | 10.2 | 28.3 | 10.8 | 1.310 | 51.08 | 480.31 | 487.58 | 196.53 | 1215.50 |

YIELDS BY DIAMETER CLASSES FUR UNTHINNED LOBLOLLY PINE IN PLANTATIONS
ON CUT-OVFH (UNPREPARED BUT PROBLEM FREE) SITES
IN THE
WEST GULF COASTAL PLAIN

*** MERCHANTABILITY PARAMETERS ***

SAWTIMBER VOLUMES ARE CALCULATED FROM STUMP HEIGHT CO.5 FEET) TO A 15.0 INCH TOP DIAMETER (INSIDE BARK). LOGS ARE BUCKED INTO 16 FOOT LENGTHS, PLUS A 3 INCH ALLOWANCE. LOG SCALING DIAMETER IS THE DIAMETER INSIDE BARK AT THE SMALL END OF EACH LOG. IF THE LAST LOG BEFORE REACHING THE MINIMUM SCALING DIAMETER EXCEEDS 8 FEET, BUT IS LESS THAN 16 FEET, IT IS BUCKED TO THE NEXT SMALLER EVEN-NUMBERED FOOT OF LENGTH, PLUS TRIM ALLOWANCE. THE REMAINING LENGTH IS DROPPED INTO THE NEXT LOWER STUMPAGE VALUE CATEGORY. IF THE LAST LOG TO THE MINIMUM SCALING DIAMETER IS LESS THAN 8 FEET LONG, THE ENTIRE LENGTH IS DROPPED INTO THE NEXT LOWER STUMPAGE VALUE CATEGORY.

| STUMPAGE VALUE CLASS | DIAMETER LIMITS (IB) | WEIGHT UNIT FACTORS | STUMPAGE VALUE PER UNIT |
|---|---|---|---|
| FUELWOOD CHIPS | LESS THAN 3.0 INCHES NO BRANCHES | 90. CUBIC FEET PER TON | $ 5.00 PER TON |
| PULPWOOD BOLTS | 3.0 - 7.5 | 26. CUBIC FEET PER TON | $ 6.25 PER TON |
| CHIP'N'SAW LOGS | 7.5 -15.0 | 30. CUBIC FEET PER TON | $ 16.50 PER TON |
| SAWTIMBER LOGS | GREATER THAN 15.0 INCHES | 30. CUBIC FEET PER TON | $ 31.00 PER TON |

WEIGHT UNIT FACTORS FCR PRODUCTS OTHER THAN FUELWOOD CHIPS ARE IN CUBIC FEET OF GREEN WOOD PER TON. TOTAL WEIGHT OF THE GREEN WOOD OF THESE PQODUCTS IS INCREASED BY 10 PERCENT TO ACCOUNT FOR HAWK WEIGHT.

LOBLOLLY PINE

SITE INDEX 85 (BASE ACE 50)

726 STEMS PER ACRE PLANTED

C-S SURVIVAL MODEL

| GROWING SEASONS SINCE EST. | AV. D+C HT. | DBH | STEMS PER ACRE | BASAL AREA | CR | AV. HT. | CUBIC FOOT VOLUME: ALL TREES GROUND TO TIP O.B. | I.H. | 2-INCH CLASS AND GREATER, STUMP HEIGHT .5 FEET, FOR O.B. TOPS OF 2 INCHES O.B. | I.B. | 3 INCHES O.B. | I.B. | 4 INCHES O.B. | 1.6. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *** | | | | | | | | | | | | | | *** |
| 20 | 52 | 2 | 1 | 0.0 | 25 | 23 | 0 | 0 | | | | | | |
| | | 3 | 6 | 0.3 | 30 | 33 | 5 | 4 | | | | | | |
| | | 4 | 19 | 1.7 | 34 | 39 | 33 | 25 | | | | | | |
| | | 5 | 41 | 5.6 | 37 | 44 | 119 | 91 | 110 | 85 | 96 | 74 | 59 | 43 |
| | | 6 | 68 | 13.4 | 40 | 47 | 308 | 242 | 289 | 229 | 274 | 218 | 228 | 178 |
| | | 7 | 88 | 23.5 | 42 | 49 | 571 | 459 | 542 | 437 | 526 | 425 | 480 | 394 |
| | | 8 | 86 | 30.0 | 44 | 41 | 764 | 623 | 728 | 597 | 716 | 587 | 687 | 562 |
| | | 9 | 64 | 28.3 | 46 | 53 | 751 | 619 | 718 | 595 | 711 | 589 | 691 | 572 |
| | | 10 | 34 | 18.5 | 48 | 54 | 504 | 419 | 483 | 403 | 480 | 400 | 471 | 393 |
| | | 11 | 12 | 7.9 | 50 | 55 | 220 | 184 | 211 | 177 | 210 | 176 | 207 | 174 |
| | | 12 | 3 | 2.4 | 51 | 56 | 63 | 52 | 61 | 50 | 60 | 50 | 60 | 49 |
| | | | 422 | 131.5 | | | 3338 | 2718 | 3142 | 2573 | 3073 | 2519 | 2891 | 2365 |

ARITH. MEAN DBH= 7.4 , QUADRATIC MEAN DBH= 7.6 , WEIBULL PARAMETERS A= 1.2 , B= 6.78 , C= 3.81

PERCENT SURVIVAL= 58.1 , MEAN CROWN RATIO= 42.8 , LAMBDA= 0.506

CORRESPONDING SITE INDEX FOR BASE AGE 25= 58

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LOBLOLLY PINE

SITE INDEX 85 (BASE AGE 50)

726 STEMS PER ACRE PLANTED

C-S SURVIVAL MODEL

| GROWING SEASONS SINCE EST. | DBH CLASS | STEMS PER ACRE | WEIGHTS PER ACRE: FUEL CHIPS (TONS) | PULPWOOD BOLTS (TONS) | CHIP'N'SAW LOGS (TONS) | SAWTIMBER LOGS (TONS) | STUMPAGE VALUE PER ACRE: FUEL CHIPS ($) | PULPWOOD BOLTS ($) | CHIP'N'SAW LOGS ($) | SAWTIMBER LOGS ($) | DBH CLASS TOTAL ($) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 20 | | | | | | | | | | | |
| | 2 | 1 | 0.0 | 0.0 | 0.0 | 0.090 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3 | 6 | 0.1 | 0.0 | 9.9 | 0.000 | 0.28 | 0.00 | 0.00 | 0.00 | 0.28 |
| | 4 | 19 | 0.3 | 9.4 | 0.0 | 0.000 | 1.37 | 2.23 | 0.00 | 0.09 | 3.59 |
| | 5 | 41 | 9.6 | 2.8 | 0.0 | 0.000 | 2.89 | 17.70 | 0.00 | 0.00 | 20.59 |
| | 6 | 68 | 1.1 | 8.9 | 0.0 | 0.009 | 5.48 | 55.37 | 0.00 | 0.09 | 60.85 |
| | 7 | 88 | 1.7 | 17.7 | 0.0 | 0.000 | 8.42 | 110.93 | 0.00 | 0.00 | 119.35 |
| | 8 | 86 | 2.0 | 24.6 | 0.0 | 0.000 | 10.15 | 153.71 | 0.09 | 0.00 | 163.86 |
| | 9 | 64 | 1.3 | 16.6 | 6.8 | 0.000 | 9.53 | 104.05 | 112.45 | 0.00 | 226.04 |
| | 10 | 34 | 1.2 | 7.5 | 8.1 | 0.000 | 5.98 | 46.67 | 132.96 | 0.00 | 185.62 |
| | 11 | 12 | 9.5 | 1.9 | 4.7 | 0.000 | 2.50 | 12.12 | 78.15 | 0.00 | 92.77 |
| | 12 | 3 | 9.1 | 0.4 | 1.5 | 0.000 | 0.74 | 2.56 | 24.15 | 0.00 | 27.46 |
| | | | | W-W-- | | | | | | | |
| | | 422 | 9.5 | 89.9 | 21.1 | 0.000 | 47.34 | 505.35 | 347.72 | 0.00 | 900.41 |

Guldin, Richard W. MERCHANDIZER: Adapting USLYCOWG to the marketplace. U.S. Department of Agriculture Forest Service, General Technical Report SO-52. South For. Exp. Stn. New Orleans, La. 36 p. 1984.

USLYCOWG is a computer model that estimates yields in cubic feet per acre from unthinned slash and loblolly pine plantations established on cutover sites in the West Gulf states (see Research Papers SO-147 and SO-148). A series of computer routines called MERCHANDIZER has been developed that convert USLYCOWG yields in cubic feet to tons of fuel chips, cords of pulpwood and chip'n'saw logs, and board feet of sawtimber, or weights of all products in tons.

**Keywords:** Economics, stumpage, forest products, volume predictions, volume yield, *Pinus taeda, Pinus elliottii* var. *elliottii*, unthinned plantation yields, Weibull distribution, taper curves, crown ratio, survival prediction, problem-free sites.